Epidemiology of Farm Injuries in New South Wales

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Abstract

Injuries to people living and working on farms in New South Wales continue to be a significant burden on the health system, Workers' Compensation system, agricultural industries and farming families. Strategies to reduce the number and severity of injuries suffered by farmers and people working on farms rely on accurate information. Unfortunately there is no one dataset available to describe the circumstances surrounding farm injuries and the size of this burden in Australia. Hence, a number of different data sources are required to provide a picture of farm injuries. To date, there has been very little critical examination of what value each of these datasets provides to describing farm injuries.

This Thesis aimed to:

- Undertake surveillance of injuries occurring to people on farms or during agricultural production in NSW using data from an Emergency Department, NSW Hospital Separations information, NSW Workers' Compensation Claims, and ABS Deaths data.
- Critically examine the utility of Emergency Department, Hospital, Workers' Compensation, and ABS Deaths Data for the surveillance of farm injuries in NSW.
- Critically examine data classification systems used in Emergency Department, Hospital, Workers' Compensation, and ABS Deaths data collections to describe the breadth of farm injuries in NSW.
- Define the priority areas for farm injury prevention initiatives in NSW based on the information obtained from the examination of the data from Emergency Department, Hospital, Workers' Compensation, and ABS Deaths.
- Evaluate the effectiveness of the NSW Rollover Protective Structure (ROPS) rebate scheme and examine the utility of the data currently available in NSW to measure the performance of the program.

Four datasets, Tamworth Emergency Department, Hospital Separations, Workers' Compensation and the Australian Bureau of Statistics (ABS) Deaths data were used to provide information on the surveillance of farm injuries, describe the breadth of classifications used to describe farm injuries, and define priorities for the prevention of farm injuries.

There were 384 farm-related injuries which presented to the Emergency Department at the Tamworth Base Hospital between 1 September 1997 and 31 August 1998. Emergency Department data collected in this study used the Farm Injury Optimal Dataset (FIOD) for classification, which allowed for a comprehensive picture of the circumstances surrounding the injury event. The three most common external causes of injury were related to horses, motorcycles, and animals. Commonly people were working at the time of injury. Children represented 21% of the people injured. The average number of injuries per 100 farms per annum was 34.7.

An examination of hospital discharge data for NSW was undertaken for the period 1 July 1992 to 30 June 2000 where the location of the injury was a farm. Classification of cases in this dataset conformed to the International Classification of Disease (ICD) versions 9 and 10. There were 14,490 people who were injured on a farm during the study period. The three most common external causes of injury were motorcycles, animals being ridden and agricultural machinery. Children represented 17% of all farm injury cases. The rate per 1,000 farms ranged from 19 to 42 per annum.

An examination of Workers' Compensation claims for agricultural industries in NSW between 1 July 1992 and 30 June 2001 was undertaken. The 'Type of Occurrence' classification system was used to code the claims. There were 24,332 claims of which the majority were males (82%). The incidence of injury / disease in agriculture per annum varied from 37 per 1,000 workers to 73 per 1,000 workers. The rate per 1,000 agricultural establishments varied from 54 to 76. The average cost of a claim was $10,880 and the average time lost per claims was 9.2 weeks. There were 81 deaths and 3,158 permanent disabilities. The three most common agents were sheep / goats (5%), ferrous and non-ferrous metals (5%), crates / cartons / boxes / etc (5%).

Using ABS deaths data to examine the deaths of people working and living on farms was limited to males whose occupation was recorded as 'farmer and farm manager' and 'agricultural labourer and related worker'. There were 952 deaths over the period 1 January 1991 and 31 December 2000. The information provided a consistent series of cases over time. Areas where prevention should be directed included motor vehicle accidents; falls; agricultural machinery; other machinery; firearms; poisoning; and drowning.

Using any one of the datasets alone to examine people injured on farms not only underestimates the number of people injured, but also misses particular types of agents involved in farm injuries. Each of the datasets used in this Thesis provides a different perspective of farm injury in NSW. By examining the information together, there are a number of areas which are consistently represented in each dataset such as falls and agricultural machinery. While no one dataset provided all the information that would be useful for the prevention of injuries, the available information does provide direction for the development of prevention strategies.

The overall weakness of the information provided is that it misses a number of risk factors that contribute to farm injuries such as fatigue and training. The lack of appropriate denominator information also makes it difficult to directly compare the datasets and estimate the size of the problem. There are a number of additional coding categories that could be included in each dataset that would provide a better understanding of the different groups at risk of sustaining an injury on a farm or during agricultural work. These coding categories include activity at time of injury, admission to hospital, and occupation.

An example of the use of data to determine the effectiveness of a farm injury prevention program is the 'NSW Rollover Protective Structure (ROPS) Rebate Scheme' evaluation. Tractor rollover deaths have been identified as an issue for prevention by Farmsafe Australia; however, such deaths were not identified in any of the datasets used in this Thesis due to coding limitations in the ABS data. In this Thesis information about the evaluation of the 'NSW ROPS Rebate Scheme' is presented. The scheme was successful in fitting 10,449 ROPS to tractors and the following lessons were learnt: when providing a rebate, the administration (i.e. sending the cheque) needs to be done well; advertising is important and should be co-ordinated, increase the awareness of the risk(s) the intervention is aiming to prevent and effectiveness of subsequent solution (s); the program should ensure there is an increased awareness of the outcome the intervention is aiming to prevent; if regulation is part of the program, enforcement needs to undertaken; and should address any barriers to uptake.

The information provided in this Thesis highlights the substantial burden that farm injury places on the agricultural and rural sector of NSW. While there is no one data source that can describe the circumstances and the burden of farm injuries, the currently available datasets do provide an insight into the circumstances of farm injuries and the burden these injuries place on health, Workers' Compensation, agricultural industries and farming families.

Dedication & Acknowledgements

Thousands of farmers every year are injured in preventable accidents, many requiring time off work and some losing their lives, causing stress and concern for loved ones and the community. To examine the causes of farm injuries and provide strategies that will in the future lead to fewer people being injured and dying is a noble cause worth studying. To all those touched by the tragedy of injury and death from farm accidents I hope this study goes a little way in reducing your angst and a long way in ensuring we are not doomed to repeat the mistakes of the past.

In the process of undertaking a PhD there are a large number of people who play both small and large roles in helping you to achieve the degree. While there are a number of specific people I would like to thank there are also a number of people who will not be mentioned below, who without their support, insight or understanding it would not have been possible to finish my Thesis.

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Thank you all my friends and apologies one last time for birthdays, and other special occasions I have missed while writing the Thesis and hope that now it is finished we will be able to pick up from where we left off.

Finally I would like to thank the staff at the University of Sydney for their support and help.

Statement of Involvement

The studies described in this Thesis, and much of the analysis presented here, were based on three studies conducted while the author was a member of the Australian Centre for Agricultural Health and Safety. The author planned each study, led the study teams, and was the key participant in all aspects of the studies, but all team members made an important contribution to the successful outcome of the studies.

The author wrote all the content of this Thesis and conducted all analyses presented here. All figures were produced by the author.

Data for the Emergency Department study was collected by Dr John Davies and data for the ROPS Evaluation was collected by Kerri-Lynn Stark, both under the supervision of the author. Coding of raw data was conducted by all team members, including the author. Checking, corrections and analysis of data for the original reports was undertaken by the author.

Publications arising from the Thesis

Reports:

Franklin R, Thomas P, Fragar L (2005). The Health and Safety of New South Wales Farmers, Farm Families and Farm Workers. Canberra. *Rural Industries Research and Development Corporation.*

Franklin R (2005). Evaluation of the New South Wales Rollover Protective Structure Rebate Scheme 2000-2004. Moree. *Australian Centre for Agricultural Health and Safety*

Published Articles

Franklin R, Fragar L, Page AN (2000). The National Farm Injury Data Collection: data to inform farm injury prevention programs. *Australasian Epidemiologist* 7(1) 18-24

Franklin RC, Davies JN (2001). Farm-related injury presenting to an Australian Base hospital. *Australian Journal of Rural Health* 11(6) 292-302

Franklin R, Crosby J (2002) Farm-related injury in New South Wales: information for prevention. *New South Wales Public Health Bulletin* 13(5):99-102

Davies J, Franklin R (2006) Injuries resulting from horse riding and motorcycle incidents on farms. *Journal of Occupational Health and Safety – Australia and New Zealand* 22(1) 51-59

Franklin RC, Stark K, Fragar L (2006). Intervention Strategies for the retro-fitment of Rollover Protective Structures (ROPS) and fleet characteristic, farm tractors. *Safety Science* 44(9) 771-783

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Glossary

AAHU	Australian Agricultural Health Unit now called ACAHS
ABS	Australian Bureau of Statistics
ACAHS	Australian Centre for Agricultural Health and Safety
Accident	The use of the word accident is controversial and the source of considerable debate in the discipline of injury prevention [1]. Some advocates recommend the use of such phrases as ‘incident’ or ‘injury event’. For the purposes of this Thesis ‘Accident’ is used in the natural parlance where the source is obvious.
ANOVA	Analysis of Variance
ANZSIC	Australia and New Zealand Standard Industry Classification [2]
Apr	April
ASCC	Australian Safety and Compensation Council (formerly the National Occupational Health and Safety Commission)
ASCO	Australian Standard Classification of Occupations [3]
ASIC	Australian Standard Industry Classification
Aug	August
ATV	All Terrain Vehicle. In this Thesis the term ATV and 4-wheeled motorcycle are used interchangeably.
av.	Average
COMS	California Occupational Mortality System
Dec	December
e-codes	External Cause Codes
ED	Emergency Department
EVAO	Estimated Value of Agricultural Output
Farm injuries	Injuries sustained by people while on a farm or in the course of agricultural production
Feb	February
FIOD	Farm Injury Optimal Dataset
FSA	Farmsafe Australia
Hierarchy of Control	is a five level guide to the effectiveness of an intervention. The order is as follows:

1. Eliminate the hazard (risk)

2. Substitute for a lesser hazard (risk)
3. Engineer out the hazard (risk)
4. Design safer work procedures (management)
5. Use personal protective equipment (PPE)

Hospital Separations	Data are one tool which can be used to measure incidence and prevalence of serious diseases and injury
ICD	International Classification of Diseases
ICE	International Collaboration Effort
Jan	January
Jul	July
Jun	June
Labour force	All persons aged 15 years and older who are not members of Australian permanent defence forces or foreign defence force personnel stationed in Australia, diplomatic personnel of overseas governments, and overseas residents in Australia [4]. It should be noted that labour force is usually broken down into employed and job seekers (which is further broken down into those in the labour force (unemployed and part-time workers (less than 10 hours & looking for work) and not in the labour force (discouraged job seekers, attending educational institution and wanted to work but not available)) [5].
LOS	Length of Stay
Mar	March
National Occupational Health and Safety Commission	is now called the Australian Safety and Compensation Council.
NCIS	National Coroners Information System
NEC	Not Elsewhere Classified
NHPA	National Health Priority Areas
Nov	November
NSW	New South Wales
Oct	October
OHS	Occupational Health and Safety
OSHA	Occupational Safety and Health Administration
PHP	Personal Hearing Protection
PPE	Personal Protective Equipment

PTO	Power Take Off
Risk factor	A measurable characteristic associated with a higher probability of occurring [6]
RLSSA	Royal Life Saving Society Australia
ROPS	Rollover Protective Structure
SLA	Statistical Local Area
Sep	September

Separation is defined "…as the process by which an episode of care for an admitted patient ceases. A separation may be formal or statistical. Formal separation: the process by which a hospital records the cessation of treatment and/or care and/or accommodation of a patient. Statistical separation: the administrative process by which a hospital records the cessation of an episode of care for a patient within the one hospital stay…" p387 [7]

TBH	Tamworth Base Hospital
US	United States of America
WorkCover	The Work Health Authority responsible for workers health and safety and in NSW the compensation of work related injuries and death.

Workers' Compensation – Refers to the insurance scheme in Australia where by the employer pays a statutory body to cover worker related injuries and diseases that an employee may suffer while undertaking work. In this Thesis Workers' Compensation claims refers to those claims made against the NSW Workers' Compensation insurance scheme.

Chapter 1 Introduction

> Life is a series of steps. Things are done gradually.
> Once in a while there is a giant step, but most of the
> time we are taking small, seemingly insignificant steps
> on the stairway of life. -- Ralph Ransom

This Thesis is being undertaken in the area of public health through the School of Public Health at the University of Sydney. Specifically it is examining injuries and deaths in agricultural industries from a public health surveillance perspective. Surveillance is the ongoing, systematic process of collecting, analysing, interpreting and reporting of the health of a population [8].

In Australia there is no one data source that can be used for surveillance or description of farm injuries. To describe the patterns of those people who are injured on farms several data sources are required. Commonly data on farm injuries in Australia is collected from General Practitioners, Emergency Departments, Hospitals, Workers' Compensation Claims, Australian Bureau of Statistics (ABS) Deaths information, Coroners, and population surveys.

1.1 Aims

The overall aims of this Thesis are:

- To undertake the surveillance of injuries occurring to people on farms or during agricultural production in NSW using data from an Emergency Department, NSW Hospital Separations information, NSW Workers' Compensation Claims, and ABS Deaths data.
- To critically examine the utility of Emergency Department, Hospital, Workers' Compensation, and ABS Deaths data for the surveillance of farm injuries in NSW.
- To critically examine data classification systems used in Emergency Department, Hospital, Workers' Compensation, and ABS Deaths data collections to describe the breadth of farm injuries in NSW.
- To define the priority areas for farm injury prevention initiatives in NSW based on the information obtained from the examination of the data from Emergency Department, Hospital, Workers' Compensation, and ABS Deaths data.

- To evaluate the effectiveness of the NSW Rollover Protective Structure (ROPS) rebate scheme and examine the utility of the data currently available in NSW to measure the performance of the program.

1.2 Public Health

The starting point for all Public Health initiatives is to define the health of the population (p2) [9]. Chapters 4-7 define the injuries people are sustaining on farms or during the course of their work. Once the health of a population is defined, then strategies are developed to help prevent disease, prolong life and promote health [10]. This is then followed by a public health intervention. Public health interventions often follow an action research spiral, where the intervention is planned based on the health issues facing the population, implemented, observed (evaluated), reassessed and a revised plan developed [11].

The penultimate chapter is an example of the 'action research spiral', where deaths due to tractor rollover were identified as a significant problem. Placing a rollover protective structure (ROPS) on the tractor was identified as a solution (prevents the deaths from occurring). An initiative to increase the number of ROPS on tractors in NSW was implemented. An evaluation of the initiative was undertaken (the information in Chapter 8 was used as a report on the effectiveness of the scheme [12]).

1.3 Farm Injury in Australia

While injuries and deaths of people on farms have been an ever present aspect of farming in Australia, it was not until 1988 that the first conference (Farmsafe '88) on farm safety was held in Australia [13]. This conference, while having a broad range of presentations on issues about rural occupational health and safety, had very little hard data about the magnitude of the problem. Indeed at the conclusion of the conference it was stated "…Information gathering and analysis on farm injuries has been haphazard…" (p491) [13].

Farm injury (i.e. those people who are injured on a farm or in the course of agricultural production) in Australia is a significant problem. In the last complete examination of farm related deaths in Australia on average 150 people died per annum from a range of hazards across all agricultural industries [14]. To address all the areas causing injuries to people on farms a range of solutions, some unique to particular agricultural industries are required [15].

To enable the most appropriate distribution of resources to address the range of causes of injuries to people on farms, accurate and detailed information about the problems are required [16].

The data used to define injuries sustained while farming or on a farm in New South Wales in this Thesis, were collected from four sources (Emergency Department presentations at the Tamworth Base Hospital, NSW Hospital Separations cases, Workers' Compensation Claims and ABS Deaths data registrations). This information was also used in the production of a profile of the health and safety of NSW farmers, farm workers and farm families which was published by the Rural Industries Research and Development Corporation [17]. Analysis of the data used in this Thesis and the report were both undertaken by the author.

In Australia there have been no attempts to examine the utility of the available information of farm injuries, nor has there been an examination of the classification systems currently used to describe farm injuries.

1.4 Structure of this Thesis

There are numerous definitions of what constitutes a farm, such as "an agricultural business having an estimated value of agricultural operations (EVAO) greater than a particular dollar value (currently $5,000)" [18], or "farm buildings and land under cultivation excluding the farm house and home premises of the farm (E849.1)" [19]. Lack of consistency of classification provides a number of difficulties when trying to understand and compare information about farm injury. This study examines the limitations and benefits of having differing definitions in Chapter 2.

The utility of the classification systems for the description of farm injuries used in the datasets analysed in this Thesis are described in Chapter 3.

Chapters 4 – 7 provide information about the surveillance of people injured while on a farm or during agricultural production in NSW from four different data sources. The strengths and weaknesses of the data are explored in the respective chapters. Chapter 8 contains a critical examination of the utility of the data and subsequent classification systems to describe farm injuries in NSW. Chapter 8 also provides a rationale and direction for where resources should be allocated in NSW to prevent the farm injuries from occurring. Chapter 9 is a case study examining the effectiveness of a rebate scheme to place Rollover Protective Structures (ROPS) on tractors and the utility of the currently available information to help in this process. Chapter 10 concludes the Thesis, provides a summary of what was found and recommendations for the improvement of the farm injury surveillance.

The ten chapters in this Thesis look at the following issues in order:

1. Introduction
2. Literature review
3. Classifications systems for farm injury events
4. Emergency Department data
5. Hospital data
6. Workers' Compensation data
7. ABS Deaths data
8. Discussion: Comparative analysis of datasets for prevention, monitoring and evaluation
9. Evaluation of the NSW Rollover Protective Structures (ROPS) rebate program
10. Conclusions and Summary

Chapters 4, 5, 6 and 7 in this Thesis represent separate datasets. Chapter 9 uses data from a number of different methodologies to evaluate the NSW ROPS rebate scheme. In those chapters (4, 5, 6, 7, and 9) where analysis was undertaken, each follow the format of a brief introduction, detailed study methodology, detailed overview of the information gained from the analysis, and discussion of the analysis.

1.5 Coverage of this Thesis

The information provided in this study can be used to:

- Provide information about the utility of current classification systems to describe farm injuries.
- A description of the farm injuries in NSW from currently available information.
- Rank those aspects of farm health and safety which are causing the burden of injury
- Identify those aspects of farm health and safety that may require targeted prevention programs or activities

- Identify areas where further research needs to be undertaken to provide guidance for prevention programs and activities
- Provide information about the representativeness of the coverage of farm injuries using existing data sources
- Provide evidence for the effectiveness of a current preventative program
- Provide a source of information for training and education

Detailed examination of information can provide insight into the problems and possible solutions that might be used. This Thesis does not attempt to provide all possible solutions to all farm injuries found, in a comprehensive fashion.

1.6 Uses for the study

Internationally there is a dearth of information about the surveillance of injuries to people living on farms and working in agriculture, in particular non-fatal injuries. There are also very few studies internationally that have used routinely collected data to examine farm injuries, including the efficacy of the different classification systems when used to describe the nature and extent of farm injuries.

This study provides a critical examination of four data collections to describe farm injuries in NSW. This information will be useful in helping to prevent injuries to people on farms, or injured while undertaking agricultural work through the identification and description of these events. Better information about the injuries being sustained and the circumstances around these injuries will allow for the better design of prevention programs [20].

Information gathered in the Tamworth Emergency Department study has been used by the Tamworth Farmsafe Action group to deliver safety programs to people who ride motorcycles and horses.

Information from the NSW Workers' Compensation analysis has been used in the production of the report "Falls in Agriculture", and as supplementary information for industry specific profiles [21-26].

Some of the weaknesses identified during the analysis of the hospital data and examination of the classification system used (International Classification of Diseases) have been provided to the National Centre for Classification in Health, in particular the lack of a code for tractors. Changes to the ICD will allow for better international comparisons.

The study provides information of particular value to Farmsafe NSW, WorkCover NSW and the NSW Health Department; all have a major investment in preventing injuries to people on farms, during agricultural production or both. This study provides the most detailed up-to-date examination of farm injuries in NSW and identifies where prevention strategies can be directed.

The study is also of value to researchers as it provides information on what can be extracted from existing ongoing datasets and where further investigation and research is required.

The evaluation of the NSW Rollover Protective Structure (ROPS) Scheme provides an understanding of how well the scheme worked and what lessons from the scheme can be provided to other prevention activities. This information has been published as a report by the Australian Centre for Agricultural Health and Safety [12].

Finally, this study provides information to those living and working on farms in NSW about the injuries that they are suffering during the course of their work and recreational activities and the circumstances surrounding these injuries. Hopefully this study will be used in the public forum to debate the issues around farm safety; their importance and preventability and in doing so reduce the burden of injuries on future generations of farmers.

1.7 Ethical Approval

Ethical approval for the study of farm injuries presenting to the Tamworth Base Hospital was provided by the New England Area Health Service Ethics Committee (DB63). Ethical approval for the examination of NSW Hospital, Workers' Compensation and ABS Deaths data was provided by the New England Area Health Service Ethics Committee for Human Health. Ethics approval for the evaluation of the NSW Rollover Protective Structure Rebate Scheme was provided by Sydney University Ethics Committee for Human Health (2606 (01/12/28)).

Chapter 2 Literature Review

All great things are only a number of small things that have carefully been collected together. - Source Unknown

2.1 Introduction

The scope of this chapter is to provide an overview of the current understanding of injuries that occur to people while on farms or in the course of agricultural production. It does not attempt to review all publications on farm related injuries as many are not related to the issues covered in this Thesis. Chapter 3 provides an examination of the injury classifications used in this Thesis.

2.1.1 Aims

The aims of this chapter are to:

Define important terms and concepts in farm injury surveillance and farm injury prevention

1. Provide an overview of current methods of data collection for farm injuries
2. Examine key models used in and for the development of farm injury prevention
3. Provide an overview of current farm injury prevention strategies

2.1.2 Search Strategies

The information presented in this chapter is based on multiple searches of both published and grey literature. At the commencement of the PhD in 2000 a search of Medline, Agricola, ScienceDirect, ProQuest, Cinahl, OSHRom, and Pubmed was undertaken using the search terms: farm, safety, agriculture, health and safety, OHS, occupational health and safety, injury, injury prevention, hospital, Workers' Compensation, prevention, tractor, header, rollover, machinery, cattle, sheep animal, horse, and dog. These terms were then further refined using combinations of the above search terms, for example 'tractor' + 'safety'.

An examination of the Australian Centre for Agricultural Health and Safety library and the internet for any reports or other publications not contained in the published literature was also undertaken.

Upon reviewing the articles, reports and other publications found in the searches a snowballing technique was then used to find further articles, reports, etc. The snowballing technique involved identifying relevant references cited in the available publication/s and tracking them down and from these finding relevant references and so on.

Between 2000 and 2006 this process was repeated twice, once in 2004 and again in 2006. During this time Safetylit was also used to monitor any new article published in the area. At the time of submitting the PhD for examination this process had identified 1,217 articles of relevance. Not all of the identified articles were used in the Thesis.

2.2 A brief history of injury prevention and control in Australia, some seminal publications

Injuries are clearly not a new phenomenon in Australia, however injury prevention is a reasonably new field of study which incorporates many disciplines [27]. Various organisations have been established over the years in Australia (such as the Royal Life Saving Society -1894, the National Safety Council of Australia – 1927, and the Australian Injury Prevention Network - 1995) to promote safety and prevent injuries [28]. However it was not until the late 1980's that the field of injury prevention started to gather momentum in Australia and in 1994 it was identified as a priority area for health [29].

In 1994 the seminal publication 'Injury in Australia' edited by Harrison and Cripps was released [30]. This publication provided an overview of injury in Australia with specific chapters focusing on transport-related injury, injury in residential settings, injury in non-urban settings, consumer product-related injury, sports-related injury, suicide and other self-injury, interpersonal violence, injury among indigenous Australians, and work-related injury. This was followed up in 1997 with the document 'National Health Priority Area: Injury Prevention and Control' which provided an updated overview of injury in Australia and provided indicators for the success of prevention and control programs [31].

In 1999 the National Injury Prevention Advisory Council (NIPAC) provided future directions in injury prevention with the publication of two reports, the first providing direction for injury prevention research and the second providing information about the 'best buys' for injury prevention interventions [32 33]. The first National Injury Prevention Plan was developed in 1999, by the National Injury Prevention Advisory Council (NIPAC), however it never passed the draft stage as NIPAC was disbanded in late 1999 [34]. It took another two years for the first official injury prevention plan (in conjunction with an implementation plan) to be released and in 2004 the second official injury prevention plan was released by the National Public Health Partnership [35-37].

Over the last two decades in Australia there has been an increasing sophistication of injury prevention techniques with a number of different approaches being used to classify, categorise and describe injury and its subsequent prevention. These approaches include specifying age groups (e.g. children, young adults), location of the injury (e.g. work place, farm, home), activity at the time of injury (e.g. working, playing, sport, boating), mechanisms (e.g. falls, traffic accidents) and agents (e.g. firearms, horses, bicycles).[38]

2.3 Definitions

To clearly examine farm injuries, particularly when comparing to other studies, good definitions are required. A study in the US examined 504 agricultural deaths using three different definitions, only 36 of the deaths were captured by all three definitions [39]. An examination of the definitions used for injury, work-related and farm-related, is explored below.

2.3.1 Children

While a definition of children may seem reasonably straight forward, many definitions have been used over the years when examining children, these include;

- People aged 0-19 years [40]
- People aged 0-18 years [41 42]
- People aged 0-17 years [43 44]
- People aged 0-16 years [45 46]
- People aged 0-15 years [47 48]
- People aged 0-14 years [49-51]

The differing definitions have been used due to the available denominator data, the population information available for the study, different interpretations of a child (including culture) and the reasons for undertaking the study.

For the purposes of this study, children are those aged 0-14 years at the time they were injured. (This is the same definition as used by Farmsafe Australia in their child safety on farms strategy [52]).

2.3.2 Farm / Agriculture

There is no single definition of farm that is commonly used by all people studying the issues about agriculture, farming and farm injuries [53]. The use of different definitional criteria has been found to result in different rates of injury or death being reported [53].

Some common definitions of farm include:

- Where the estimated value of agricultural output (EVAO) is above a nominated level (the Australian Bureau of Statistics uses $5,000 but has also used $20,000 in the past) [54]
- Any buildings or land under cultivation on a farm or ranch excluding farmhouse and home premises of farm [19 55]

Most often farm is defined by the person being injured (i.e. the injured person says that the injury happened on a farm). However sometimes this is expanded to include other situations such as farm machinery on roads, e.g. "…injury occurring to individuals on any farm … or on any public road in which the injury event involved farm machinery…" [53] p175

Studies of farm injuries often come across difficulties in trying to classify those people who suffered an injury at the boundary of farm. The boundary is often difficult to define due to:

- roads and lanes being used for the movement of stock and in some cases grazing;
- cropping bordering the road;
- farms having roads traverse the property; and
- farms being spread over a larger area with non adjoining sections requiring the farmer to move equipment through public areas.

Studies requiring people to self select as a farmer may include or exclude those people who have a 'hobby farm' (i.e. very small farms - size or production), often income is derived off farm and they may / not see themselves as farmers or their land as a farm.

Studies that have not collected agricultural output have relied upon self identification making it difficult to compare studies. Geographical differences in farm size and agricultural production create differing results in what people would interpret as constituting a farm. Definition impacts on developing appropriate prevention programs (i.e. ability to reach the target audience), comparing studies, evaluating the cost of injuries and establishing the impact of farm injuries.

2.3.3 Injury

While there are a number of definitions of injury and what constitutes an injury, on the whole, injury refers to damage to the body because of an exchange of energy usually in a single episode (although some injuries are caused due to exposure over a longer period such as those caused by vibration, chemicals and repetitive use) . The two most common definitions of injury are:
"…tissue or body damage or loss of function of a body part that occurs because of an abnormal energy exchange between a person and an energy agent…" p274 [39]
"…An injury is the result of a single traumatic event where the harm or hurt is immediately apparent, for example, a cut resulting from an accident with a knife or, burns resulting from an acid splash…" pD1 [56]

In the hospital system or those using the International Classification of Diseases (ICD) coding framework, patients who have a medical condition coded in the range S00-T98 according to ICD10 [55] 'Chapter XIX Injury, Poisoning and certain other consequences of external causes' or reciprocal chapters in other versions are considered to have an injury.

2.3.3.1 Injury event, accident, incident

While strictly speaking not a definitional issue, the use of the terms accident, incident, and injury event is somewhat controversial in the injury prevention world. Accident has been the traditional term used when someone suffers an injury, however accident is defined as "…event that is without apparent cause or unexpected…" p 7 [57] and it is argued that injury is not without cause nor is it unexpected [1 58 59]. In this Thesis the term accident is used interchangeably with incident and injury event, but with the assumption that all accidents are potentially preventable.

2.3.4 Intent

Injuries have long been recognised as a major public health problem in Australia. When trying to understand the nature of these injuries they are usually divided into intentional and unintentional injuries. Unintentional injuries are all those injuries that occur during the course of a person's day without being perpetrated by themselves or another person. Thus intentional injuries are those where intent is involved, that is a person sets out to cause harm or in the process of an aggressive behaviour causes harm.

There are two types of intentional injuries, those that are inflicted upon oneself (e.g. suicide) and those inflicted upon others (e.g. homicide). There is a significant amount of research and work being undertaken in Australia and world wide in the area of self-inflicted harm and violence.

This Thesis focuses on unintentional injuries.

2.3.5 Prevention

Prevention is a reasonably self explanatory term; it is ensuring that injury does not occur. There are a number of terms used to describe prevention activities such as countermeasures, interventions, and programs [60-62]. There are also a large number of prevention activities used in injury prevention and they fall generally into three categories known as the 3E's - engineering, education, enforcement [63].

- Engineering (environmental, ergonomics) prevention strategies are those strategies that affect the built environment, equipment, clothing and other objects. Examples include better roads, safety barriers, guards on machines, and personal protective equipment.
- Educational prevention strategies are those that aim to change behaviour. An example is the Royal Life Saving 'Keep Watch' program for parents of children under five years of age to help them prevent the child from drowning through a combination of supervision, restricting access to water (e.g. pool fences), water familiarisation (i.e. learning to swim), and parents learning resuscitation if something does go wrong.
- Enforcement prevention strategies are those that have some form of regulatory framework to back them up such as drink driving or speeding.

Often prevention strategies require a mix of all three to be successful. For example the most effective strategy to prevent drowning deaths of children less than five years of age in backyard swimming pools is a pool fence [64]. For the strategy to be effective the pool needs to be fenced with a self closing self latching gate (environmental change) and the pool owner needs to maintain the pool fence (including ensuring the gate is not propped open). As such, educational programs have been established to ensure that people fence the pool and maintain the integrity of the barrier. Regulations have also been put in place to require people to fence the pool and for inspection of the fence to be undertaken on a regular basis so that the fence continues to provide a satisfactory barrier [65].

2.3.6 Surveillance

Surveillance is the process of collecting, analysing, describing and disseminating information about a particular issue. A good definition of surveillance is:
"…the ongoing, systematic collection, analysis, interpretation, and dissemination of data regarding a health-related event for the use in public health action to reduce morbidity and mortality to improve health…" p87 [66]

2.3.7 Work-related

The traditional or narrow definition of work-related refers to people who are being paid for working at the time of the injury; however this does not adequately describe those who are not working (or not being paid) but injured in the process of work activities or by work equipment. In the latest and most significant examination of work-related fatalities in Australia, three types of deaths were described: workers (i.e. those who were receiving pay, profit or payment in-kind, including unpaid work in a family business or on a farm); bystanders (i.e. those who were not working but killed as a result of someone else's work activities); and other (this included students, volunteers, people performing home duties, and deaths on farms) [67].

Using only the definition of work does not include those who are injured due to work equipment (e.g. animal on a road, child injured on an ATV) or injured in the workplace (i.e. on a farm).The expansion of the National Occupational Health and Safety Commission's (now called Australian Safety and Compensation Council) study to include not only those who were working when injured, but also bystanders and others is particularly useful for the study of farm injuries and deaths.

Workers' Compensation data both in Australia and elsewhere [53] has been found to have some weaknesses, such as missing people who are self employed, unpaid, or not injured as a result of work.[68]. Comparing Australian Workers' Compensation information with other countries is difficult as different definitions are often used, for example in the United States of America information collected by the Occupational Safety and Health Administration (OSHA) about injuries sustained on the job only covers those workplaces employing 11 or more people [69]. As many agricultural business in the US do not employ 11 or more people they would not be included in the OSHA information [69]. Karlson and Noren found that less than 50% of farms in Wisconsin hired non-family labour [70]. In Australia, approximately 50% of the workforce is self-employed [4] and thus not covered by mandatory Workers' Compensation.

This study uses the broader definition of work-related unless otherwise stated. That is people injured in the course of work either while working for pay or not, as a bystander to work and in a work place (on the farm or at yards etc) or by a piece of work-related equipment including animals.

2.4 An overview of farm injuries in Australia by collection method

There have been a large number of studies examining injuries in agriculture internationally and in Australia. These studies have used a range of methods such as: survey (mail, telephone, and interview); analysis of routinely collected data (emergency department data, hospital data, Workers' Compensation data, death certificates, and autopsies); newspaper clipping services; and randomised controlled trials. However in Australia there have been four primary methods for the examination of farm-related injuries: Emergency Department data, hospital data, Workers' Compensation data, and deaths data.

2.4.1 Emergency Department data

There have been a number of small scale studies in Australia examining farm injuries using Emergency Department (ED) data, however only four of these have been published. This section examines the four published studies from across Australia that collected farm injury data from Emergency Departments in NSW, Queensland, and Victoria [71-74].

The earliest study of farm injuries presenting to Emergency Departments was undertaken by Wolfenden and Sampson-Fisher in the Taree and six New England areas of NSW between November 1990 and October 1991. Injuries to adults were predominantly occupational in nature and injuries to children were mainly leisure in nature. Animals were involved in a large number of injuries, and agricultural machinery was less prominent than what had previously been found in mortality and hospital admission data. The study was also able to separate out different commodity groups on farms, which showed that some injury agents were more likely to be involved in some commodities compared to others (e.g. cattle on beef farms). Injuries to males were more common than females across all commodity types and mechanically inflicted injuries were to arms, legs and heads. This study was the first to suggest an industry based approach to farm injury prevention may be appropriate and it also confirmed that strategies for the prevention of injuries to children and by animals were a priority. [71]

There have been two studies from the Callide-Dawson region of Queensland examining farm injuries presenting to Emergency Departments and medical practitioners. The first of the studies collected information between August 1992 and July 1993 [72] and the second collected information between July 1995 and June 1996 [73]. These studies provide a unique perspective on where people choose to be treated for minor injuries (i.e. at an Emergency Department or by a General Practitioner). Both studies also provide details on the types of farms by commodity, work status, information on child injuries, agents and mechanisms of injury, activity at time of injury, location on farm and time of injury. [72 73]

These studies were also able to provide rates of injuries per 100 workers in the first study (14-39) and rates of injuries to farm owners / managers (59.8) and farm workers (112.9) per 1,000 people. This study found similar statistics for work-related injuries to older people on farms and leisure injuries to children as Wolfenden and Sampson-Fisher [71]. Injuries resulting from animal handling were common in both timeframes. That similar results were found in both studies is encouraging for surveillance systems and also provides evidence that ongoing surveillance at Emergency Department level may not be needed, as a survey every couple of years may suffice. While there were small differences in treatment patterns for injuries (i.e. fracture and puncture wounds were more likely to be treated in the ED and cuts / lacerations and foreign body in soft tissue were more likely to be treated by GP’s), the biggest issue with using just ED information to calculate the number of minor injuries on farms is that it would underestimate the problem by one-third. A weakness of both studies was the number of cases per month declined as the study proceeded without any interventions being undertaken. [72 73]

The study by Day et al [74] of farm injuries in Victoria includes deaths, hospitalisations and ED presentations. This study found a ratio of 7:761:3,074 deaths: hospitalisations: ED presentations for Victoria. The male: female ratio was the same for hospitalisation and ED presentations (3:1) but was 8:1 for deaths. While there were some similarities (children -motorcycles and horses, adults – falls, motorcycles and horses) in the cause of injury for hospital admission and ED presentations, there were also some differences (children –farm animals, cutting/piercing object, and struck by or collision with object, adults –agricultural machinery and struck by or collision with object). Fractures were common to both hospital admissions and ED presentations, as was open wound, and intracranial (for children) injuries. Similar body parts were injured in both hospital admission and ED presentations however the rank order was slightly different. This study was the first to be able to provide information on the ratio of deaths to hospital admissions to ED presentations; however the information provided covers different time periods and lengths of time. [74]

Emergency Department information has added to our understanding of farm injuries and the magnitude of this problem. Comparisons over different coverage areas, time frames and collection methods allow for a better understanding of how to prevent the injuries from occurring and the success of interventions aimed at preventing further farm injuries.

2.4.2 Hospital data

There are three main areas where information is collected from hospitals: people presenting to Emergency Departments, people admitted to hospitals, and trauma registries. With the advent of the computer and the integration of computerised systems into the hospital setting the collection, analysis and reporting of people using the hospital is now routine and has spawned its own area of research (health informatics). A number of coding systems have been developed to enable health administrators to manage the information they are collecting. These coding systems will be examined in more detail in Chapter 3. Information collected from hospitals enables the setting of priorities for the reduction of injuries and diseases and the monitoring of success of interventions [75].

Hospital Emergency Departments are the arrival point for the vast majority of injuries seen in the hospital setting and provide a picture of the outcomes of most of the non-trivial injuries suffered [75]. The Injury Surveillance Information System (ISIS) was successful at demonstrating the feasibility of data collection in Emergency Departments and subsequently there have been a number of farm injury studies conducted in Emergency Departments in Australia (see 2.4.1 Emergency Department data).

Fragar and Franklin in their study evaluating the success of Farmsafe Australia's goals, targets and strategies for 1996-2001 examined hospital data in Australia to determine if goal 3 "Reduction in admissions to hospital due to on-farm injury by 30%" had been achieved [76]. They examined information from NSW, Victoria, and South Australia which did show a reduction in the number of injuries. Whereas a subsequent study in Western Australia showed an increase in hospital admissions followed by a decrease [77].

With a large number of possible external cause codes (e-codes) and a lack of critical analysis of hospital data for the surveillance of farm injuries the Farm Injury Data Centre (an initiative of the Australian Centre for Agricultural Health and Safety) provided a grouping of e-codes to monitor hospital admissions coded as having occurred on a farm (Table 1) [78]. This grouping system is explored in greater detail in Chapter 5. The grouping system has been used in this Thesis to allow comparisons with other Australian studies.

Table 1 Farmsafe Australia e-code groups

E-code	Description
E820-829	Motor vehicle non traffic accident and other road vehicle accidents
	Motorcycle
	Other vehicles
	Animal Ridden
E862	Poisoning by petroleum products
E863	Poisoning by Agricultural Chemicals
E864	Accidental poisoning by corrosives and caustics, not elsewhere classified
E866-869	Poisoning by other solids, gases and liquids
E891-899*	Fire and flames
E905	Venomous animal and plants
E906.0	Dog bites
E906.8	Injury by other animal
E919.0	Agricultural machinery
E919.1-.9	Accidents cause by machinery excluding agricultural
E920	Accidents cause by cutting and piercing instruments or objects
E922	Firearms
E810-819	Motor vehicle accidents
E850-865**	Poisoning
E880-E888	Falls
E900-909#	Natural & Environmental Factors
E910	Drowning
	Other E-code##

*Excluding E893.0, E895.0-9 and E898.0 (if included are in other e-codes). ** Excludes E863.0-9, E864.0-9
E905.0-9, E906.0 & E906.8. ## Includes all E-codes not elsewhere represented

As hospital admissions data has been used extensively by Farmsafe Australia for the monitoring of farm injuries and subsequent prevention programs there is a need to have a better understanding of the utility of hospital admissions data. In New Zealand the use of the place of occurrence to code farm injuries was found to be accurate, with only one misclassification being noted [79]. Further information on the utility of hospital admission data is provided in Chapter 5.

2.4.3 Workers' Compensation data

The only study in Australia that has used Workers' Compensation records to examine agricultural related injuries is by Cole and Foley, who used Workers' Compensation data from the 1992-93 financial year for agriculture and services to agriculture [80]. The State and Territory Work Health Authorities and the Australian Safety and Compensation Council provide aggregated annual figures on Workers' Compensation claims, which include limited information about agricultural industries.

Cole and Foley's examination of worker compensation provided for the first time in Australia an estimate of the cost of agricultural work related injuries (between $0.53 billion and $1.29 billion) and also the average cost per injury ($6,920 which was 1.23 times higher than all industries $5,635). Their examination of 5,885 compensated injury/diseases found that 1 in 20 wage and salary earners in the agricultural sector will suffer the effects of a work-related injury or illness involving five or more consecutive days off work per annum. The study also provided, by agricultural industry, the injury/disease incidence per 1,000 workers which ranged from 8.7 for cereal grains to 89.6 for sheep shearing services and the injury/disease frequency per million hours worked by agricultural industry groups (range 13 for vegetables to 46.1 for services to agriculture). [80]

The Cole and Foley study also examined industry by occupation (agricultural labourers were the largest group), gender, age group, time lost from work, nature, bodily location, mechanism, agency, time of day, and day of week. They also identified five areas for OHS focus: plant (in particular motorcycles, tractors – including falls from tractors, sheep shearing plant, conveyors and lifting plants); hand tools, appliances and equipment (primarily knives, scissors, shovels, scythes, axes, chainsaws, abrasive/planing/cutting powered tools); manual handling (particularly handing livestock, and manual handling of fastening, packing and packaging); work environment (focusing on 'falls, slips and trips' on the same level and falls from horses, trucks, ladders, and tractors); and livestock (areas included being hit by an animal, fall from an animal, manual handling of animals). [80]

Cole and Foley also noted three major limitations of Workers' Compensation information. These were:

- only cases where the person had five or more days off work are included in the data;
- it only covers wage and salary earners and as such self employed people working in agriculture may have a different injury/disease profile; and
- coverage of hazardous substance and long term exposures. [80]

2.4.3.1 The power of Workers' Compensation information

While there are a number of limitations in using Workers' Compensation information (especially that it only covers approximately half of the people working in agriculture), there is no doubt about the value of this information to provide insight into occupational health and safety problems [68].

There have been a few studies in Australia which have used Workers' Compensation information. The studies have examined a specific occupation (physical therapists) [81], claims vs number of hours worked [82], size of compensation claims [83], factors associated with inter-industry differences [84], disability [85] and death differentials [86].

An overseas example specific to agriculture is the study by Jones and Switzer-McIntyre who used Workers' Compensation information from Ontario in 1997 to examine the issue of falls from trucks. In their study they found 352 injuries matching a fall from a truck of which the majority were from the back of the trailer/truck, step and cargo area. The total cost of these falls was $5.3 million dollars and there were 9.6% of cases who had not returned to work after a year and 4.5% who were on modified duties. They also suggest a number of strategies to prevent the injuries from reoccurring such as engineering controls, workplace practices and education programs. [87]

Workers' Compensation information has also been used to examine the injury/disease profile of people at different stages in their working career [88]. The ability to examine age groups, gender and occupation within an industry allows for the development of targeted prevention programs increasing their effectiveness.

One of the biggest motivators for any government or organisation for prevention of injuries is reducing costs. Workers' Compensation is one of the few areas which record the cost of the injuries/disease. This information has been explored by a number of studies and by examining the actual costs another measure of the success of the intervention was available [80 87 89].

The limitations found by Cole and Foley for using Workers' Compensation included poor coverage of cases (i.e. only included people who had more than five days off work), workforce (i.e. only wage and salary earners) and hazardous substances and long term exposure. Limitations identified by others include missing data, under-reporting (i.e. workers not making claims), and fraudulent claims [80 87 90]. While there are limitations, the full potential of Workers' Compensation information in Australia has not been explored, nor has the utility of this information.

2.4.4 Deaths data

There are a large number of studies that have examined deaths on farms internationally, however only a few in Australia have examined farm deaths or particular types of deaths (e.g. drowning) that occur on farm [47 91-94]. There are a number of reports where deaths on Australian farms have been part of the overall study[15 17 76 77 95]. A number of studies have identified problems with case identification when examining farm deaths and the effect this can have on case ascertainment [14 39 67 96-99]. In particular Conroy and Sciortino undertook an examination of deaths from the California Occupational Mortality System (COMS), using three different definitions of occupation/industry = agriculture (n=306), location = farm (n=258) and agricultural machinery (n=104), overall 504 cases were identified but only 36 occurred in all three definitions [39].

A study of farm related deaths in Australia was a sub study of a nation-wide examination of work-related deaths in Australia [67]. This study by Franklin et al used multiple definitions to capture all agricultural related deaths (these included those who were killed on a farm, as a result of farm work, or as a result of a piece of farm equipment or produce such as an animal wandering onto a road and a car crashing into it) [14]. From the study four articles were produced examining work related deaths on farms, children's deaths on farms, difference in young and older workers farm deaths, and non-work related deaths on farms [50 100-102].

The study by Franklin et al provided a detailed examination of the 587 farm-related deaths that occurred between 1 January 1989 and 31 December 1992. The deaths were primarily categorised into three groups of people, those working at the time of the incident that led to their deaths (373), bystander to the work (142) and other (72). The study provided overall information on age, gender, agricultural industry, occupation, how the worker was found and who found the worker, state or territory, location on the farm where the incident occurred, agent, mechanism, activity at time of death, multiple incidents, pathophysiological cause of death, blood alcohol content, month, day, time of incident and if they were a visitor to the farm. The study then examined in detail specific agricultural enterprises, agricultural deaths by State or Territory, age groups (1-14 years, 15-29 years, 30-55 years and 55+ years), specific agents (trucks, utilities, cars, two-wheeled motorcycles, aircraft, tractors, firearms, dams, horses, and trees being felled), mechanisms (falls from a height, drowning, and electrocution) and reporting of farm-related fatalities by occupational health and safety (OHS) and Workers' Compensation agencies . [14]

The examination of OHS and Workers' Compensation agencies revealed some systematic weaknesses in their collection of farm deaths information. Of particular note was the lack of information on people who were bystanders to farm work, and those fatally injured on the farm but not working or bystanders. It is also interesting to note that there is variation in the ascertainment of farm deaths by age, agent, mechanism, and employment status. In-particular unless the person fatally injured was an employee their chances of being recorded in OHS and Workers' Compensation information was low. [14]

The depth of detail found in the study by Franklin et al has allowed Farmsafe Australia to develop a number of strategies for the prevention of farm deaths associated with farm machinery and children [14 52 103 104]. In the study only four (4) four-wheeled motorcycle deaths were recorded. Since then the use of four-wheeled motorcycles on farms has increased and as such so have the number of deaths associated with four-wheeled motorcycles. Information from the ABS Deaths data has not previously been used to examine non-intentional deaths to farmers and farm workers, nor has the utility of this information been explored.

2.4.5 Other sources of information

The other major method of collecting information about farm injuries is via surveys. The survey information can be collected from direct contact such as a telephone survey, survey of people related to farming at a common location (such as a mall, field day, school or at the farm), or postal survey [41 105-112]. Participation rates in surveys can influence the sensitivity, representativeness, predictive value, and accuracy of the information collected [113].

There have been four studies published that have examined farm injuries in Australia using a survey methodology. Three of these reports are by Keith Ferguson from the Department of Employment, Training and Industrial Relations, Queensland Government examining farm injuries in Queensland and the fourth is by Mather and Lower in Tasmania.

Over a seven year period Ferguson released three reports examining farm work-related injuries and risk factors in Queensland [114-116]. Each study takes a random sample of agricultural establishments with an Estimated Value of Agricultural Output (EVAO) greater than $22,000 and seeks information on work-related injury, and depending on the survey the availability of farm safety information on children, safety management practices, chronic disease and the farm workforce [114-116]. The response rate for the studies were 70.4%, 68.2%, and 52.5% respectively [114-116].

There was variation in the rate of injury per 100 farms (15.9-57.5) across geographical locations per annum. The reports also provided information on;

- the rates per hours worked by industry (ranged from 1.05/100,000 hours for injuries in "Apples, Pears, Stone Fruit" industry to 5.59/100,000 hours worked in the pig industry),
- activities that were being undertaken at the time of injury (animal handling was the most common),
- agents (animals, farm vehicles and farm machinery were common),
- types of injuries (superficial and sprains and strains were common),
- cost (average $74,682 per 100 farms and $10,926 per 100,000 hours worked),
- chronic injury/illness (back pain was common), and
- safe work practices. [114-116]

The ability of the survey method used by Ferguson [114-116] to collect information not only on the injuries but also safety behaviour should be explored in greater detail in Australia to provide an Australia wide profile.

The other Australian study of injuries in Agriculture was by a retrospective survey of industrial members of the Tasmanian Farmers and Graziers Association for injuries that occurred in the past two years [117]. The response rate for this study was 55.4%. The rate of injury was 19 /100 farms per annum. Common types of injuries sustained by farmers were non-specific contusions/haematomas, sprains, fractures, crush injuries and stab/puncture wounds. The body locations commonly injured were the hands, lower back, ankle and face. People age 25-54 and employees comprised the bulk of those injured. [117]

There are a number of limitations with retrospective studies that require the person to recall the number of injuries sustained, such as poor recall, and better recall of more severe injuries. Extending the period of recall to two years in the Mather and Lower study may have resulted in a lower injury rate than the Ferguson studies with a 1 year period [114-117]. While all of the survey studies of farm injuries conducted in Australia collect a range of injury severity, they do not however contain information on people who died during the study period or who have moved away from the farm due to their injury.

2.5 Models used in and for prevention of farm injuries

The prevention of farm injuries has until recently lacked well-articulated, research based theories or models to guide prevention and education programs [118]. In Australia a public health approach has been the underlying method used, that is surveillance of the problem, identification of the risk factors (causes), development of a strategy to address the identified risk factors and then implementation and evaluation of the strategy [68 119].

However there are several models proposed in the area of injury prevention and farm safety such as ‘Health Belief Model’ and ‘Theory of Reasoned Action’, this Thesis does not review all of them, as this has already been undertaken by Murphy [118]. However, as the Public Health Model and the Hierarchy of Control is used extensively in farm safety in Australia a brief description of these are provided below [60].

2.5.1 Public Health Model

In Australia the Public Health Model has been used by Farmsafe Australia in the development and implementation of their strategies[52 103 104 120 121]. Farmsafe Australia strategies have followed the formula (Figure 1):

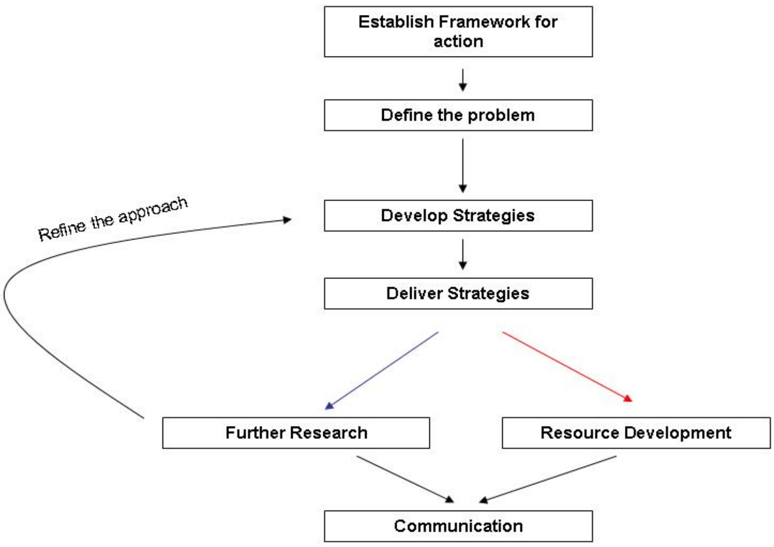
- Establish a framework for action – this is ensuring that all the stakeholders are informed, involved and committed to finding solutions to the problem;
- Define the problem – where there is not enough information or more information is required to identify the issues, costs, scope and contributing factors to the problem

(ideally this will also provide baseline information that can be used to evaluate the successfulness of the strategy);

- Establish strategies to address the identified issues – these will be based on the information about the issues, cost, scope and contributing factors identified in the previous step, which will define the scope of the strategy (i.e. what is to be targeted). Some examples of strategies include:
    - Education and training – this is the provision of skills and knowledge to the target audience so they are aware of the issues and possible solutions to identified problems;
    - Regulations / legislation / standards – changes to regulations, legislation and standards have been found to be an effective measure of preventing injuries from occurring or minimising their impact (e.g. seat belts in cars);
    - Design / environmental modification – changes to the design of a piece of equipment or the environment that will remove the hazard.
- Research – for all areas of farm safety there is still information missing from our understanding of the problem. This may be in the area of defining the issues and causal factors, exposure, effectiveness of prevention strategies, design, and work practices. Further research helps improve our understanding and feeds back into the strategy;
- Resources – resources are developed that support these strategies;
- Communication – ensure that all people know about the issue and its importance and how to prevent it from occurring.

It should be noted that once the strategies have been developed the rest of the model does not necessarily occur in a linear fashion, thus research will be being carried out at the same time as resource development and delivery of some strategies may follow the development of resources.

Figure 1 Farmsafe Australia model of strategy development and implementation



This systematic approach to the prevention of farm injuries appears to have worked well for Farmsafe Australia. There is however very little information on the success to date of any of their strategies. The process adopted allows for the engagement of key partners in the process of development of strategies as well as allowing for the implementation of strategies while further information is being gathered and analysed.

2.5.2 Hierarchy of Control

As part of the Farmsafe Australia strategies the Hierarchy of Control is used in the development of strategies, education and training, resource development, and communication. The Hierarchy of Control used by Farmsafe Australia has five levels:

1. Eliminate the hazard
2. Substitute the hazard for a lesser hazard
3. Engineering Controls
4. Design safer work procedures or practices (including training)
5. Use of personal protective equipment [122]

The Hierarchy of Control is based on work undertaken by William Haddon Jr examining countermeasure strategies to road traffic accidents, his ten strategies were:

1. Prevent the marshalling of the form of energy in the first place
2. Reduce the amount of energy marshalled
3. Prevent the release of the energy
4. Modify the rate of spatial distribution of release of energy from its source
5. Separate in space and time, the energy from being released
6. Separation by interposition of a material "barrier"
7. Modify surfaces with which people come into contact
8. Strengthen structure
9. Quickly stop the damage from occurring
10. Quick stabilisation of the person and appropriate care and rehabilitation after the incident has occurred.[123]

The Hierarchy of Control Model provides a simple yet effective framework for informing the farmer about possible strategies that they can use to prevent injuries occurring on their farm. The following example of toddler drowning deaths in backyard pools illustrates how the model can be adapted to different situations:

- Eliminate the Hazard – removing the pool from the back yard eliminates the possibility of a person drowning.
- Substitute with a lesser hazard – instead of a pool, install a spa, or wading pool, or reduce the depth of the water.
- Engineering controls – placing a fence around the pool restricts access to the pool
- Design safer work procedures or practices – whenever the child is in the vicinity of the pool, ensure they are supervised by an adult
- Use of person protective equipment – the child wears a device that emits an alarm when the child is wet, notifying the parents they are in the pool, or the child wears a personal floatation device

It should be noted that the effectiveness of the strategies decreases as strategies down the model are employed. Where possible, higher order strategies should be used. Using the toddler drowning in pools example again, it has been shown that a pool fence is a much more effective prevention solution than the child wearing a water alarm [64 124].

2.6 A brief examination of prevention strategies for farm injuries and deaths

This section briefly outlines the approaches to the development of preventing strategies in farm health and safety from both a theoretical and practical perspective, as well as providing information on some successful strategies. Two specific areas for farm safety (children and tractors) have been chosen to explore further due to the large amount of research having been undertaken in both areas and their significance to current Farmsafe Australia activities.

Broadly there are two categories of strategies used for the prevention of injuries, these are active prevention strategies (behavioural i.e. those requiring a human element for them to work, such as wearing a seat belt) and passive prevention strategies (environmental, i.e. those that occur without the need for constant human intervention e.g. pool fencing). The prevention of injuries is not an exact science as there are many factors involved in an injury event. Often a person sustains an injury due to cascading events (e.g. a dog wanders onto a road, a car travelling too fast swerves to avoid the dog causing a second car to swerve to miss the first car and crashes into a tree) that without all of the events, the injury may not have occurred. [58]

Passive approaches are effective when in place and usually rely on technology or environmental change. There is however an inherent risk in passive measures and these are where the person being protected does not respond in the correct manner. Passive approaches often require some form of human intervention / maintenance / oversight to ensure they continue to work. Active approaches require human intervention / acceptance to be effective. Active approaches fail due to a person not undertaking the required action (e.g. not placing medicine out of the reach of children). Active and passive approaches, or combinations of the two, are used in injury prevention. To ensure the public, government and business knows and understand about prevention strategies (so they may implement them), health communication strategies are required.

Health communication is an area that is gaining importance in the injury prevention area and is often referred to as advocacy [125]. To effectively engage all who have a stake in the prevention of injuries, multifaceted approaches are required [58]. In farm safety these strategies include mass media campaigns, education and training, development of strategies and involvement of key stakeholders, field day promotions, engagement of politicians and government bureaucrats, conferences, local action groups, state bodies and word of mouth [68].

There are multiple methods that can be used to develop prevention strategies, depending on what is required to reduce the number of people injured and how the effectiveness of the strategy is measured. Measures of success of a strategy may be the reduction in the cost of injuries, lthe reduction in deaths, the number or severity of injuries, and effectiveness of prevention (i.e. Rollover Protective Structures (ROPS) prevent close to 100% of tractor rollover deaths). When developing a prevention strategy, it is usually predicated on the information available, that is the information that was collected to describe injury patterns and information available for measuring effectiveness.

There are a number of publications in Australia that provide insights into the prevention of injuries occurring on farms. The Australian Centre for Agricultural Health and Safety has produced a number of fact sheets for different hazards on farms. Fragar provides a list of hazards as a priorities for prevention based on size of the problem and available solutions [68]. Day et al in their report provide a list of general principals for the prevention of farm injuries for specific hazards [74]. While many of the proposed strategies may be effective, there is little available evidence of their effectiveness [61].

Examples of some strategies that have been identified for a variety of Australian farming conditions are displayed below using the Hierarchy of Control to arrange their order:

1. Eliminate: removal of water storage near the house for drowning prevention; place children in care off the farm to prevent all farm injuries; and growing organic foods thus removing chemicals from the farm.
2. Substitute: using a less toxic chemical reduces chemical poisoning; using mechanical lifting devices reduces back injuries; and using a more docile breed of animal reduces animal related injuries.
3. Engineering controls: rollover protective structures on tractors prevent deaths from tractor rollovers; falling object protective structures (FOPS) prevent items such as tree branches falling on the person driving the tractor; guards on augers prevent the person becoming entangled in the auger; fences to restrict access to water to prevent child drowning; improved design of stock yards to reduce animal related injuries; guards on grinders to prevent eye injury; non-slip surfaces to reduce the incidence of falls; and restricting access to chemicals to prevent child chemical poisoning.

4. Design safer work practices: no passengers on tractors rule to prevent people from falling off tractors; training to provide people with a better understanding of how to be safe; learning first aid to reduce the severity of injuries; and licence system for using machinery ensuring competent people use the machine.
5. Use personal protective equipment (PPE): gloves, suits, boots and face masks for chemical exposure; helmets for horse riders; helmets for motorcycle riding; and hearing muffs / plugs to reduce noise injury.

No prevention strategy is perfect. Education methods have been found to be less effective at preventing child deaths on farms and a better strategy has been the modification of the environment or machinery (e.g. building fences to keep children in or restrict access to a potential hazard is commonly used) [126-128]. Farmers sometimes deliberately bypass or disable safety devices because they reduce the efficiency of their work practices (e.g. guards are taken off machinery because of the need to access regularly what is behind, increasing the time required to service the machine) [118]. Sometimes safety features that were present when a piece of equipment was purchased may during the course of its life become damaged, fall off, or be removed and not replaced, thus removing its effectiveness [129].

Legislation has also been used as a method of preventing injuries on farms, however due to there being a large number of small enterprises dispersed over a large geographical area the ability to enforce legislation is limited [118]. Further work needs to be undertaken in examining the role of legislation in preventing injuries on farms [128].

Farms have multiple areas of risk and so multiple strategies are required for the prevention of farm injuries. While there are a large number of strategies that have previously been identified, their effectiveness has not been proven. They often require the farmer to implement the strategy and ensure it remains effective through continual use or maintenance programs [39]. Strategies that address the common injuries in agriculture such as back pain, contact with animals, farm machinery, and injuries to children [130] will have the greatest impact. Addressing the issues of health care (such as distances and appointment times) is also important but not part of the scope of this Thesis [130].

2.6.1 Risk factors for farm injuries

A risk factor is defined as a factor that increases the probability of a person sustaining an injury. There are many risk factors that have been identified as contributing to farm injury. A summary of the overall risk factors is provided by Murphy [118] (Table 2). These factors cover a broad spectrum of issues that farmers or farm industries are dealing with on a regular basis. Farmers have very little control over some of the factors, such as weather, farmers' age, and market forces. Whereas other factors such as noise, contact with medical services, and selection of crops can be influenced by farmers.

Table 2 Factors that contribute to the hazards involved in farming, adapted from Murphy [118]

Environmental	People	Work activity	Social, economic & Political
Weather	Young Workers	Long work hours	Market forces
Work sites	Older workers	Lack of specialisation	Agrarianism
Emergency Services	Minimum physical limits	Irregular work routine	Child care
Isolation of work	Lack of contact with medical service	Variability in agricultural production	Legislation
Personal hygiene	Lack of special provision for physical and mental conditions	Labour and management functions undertaken by one person	Enculturation – values based around agricultural work
Noise	Lack of light duty work	Instruction on the job and experiential	Lifestyle vs. occupation
Dust	Disperse workforce	Lack of holidays and vacations	Self-reliance
Vibration	Education	Uncertainty	Cultural beliefs
Sun exposure	Social contact	Erratic work pace	Finances

An injury event is often the result of cascading factors that, due to their sequence, end in an injury. While there are a broad range of factors that can increase a farmer's risk of being injured, traditionally farm occupational health and safety has identified specific hazards that a farmer can change. Fragar in 1996 identified a number of hazards that Australian farmers were being injured by, these included the operation of tractors, farm machinery, augers, agbikes, horses, farm noise, pesticides, dusts, manual handling, solar radiation, zoonoses and tetanus, overhead powerlines, and animal handling [68]. Farmsafe Australia has developed a range of strategies to reduce the number and severity of injuries caused by many of these hazards [52 103 104 120 121].

Knowledge about the effectiveness of programs aimed at reducing the exposure to a hazard in agriculture is poor and more work needs to be undertaken to gather this information [61]. There will however be some strategies that are not possible to evaluate using the traditional double blind randomised trial methodology. New evaluation methods will be required, as farm safety researchers and practitioners continue to develop, advocate and validate farm injury prevention strategies [118].

One of the areas of farm safety in Australia where much work is currently being undertaken is in separating out the different production processes and their associated risks. To date, profiles of occupational health and safety in sugar cane, sheep and wool, beef cattle, cotton, grains, dairy, and horticulture have been produced [22-26 131 132]. These profiles provide a list of the associated physical hazards in each of the production phases and their associated risk. The information about risk for each activity includes information about who is at risk, nature, severity, and frequency of risk. This information is then used to provide a risk rating for a physical hazard in a production phase. The development of specific production profiles has allowed Farmsafe Australia to be more targeted in its prevention activities and make farm safety messages more salient to the farmer.

In farm safety, children, tractors and pesticides (long term exposure) as risk factors have been examined in more detail than any other risk factor in farming. Pesticide exposure over a long period is outside the scope of this Thesis, as only acute injuries (i.e. those events where there is an immediate injury) are being examined in this Thesis. Acute pesticide poisonings, injuries sustained by children on farms and injuries as a result of tractors accidents are part of the Thesis.

The use of personal protective equipment (PPE) to reduce exposure to hazards such as noise, foreign bodies in the eye, and head injuries are routinely used in farming, however there are very few studies that have examined their use in detail [43 130 133 134]. A New Zealand study found that the use of PPE such as eye wear and hearing muffs varied depending on where they were used. For example, ear and eye protection use overall was low but used more frequently when using a chainsaw or tractor. The study also found that the use of protective equipment for chemicals has increased in NZ since 1980 [130].

The risks involved in farming are many and varied and to prevent these risks from occurring a range of strategies are required. While many of the risks have been described broadly for agriculture this information is not readily available for farming in NSW or for specific subsections such as agricultural commodity groups or age groups, by occupational status or gender.

2.6.2 Children

Children live, play and work on farms in Australia. While not as common as in other countries, they are also involved in farm work-related activities (such as collecting eggs and feeding animals) and as they age they are included in the more complex tasks of driving the tractor or drenching farm animals. This crossing of work and living boundaries creates unique hazards not found in other industries. As farms have become more mechanised the exposure to hazards ranges from normal household exposures (hot water, knives) to what would be found in heavy industry (large heavy machinery) [135 136].

In Australia a strategy to prevent child injuries has been developed by Farmsafe Australia. Similar strategies have been developed elsewhere, like the North American Guidelines for Children's agricultural tasks, that provides advice to parents about what tasks may be suitable for their child based on age, skills, training and supervision [52 137].

When examining child injuries on farms there are a number of problems:

- Consistency of definition, as the age of children has been defined as 0-19 years, less than 18 years, and 0-14 years [50 128 138].
- Information ascertainment varies
    - death information about children has been collected using a variety of methods from survey to death certificates [127 128]
    - information about injuries to children have been collected from hospital admissions data, emergency departments, and surveys [71 138 139]
- Denominator information about exposure both of the number of children living on farms and activities that children undertake (how often and for how long) is unavailable [45 128 135].
- Ability to differentiate work from recreational activities [128]
- Contribution of alcohol and drugs often not collected [128]
- Ethnicity not collected [128]
- Child injuries being included as part of all farm injuries [135]
- Incomplete data in hospital and medical records [135]

- Non-collection of child work related injuries in Workers' Compensation statistics [135]

There have been a number of reviews examining farm injuries in children over the years. Some of them have looked at all farms injuries such as DeMuri & Purschwitz and Reed & Claunch. Other studies have examined specific hazards to children such as horse injuries by Jagodzinski and DeMuri [40 135 140].

The age and gender of the child is a risk factor when examining injuries and deaths to children on farms. The rate of deaths and injuries varies by age and gender with males on average having three times the rate of females [127]. Older children are more likely to have a higher rate of injury than younger children and younger children are more likely to have a higher rate of death than older children [50 141]. There is also a variation in rates when examining specific hazards such as drowning (younger children are more likely to drown)[142].

A large number of specific hazards have been identified:

- Machinery [127 128 138]
    - tractors [50 128 141]
    - combines [128 141]
    - elevators / conveyor /augers [50 128 141]
    - farm wagons / trailers [50 128 138 141]
    - tow chains [128]
    - forklifts [128]
    - silo loaders [128]
    - tillage equipment [128]
    - bailer [141]
    - manure spreaders [141]
    - power take off [141]
    - trucks [50]
    - motorcycles [50]
    - cars [50]
- drowning[50 127 128]
- chemical poisoning
    - pesticide poisoning[50 127]
    - fertilizers [128]

        - fuel [50]
- firearms [50 127 128]
- farm animals [128]
    - horse [50 138]
        - kicked by horse[127]
        - fall from a horse [138]
    - cow [138]
- falls
    - fall from ladder [127]
    - fall from building [138]
- submerged in corn [127]
- suffocation or asphyxiation [128]

Other risk factors that have been identified include:

- Time of year – at certain times of the year children are at increased risk of injury and death either because they are part of the work force or the parents are busy. The times that have been noted are summer, and harvest time due to reduced supervision [127 128 138]
- Type of farm - different types of farms have been identified as a risk factor [127]
- Income levels and the maintenance of machinery [127]
- Child visitors to the farm are at increased risk due to their lack of experience, knowledge of the dangers on farms and lack of safety practices on farms [129]

Children perceive activities to be dangerous with qualifications such as driving too fast or when not wearing a helmet [51]. Children have confidence in their own abilities [51]. Children believe their knowledge of farm safety is adequate for their own farm environment, however this knowledge is not manifested in safe farm practice [51]. Children receive almost all of their education on an informal basis from family (particularly from their father) and would like all future farm safety information to come from the same source [51].

The large number of risks to children on farms, their lack of understanding of risk and their natural curiosity, place them at higher risk than adults of sustaining an injury on a farm.

2.6.3 Tractors

Tractors have been found to be the most dangerous piece of machinery on farms around the world and there has been significant research undertaken in the area of tractor safety [47 70 100 136 143-152]. Tractor related injuries are usually broken down into three categories: run-overs, rollovers and other [153].

Run-overs happen when either the person falls from the tractor and is subsequently run over by the tractor or an implement being towed by the tractor, or the person is already on the ground and the tractor runs over them (such as when a person is starting a tractor from the ground, or the tractor is left moving and they hop off while undertaking an activity). Rollovers occur when the tractor overturns, which can be sideways or backwards and usually happens very quickly. Other tractor related injuries during maintenance on the tractor (the tractor is raised to remove a wheel and the tractor falls on the person), a piece of the tractor injuring the person (e.g. hydraulic fluid, tyre rims).

There are a number of solutions that have been identified over the years to either help prevent tractor incidents from occurring or reduce the severity of the injuries to the people involved in the incident. A rollover protective structure (ROPS) is the most successful invention that can eliminate all deaths when a tractor rolls and the operator is wearing a seat belt, however it is still very successful without the person wearing a seat belt [154]. In Australia there have been several schemes to increase the number of tractors which are fitted with a ROPS. The most recent was in NSW (examined in further detail in Chapter 9) which followed the very successful ROPS scheme in Victoria [155].

Other strategies have been proposed to reduce the number of deaths and injuries from tractors. These include adding a kill switch (a device that stops the machine) to the seat so that if the person is not sitting on the seat the tractor will not run [136] and providing a safe access platform which provides better access to the tractor and if the person falls, ensures that they land outside of the wheels of the tractor [156 157].

2.6.4 Determining priorities, opportunities for interventions, and monitoring

There are a large number of issues in farm health and safety that need to be addressed. There are limited resources available to address all the issues, consequently a set of priorities needs to be established to try and arrange the order in which issues should be addressed.

There is no hard and fast way in which to determine priorities, however there are a number of principles advocated as outlined in Pointer et al [38]. These are: frequency and severity of injury, availability of interventions, political and economic climate, lifetime of the strategy, future potential, momentum of existing prevention activities, and data shortfalls.

The determining of priorities is usually made via a consensus of responsible or interested parties, however in this Thesis the determining of priorities is based predominantly on the frequency and severity of injury.

There are a number of opportunities for interventions to occur from small individual strategies (such as when visiting a health professional) to major large scale interventions such as a rebate scheme for ROPS (an evaluation of a ROPS Rebate scheme is provided in Chapter 9). Part of the strategy for most interventions is to inform the people at risk about of the size of the problem in order to convince them why they should act to prevent 'it' from happening to them. To monitor the effectiveness of an intervention, surveillance of the issue will be required.

2.7 Conclusion

While the field of injury prevention in Australia is reasonably new, over the past two decades there has been an increasing sophistication of approaches to injury prevention including those used to classify, categorise, and describe the injuries people are sustaining. This Chapter provides information on the important terms and concepts in farm injury surveillance and prevention (children, farm/agriculture, injury, intent, prevention, surveillance, and work related).

An overview of farm injuries in Australia by the data collection methods - Emergency Department, hospital, Workers' Compensation, deaths and survey data are provided. There have been a small number of studies in Australia (a review of each is provided) that have examined injuries to people while living and working on farms and there continues to be a need for additional and improved information on farm injuries to be collected. However the studies available provide a broad range of information about farm injuries and enable the setting of priorities for Australia. The lack of information for NSW in the area of hospital admissions and Workers' Compensation needs to be addressed.

The key models used in the farm injury prevention, 'Public Health Model' and 'Hierarchy of Control' are examined. A brief examination of prevention strategies for farm injuries and deaths are provided using the 'Hierarchy of Control' model. Risk factors for farm injuries are explored and a detailed examination of risk factors to children and tractors and their preventability are provided. There was a lack of evidence for the effective of any prevention strategy except for ROPS on tractors, highlighting the need for further studies in this area.

Chapter 3 Classification systems for farm injury events

We are drowning in information and starving for knowledge.

- Rutherford D. Roger

3.1 Introduction

To be able to make sense of the world around us people tend to classify things into categories that help with our understanding. Classification reduces the complexity of the information that needs to be processed; this also applies for those undertaking research. Walker and McEvoy describe the process of applying a classification system as coding, noting that it needs to be applied according to the rules and convention of the classification system [158].

In describing farm injuries in Australia there are three main classification (coding) systems used by the organisations that routinely collect this information, these are:

- The International Classification of Diseases (ICD) (version 9 and 10);
- The Type of Occurrence Classification System;
- The Farm Injury Optimal Dataset (FIOD).

This is not to say that other coding systems cannot be used or that there are other coding systems not being used.

Each agency from which the data for this Thesis was provided used one of the above classification systems. The ICD coding system was used by NSW Health to code the hospital separations information, and the Australian Bureau of Statistics (ABS) for coding death registrations in Australia. The Type of Occurrence Classification System is used by Work Health Authorities to code Workers' Compensation cases. The FIOD is used in cases where people are collecting farm injury data outside of other coding systems or are looking to collect greater detail about farm injuries.

The following sections describe the three classification systems in more detail.

3.1.1 Aim

The aim of this chapter is to describe the classification systems used in Australia to describe injuries sustained by people on farms or involved in agricultural production.

3.2 International Classification of Diseases (ICD)

The International Classification of Diseases (ICD) is a system of categories to which diseases and injuries of people are assigned according to established criteria [19]. There have been 10 major revisions of the International Classification Diseases since its inception in 1900 from the Bertillon Classification developed by the medical statisticians William Farr (1807-83) and Jacques Bertillon (1851-1922) [55]. It was in the sixth edition that non-fatal diseases were also included, which was ratified in 1948 by the International Conference for the Sixth Revision of the International Lists of Diseases and Causes of Death at the World Health Assembly [19 55].

The data in this Thesis which was coded according to the ICD primarily uses ICD9, except for the last few years of information (approximately from 1998 onwards).

3.2.1 International Classification of Disease Ninth Revision [19]

The International Classification of Diseases ninth revision (ICD9) came into being in 1975 following its acceptance by the delegates at the International Conference for the Ninth Revision for the International Classification of Diseases convened by the World Health Organization in Geneva from 30 September to 6 October 1975 [19].

ICD9 has seventeen categories into which diseases have been separated and two supplementary sections: the first is classification of external causes of injury and poisoning and the second is classification for factors influencing health status and contact with health services.

The two sections used for injury classification are Chapter XVII ‘Injury and Poisoning’ and the supplementary classification of external causes of injury and poisoning (external cause code). It is the supplementary classification section that provides information on the location where the injury occurred, known as the ‘Place of Occurrence’ E849.

Chapter XVII ‘Injury and Poisoning’ is broken down into 24 subsections predominantly based on type of injury sustained and body location injured. These are the primary codes used for describing the cause of injury. These 24 subsections are further broken down into smaller groups, predominantly describing more specific body locations. Each smaller group has a unique code that is used to describe the injury sustained. For each injury the external cause code can also be added. The classification of external cause of injury and poisoning is broken down into 23 subsections. Each of the subsections is a description of a type of accident such as motor vehicle traffic accident or fall; these subsections are then broken down into smaller groups to provide detail about the agent/s involved, with each having a unique code.

The E849 code is a secondary code and can not be used as a primary code as it does not describe the cause of injury but the location where the injury occurred. There are ten ‘place of occurrence’ codes available for use: home, farm, mine and quarry, industrial place and premises, place for recreation and sport, street and highway, public building, residential institution, other specified places and unspecified place. Farm is defined as any farm building or land under cultivation excluding the farm house and home premises of farm. If the data does not include this information then it is not possible to separate people injured on a farm from people injured at other locations.

3.2.2 International Classification of Diseases Tenth Revision (ICD10) [55]

Work on the tenth revision began in 1983 and was completed in 1989 when it was adopted by the Forty-third World Health Assembly [55]. The World Health Assembly adopted the recommendation that ICD10 come into effect on the 1 January 1993. Following this, Australia developed a modified version of ICD10 known as International Classification of Disease and Related Health Problems, Tenth Revision Australian Modification (ICD-10-AM) [55]. The ICD-10-AM was developed to ensure consistency with ICD10 and that it is appropriate for Australian clinical practice [55]. From hereon in this Thesis, ICD-10-AM will be used interchangeably with ICD10 (however it should be noted that Australia uses the ICD-10-AM version unless otherwise stated).

ICD10 is broken down into 21 categories of which Chapter XIX ‘Injury, poisoning and certain other consequences of external causes’ and Chapter XX ‘External causes of morbidity and mortality’ are relevant to coding information about injuries and the circumstances surrounding the event.

Chapter XIX is broken down into 22 subsections of which 13 deal with body locations (such as head, neck, thorax), four address types of injuries (burns, frostbite, poisoning medical substance and poisoning non-medical substances) and the last five cover the rest. The subsections are then broken down further to address specific injuries, body location, or causes of injury (such as asphyxiation).

Chapter XX is slightly more complex than the previous version of the external causes of morbidity and mortality as defined in ICD9. There is secondary coding for activity, which has a working for income category and a sub category related to agriculture, forestry and fishing. Similar to ICD9 it has a place of occurrence coding secondary to the main codes that includes farm (Y92.7) with the same definition as ICD9. This code can also be used as an extra digit/s on a code to describe the location of the event. However in Australia we use a separate field for location or do not use the place of occurrence code. There are eight major categories: accidents, intentional self harm, assault, event of undetermined intent, legal intervention and operations of war, complications of medical and surgical care, sequelae of external causes of morbidity and mortality, and supplementary factors related to causes of morbidity classified elsewhere. These major categories are then broken down into smaller groups.

This study primarily focuses on the external causes of morbidity major category of 'accidents', with some inclusions from the major categories of 'event of undetermined intent', and 'sequelae of external causes of morbidity and mortality'. The major category has two minor categories; 'transport accidents' and 'other external causes of accidental injury'. The 'transport accidents' minor category has twelve subcategories and the 'other external causes of accidental injury' minor category has thirteen subcategories.

For example:

- a person who is injured on a farm (Y92.7) while riding a motorcycle that crashes into a tree would be classified as V27.0 – 'V27-Motorcycle rider injured in collision with fixed or stationary object' and '.0-Driver injured in non-traffic accident.
- A person who dies as a result of an entanglement with a grain auger on a farm (Y92.7) would be classified as W30.0 – 'W30-Contact with agricultural machinery' and '.0-Contact with grain auger, elevator and conveyor'.

3.3 Type of Occurrence Classification System [56]

The Type of Occurrence Classification System was developed by the Australian Safety and Compensation Council (ASCC) for use in coding details of people who are injured in work related accidents requiring compensation via a government Workers' Compensation agency [56]. ASCC is a tripartite body established by the Australian Government to lead and coordinate national efforts to prevent or reduce the incidence and severity of occupational injury and disease in Australia by providing safe working environments [159].

The Type of Occurrence Classification System was developed following the review of the National Dataset for Compensation-based Statistics released in 1987 because of perceived inadequacies in the available coding at the time. Some of the inadequacies identified include:

- Inability to fully code disease processes;
- Lack of comprehensive coding guidelines and rules;
- Lack of comprehensive alphabetical indexes; and
- Over use of 'dump' (generic) codes. [56]

The Type of Occurrence Classification System includes information on:

- How to code (coding guidelines) including examples which demonstrate the application of the codes in a step-wise manner, including the associated rules;
- Nature of Injury/Disease Classification;
- Bodily location Injury/Disease Classification;
- Mechanism of Injury/Disease Classification; and
- Agency (agent) classification.

Each classification includes a summary, detailed listing (including inclusions and exclusions) and for nature, bodily location, and agency an alphabetical index.

The Nature of Injury/Disease is intended to identify the most serious injury or disease suffered by the worker. The classification is structured into 11 major groups which are then divided into a number of sub groups. Bodily location describes eight body regions and has a ninth category for unspecified location. The body regions are then broken down into the body part injured.

Mechanism of Injury/Disease classifies the action, exposure, or event which was the direct cause of the injury or disease. This classification has six major groups which are then broken down into a number of smaller groups. The agency classification is used to classify the object, substance or circumstance involved in the injury or disease at the point where things started to go wrong. There are nine major groups of agencies which are then divided into more targeted categories.

Additional information that is collected as part of a Workers' Compensation claim is demographic information (age, sex, geographical location, and address), duty status, employment status, occupation, industry, date of injury, date returned to work, and compensation costs. Industry and occupation are classified according to the current Australian Bureau of Statistics (ABS) classifications [2 3].

For example:

- an employee who fractures their upper arm while riding a motorcycle on a farm that hits a tree would be classified as following:
    - Nature of Injury Disease – first digit level = 1 – 'injury and poisoning' three digit level = 010 – '010-Fractures'
    - Bodily Location – first digit level = 4 – 'upper limbs' second digit level = 42 – '42 Upper arm'
    - Mechanism – first digit level = 1 – 'hitting objects with a part of the body' second digit level = 11 = 'hitting stationary objects'
    - Breakdown Agency – first digit level = 2 'mobile plant and transport' second digit level 24 'Road transport' third digit level = 244 'motorcycle'
    - Agency of injury or disease – first digit level = 7 'environmental agencies' second digit level = 71 'outdoor environment' third digit level 718 'vegetation'

3.4 Farm Injury Optimal Dataset (FIOD)

The development of classification systems is not unique and has been proposed previously in agriculture [160-164]. Murphy et al (1993) identified the problem of not having an appropriate classification system for agricultural injuries and hence proposed the Farm and Agricultural Injury Classification (FAIC) [165]. The FAIC was intended as a step towards a system that was nationally recognised, able to distinguish between farm and non-farm cases and reflected the unique nature of activities that occur farms [165]. This approach was sensible and used to code farm injuries successfully in the article although no further mention of it appears in the literature.

In Australia in 1995 a farm injury classification system was developed by the Australian Centre for Agricultural Health and Safety (ACAHS) that could not only separate out work from non work cases but identify in what phase of production the injury occurred [166]. In 2000 version 1.2

of the FIOD was published by the National Farm Injury Data Centre (an activity of the ACAHS) [167].

In 1997 Fragar and Coleman outlined the data requirements of Australian agriculture health and safety needs [13]. In particular they noted that no one data source was sensitive enough to capture all the information required for the prevention of farm injuries and deaths. They acknowledged that while data gathering does not in itself reduce injuries and deaths it does allow for better direction of resources, identification of major issues, allow evaluation of intervention to occur, and alert us to the changing patterns of injury and disease. [13]

The premise behind the FIOD is to provide a classification system specific to agriculture that allows for the examination of farm injuries in enough detail to accurately describe and subsequently provide advice on appropriate prevention strategies. The dataset needed to be robust enough to enable the consistent coding of information from multiple sources, allow for expansion, provide the level of detail required to separate work into the smallest possible units, and allow for multiple datasets to be combined for analysis. [167]

The FIOD has 12 sections (Table 3). Many of these sections are based (where possible) on coding from other sources such as the Office of the Australian Safety and Compensation Council (ASCC), Australian Bureau of Statistics (ABS) and the Australian Institute of Health and Welfare (AIHW).

While most of the coding can be mapped against other coding sources and some of it is being collected in other ongoing data collection, it is the three codes of place, agricultural context / work phase, and agent, which make this classification system unique. The use of coding already in existence was deliberate and was supposed to have two effects: when people saw the dataset there were many items that they were already familiar with, and there was no need to validate the items as they are already being used elsewhere.

While the information collected on agricultural context / work phase is unique to the FIOD, it is based on work by the Finnish occupation health system [78]. Information collected about farm injuries in Australia from data that used this classification has been utilised to develop industry profiles that include a hazard rating for each stage of production [22 23 25 168]. While agent and place are also unique to the agricultural setting similar concepts are used elsewhere [19 55 56 169 170].

Table 3 Data Items within the Farm Injury Optimal Dataset and source for coding

Dataset Items	Item #	Description	Source for Coding
General Information items	1.1-1.6, 1.9-1.10, 1.13-1.14	Includes coding for sex, date of birth, date of attendance, area of usual residence (postcode), aboriginality, employment status, date and time of injury	Farm Injury Optimal Dataset
	1.7	Mode of Separation	National Data Dictionary [169]
	1.8	Country of Birth	Australian Bureau of Statistics [171]
	1.11	Occupation	Australian Bureau of Statistics [3]
	1.12	Preferred language	Australian Bureau of Statistics [172]
Main external causes of injury	2	There are 30 categories used to describe the agent of injury and where possible their role (e.g. driver of a motor vehicle)	Matched against ICD9 external cause codes
Intent	3	Describes eight different types of intent (such as accident, international self harm) and provide an 'other' and a 'not specified' field	Match against the ICD9 external cause codes
General Activity	4	Defines in broad terms the activity the person was undertaking prior to being injured (i.e. sport, leisure, work)	
Place	5	This in the place on the farm or place associated with agricultural work where the injury occurred. There are three major categories of 'farm excluding residence', 'farm residence' and 'other place associated with agricultural work'; these are then broken down into more specific locations.	
Agricultural Enterprise	6	This is the coding used by the ABS to categorise industries in Australia and New Zealand	Australian Bureau of Statistics [2]
Agricultural Context / Work Phase	7	This information describes the area of work being undertaken (e.g. cattle production for meat) and the stage in the production process (e.g. feeding) when the injury occurred	
Agent	8	The agent is broken down into 12 sections describing the major groups of agents on farms. These sections are made up of individual agents.	
Text Description	9	This is an open character field that allows for the collection of a brief description of the injury event (i.e. what was the person doing at the time of injury, what went wrong and what caused the injury) including detail about the agent such as brand name and model	
Nature of Injury	10	For each person injured up to three nature of injuries can be collected. The nature of injury is the type of injury suffered (e.g. bite, fracture)	Initially based on the National Data Standards for Injury Surveillance [170] and then revised for version 1.2
Bodily location	11	For each person injured three body locations matching the nature of injury can be collected. The bodily location has 8 major groupings and then specific body parts (e.g. hip, heart)	Initially based on the National Data Standards for Injury Surveillance [170] and then revised for version 1.2 to closer to the National Occupational Health and Safety Commission coding of bodily location [56]
Mechanism	12	This field is intended to identify the action, exposure or event that directly caused the injury	National Occupational Health and Safety Commission [56]

In Australia people prior to the development of the FIOD farm injury studies tended to collect information for a short period of time and for specific purposes [13 132 173]. The optimal dataset was designed to allow new projects to start faster as work on developing a classification system was not required and data collection forms from other studies could be used. The FIOD should also allow comparisons between studies as the same definitions and classification system is used. It was also anticipated that the information from a number of smaller studies would be able to be combined to allow for comparisons within a state or at national level, thus providing a better understanding of farm-related injuries, this has to date not occurred [167].

The FIOD has been used in several studies to explore farm injuries in Central Queensland, Eyre Peninsula, Tasmania, farm-related fatalities in Australia, farm injuries presenting to a base hospital (this Thesis), motorcycle-related injury, and commodity specific studies [14 26 73 117 174-180]. Information collected using the dataset has been translated into a number of other publications that provide detail about injuries such as commodity profiles and agent profiles, strategies and training material [22 23 25 26 52 76 103 104 121 122 180-183].

It is unlikely that in Australia there will ever be the resources available to have a surveillance system that collects all the information on farm injury. To fill this gap small ad-hoc studies will be required, in particular when evaluating the success of an intervention. The ability to quantify the risk of an activity, particularly when there is a choice of equipment or technique, will be invaluable in future prevention programs.

3.5 Discussion of injury classification systems

This chapter only describes those classification systems that are used as part of this Thesis. There is a large number of other classification systems that are available and being used both in Australia and overseas [158]. Australia started developing its own stand alone injury classification system ‘National Data Standards for Injury Surveillance’, which has now been superseded by the International Classification of External Causes of Injury (ICECI) [75 170].

Each classification system has its own set of unique strengths and limitations when used to examine farm injuries and deaths (Table 4). Further examination of the strengths and limitations occur in the following chapters examining farm injuries. Within each of the classification systems used in this Thesis there are elements that are similar, as no classification system is built in isolation.

Table 4 Strengths and limitations of classification systems used in this Thesis

Classification System	Strengths	Limitations
ICD10	• Used internationally • Used across Australia by Health Departments and ABS • Place of occurrence allows for the identification of farms • Activity – know if person was working	• Specific information about agriculture • Detail about the injury event • No occupation information • Lack of information about some risk factors excluding age and gender
Type of Occurrence	• Used across Australia by Work Health Authorities • Good detail about the event • Agricultural industry information	• Does not have place of occurrence information (thus cannot specifically identify farm cases) • Lack of information about some risk factors excluding age, gender, agent and industry
Farm Injury Optimal Dataset	• Designed for farm injuries • Location codes • Activity codes • Agricultural context and work phase information • Specific agricultural agents	• Lack of information about some risk factors excluding age, gender, industry, agent and activity. • Not part of an ongoing surveillance system

As farm injuries are often a small part of a much larger dataset, detailed examination of the data on a regular basis will be required for a comprehensive understanding of the data. Most datasets that contain information on farm injuries are administrative in nature, are not collected to provide information for prevention purposes, and have multiple people entering the information. These idiosyncrasies mean that changes in collection methods, coding, or personnel can alter how farm injury is described by the dataset.

Without classification systems we would not be able to understand what is going on around us, adapt and change to meet new and different challenges. This Thesis undertakes the surveillance of farms injuries in NSW within the confines of the classification systems provided. It explores the utility of the data from the different classification systems perspective and critically examines each classification systems in light of the findings.

Chapter 4 Emergency Department Data

> Slight small injuries, and they will become none at all. -
> Thomas Fuller

4.1 Introduction

Using Emergency Departments to collect information about injuries (or as a surveillance system) is not new even in the area of farm injuries [184]. Predominantly it has been used to fill the gap in understanding of injuries particularly at a local level and is used in many countries to describe the burden of injury [185 186].

A surveillance system is defined as "…the ongoing and systematic collection, analysis, and interpretation of health data in the process of describing and monitoring a health event…" p 1 [187]. This information can be used for "…planning, implementing, and evaluating public health interventions and programs…" [187]. This is not to say that data collection that occurs once (one-off) cannot provide valuable information for planning, implementing, and evaluating public health interventions and programs.

In Australia there have been a number of projects that have used Emergency Department information to describe the burden of farm injuries [72-74 173 174 188]. All of these studies have provided information about the nature and incidence of injury in the communities that they were undertaken. Theses studies have unfortunately been one-off with no subsequent studies undertaken. To address the problem of one-off data collections, the National Farm Injury Data Centre (an activity of the Australian Centre for Agricultural Health and Safety) developed a classification system to describe farm injuries called the FIOD [166 167].

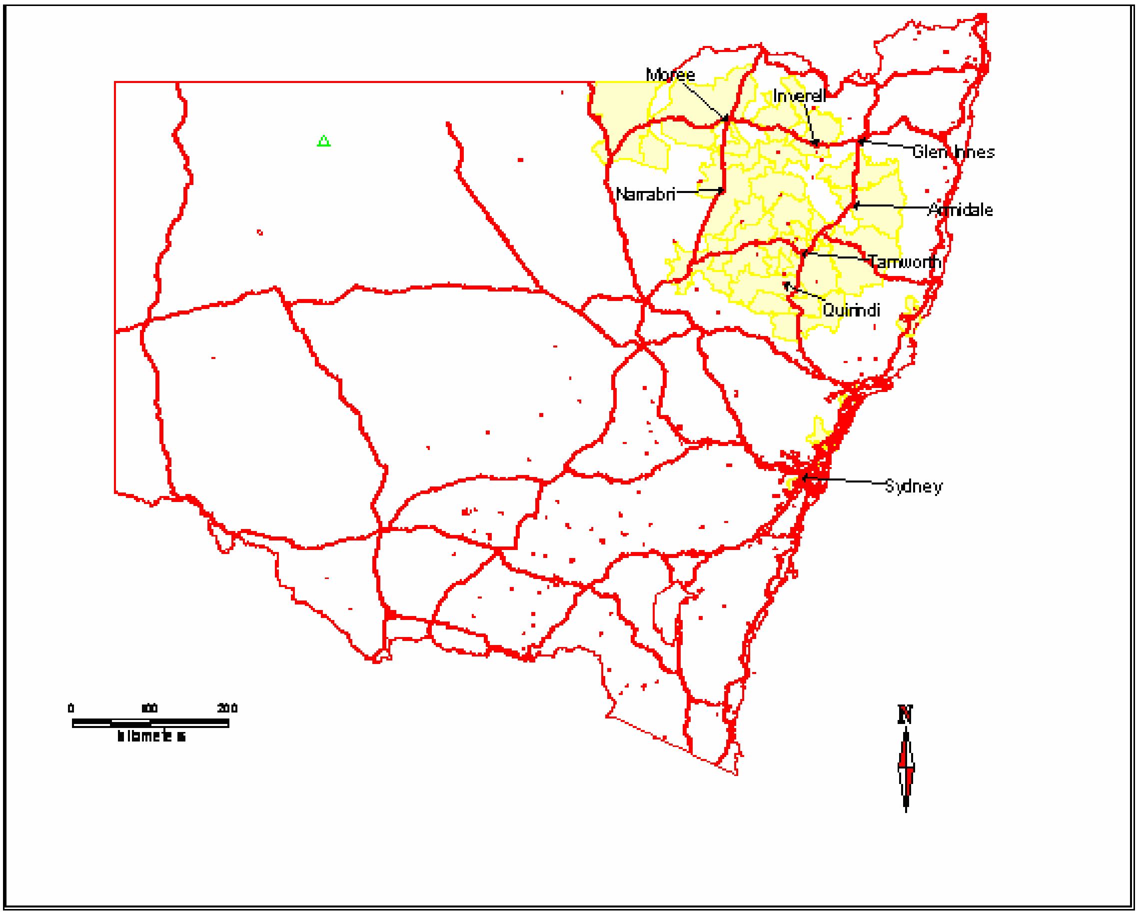
4.2 Aim

The aim of the study was to collect information about farm injuries using the FIOD at a local level to increase the body of knowledge of patterns of injury that occur in the various commodity groups in northern NSW, with a view to establishing baselines and developing prevention strategies to lower the incidence of agricultural injury. The information gained would also be useful for staff and equipment planning in the Emergency Department of Tamworth Base Hospital.

4.1.1 Tamworth Region

The town of Tamworth is located in Northern New South Wales (NSW) and services a population of approximately 54,000 people, with coverage of 9,653 square kilometres (Figure 2). The main agricultural activities around Tamworth include beef cattle, sheep, grain and poultry production.

Figure 2 Location of Tamworth and where people came from who were injured in the study



4.3 Methods

This study documents the circumstances of injuries of all patients who, having sustained an injury on a farm, presented to the Emergency Department of the Tamworth Base Hospital between 1 September 1997 and 31 August 1998. All eligible patients granted permission for their injury data to be included in the study. Note between 1 June and 31 August 1997 a pilot was conducted

Inpatient hospital records were used to check for people who were admitted directly to hospital. This system also found four farm-related deaths, all of which bypassed the ED. These deaths were included as they occurred within the New England Area Health Service (NEAHS) during the timeframe of the study. The autopsies were performed at the Base Hospital.

The data were collected in the ED by the clerical staff onto a questionnaire, which included demographics of the person injured, information about the injury event and the nature of the injury (Figure 3 and Figure 4).

Ethics committee approval was obtained (New England Area Health Service Ethics Committee DB63). Clerical staff were trained during a pilot study conducted three months prior to the start of the main study. The questionnaire was derived from other similar questionnaires developed by the Australian Centre for Agricultural Health and Safety. It was validated and modified during the three month pilot study.

The information from the questionnaire was coded using the 'Farm Injury Optimal Dataset', entered into Epi Info ™ for DOS and analysis was undertaken using SPSS [189]. The χ^2 statistic was used to analyse trend and differences between rates.

A number of categories were collapsed for analysis. These included:

- Separation mode where those who were discharged or transferred to another hospital (four cases) were included in the admitted category and those who left against medical advice (two cases) were considered to be discharged.
- Agents were grouped into broader categories as defined in the farm injury optimal dataset [167].
- Age was grouped into 5 year age group brackets until 75 years, after which all older people are grouped together.

Figure 3 Tamworth Base Hospital Injury Data Collection Form page 1

Tamworth Base Hospital Farm Injury Data Collection. June 1st 1997 till August 31st 1998

Today's Date ☐☐/☐☐/☐☐ MRN ☐☐☐☐☐☐

Date of Birth ☐☐/☐☐/☐☐ Gender: ☐ Male ☐ Female

Date of Injury ☐☐/☐☐/☐☐

Was the patient? If a farm manager use number 7 rather than number 4 code

A child under school age.	☐	A student	☐
Self-employed	☐	Employed	☐
Unemployed.	☐	Farm resident	☐
Farm manager	☐	Visitor	☐
Contractor	☐	Performing home duties	☐
Other	☐		

What type of farming was carried out? ____________________

What was the patient doing at the time of the accident? ____________________

What happened in the accident? ____________________

What type of illness/injury occurred? **To which part of the body?**

Minor only	☐	Head (excluding face)	☐	Hand (including fingers)	☐
Open wound	☐	Face	☐	Wrist	☐
Fracture	☐	Neck	☐	Hip	☐
Dislocation	☐	Thorax	☐	Thigh	☐
Sprain or strain	☐	Abdomen	☐	Knee	☐
Crush or contusion	☐	Lower Back	☐	Lower leg	☐
Traumatic amputation	☐	Pelvis	☐	Ankle	☐
Internal organ injury	☐	Shoulder	☐	Foot	☐

Figure 4 Tamworth Base Hospital Injury Data Collection Form page 2

Burn/scald/chemical burn	☐	Upper arm	☐	Unspecified	☐
Eye injury	☐	Elbow	☐	Polytrauma	☐
Other	☐	Forearm	☐	Body region code not required	☐

Where did the injury/illness happen in NSW? Postcode ☐☐☐☐

Where was the injury/illness site?

In the house	☐	In the yard	☐	On a farm	☐
Scholastic institution	☐	Public road	☐	Sports arena	☐
Workplace (other than farm)	☐	Water/river dam or pool.	☐	Public place. park/footpath or car park	☐

What caused the injury?

☐ Animal Related: Sheep ☐ Cattle ☐ Horse ☐
Dog ☐
Insect/spider ☐
Other ☐ Please State ______________________________

☐ Vehicle Related Bicycle ☐ Car/van ☐ Tractor ☐
Truck ☐
M/cycle ☐
Other ☐ Please state ______________________________

☐ Struck by object

☐ Electricity

☐ Poisoning

☐ Fall < 1 metre

☐ Fall from height

☐ Firearm

☐ Others? Please state ______________________________

- I have tried to make this simpler than it must look to you.
- I would be very grateful if this could be filled in as completely as possible.
- If you have any suggestions towards improving it, I would be grateful if you would let me know
- It is planned to put the information to good use. Accident prevention – Forward planning of A&E Department needs etc.

Please Contact:
Dr John Davies
73 Hill St
Tamworth 2340
Ph: 02 67661667

4.3.1 Calculations of rates

Unfortunately, not all people injured in a catchment's area go to their local hospital for treatment, this effect is more noticeable at the edges of an area. For this study there were seven postcodes identified where it was felt that people injured in these postcodes were more likely to present to the Tamworth Base Hospital. To calculate a rate of injury the number of farms present in these seven postcodes was used to provide a rate of people injured per 100 farm rate.

Number of people injured per 100 farms has been used previously and while there are some limitations such as the number of people per farm varying over time - in particular those employed on farms - it is a proxy and works best where there is some homogeneity (i.e. similar commodities are produced or similar geographical location) [74 114-116]. While there are differences in the number of people living on a farm over time, it is not large [190].

4.3.2 Pilot

A pilot study was undertaken between 1 June 1997 and 31 August 1997. During this time 34 people presented to the Emergency Department (ED) for farm injuries, of these 21 (61.8%) were males and 13 (38.2%) were females. The two areas identified where more work needed to be undertaken was the place on the farm (Farmplace) where the injury occurred and enterprise of the farm. The information collected in these fields in the pilot study had a high percentage of unspecified (41.2%) or unknown (76.5%).

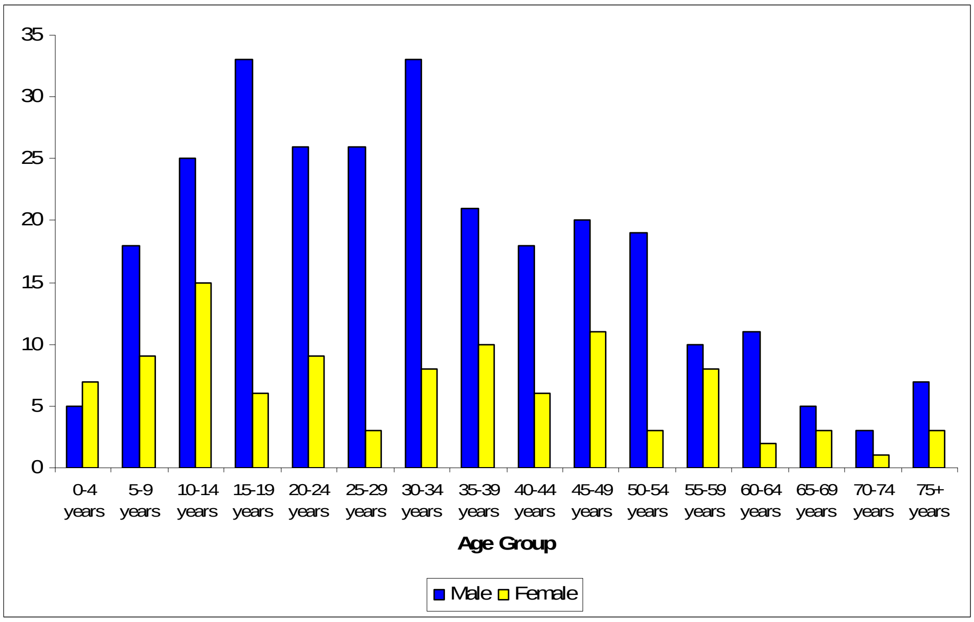
4.3.3 Results presentation

The results provide an overall view of the ED information by demographics, general activity, specific agents, injury type and work activity. Injuries sustained by children are examined in more detail as this information is not available in two of the other datasets (Workers' Compensation and ABS Deaths data) and is a priority area for Farmsafe Australia. The children information is followed by an in depth examination of the injuries sustained due to peoples interaction with horses and motorcycles (including ATV's). Horses and motorcycles were most common agents and people often make choices in their work and leisure activities about using one or other of them.

4.4 Results

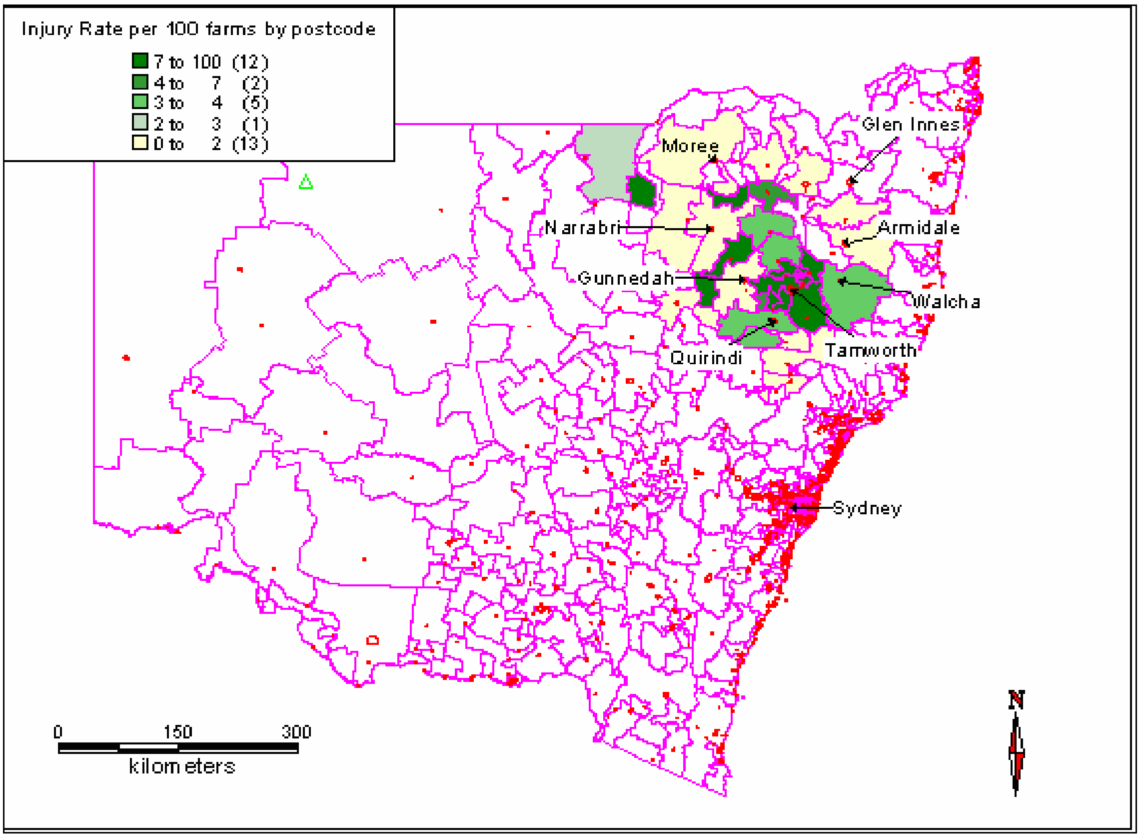
Over the 12 month study period (1 September 1997-31 August 1998), there were 384 people who sustained a farm-related injury and presented to the Tamworth Base Hospital. Of these, 72.9% involved males and 27.1% females. One in five (20.6%) of those who presented were aged less than 15 years, one quarter (26.8%) were aged 15-29 years and one third (33.1%) were aged 30-49 years (Figure 5). The 0-4 years age group was the only group where females out number males. The male to female ratio in this study was approximately 3:1.

Figure 5 Age group by gender, number of injuries presenting to the Tamworth Base Hospital, Sep 1997-Aug 1998 (n=384)



The majority (97.1%) of people in this study were born in Australia, lived in the New England Region (94.9%) and spoke English (99.0%) as their first language.

Figure 6 Map of postcodes where injuries occurred by Rate per 100 farms



Cases in this study were drawn from 44 different postcodes. Seven postcodes (Tamworth, Currabubula, Duri, Attunga, Kootingal, Moonbi and Bendemeer) were identified as areas where people would normally go directly to TBH (Figure 6, Table 5). The Tamworth postcode had the highest number of residents injured (49.7%) and injuries sustained (51.0%) in its boundary.

An injury rate per 100 farms was calculated for residence by postcode (geographical location where injury occurred) based on information from the 1997 ABS agricultural census [191]. The rates per 100 farms ranged from 1 (Inverell) to 100 (Duri), however for those seven postcodes identified as most likely to have all people go to the TBH it ranged from 9.2 (Moonbi) to 100 (Duri) (Table 5). The average rate of injuries occurring in the Tamworth district and surrounds was 34.5 per 100 farms per annum.

Table 5 Injury rate per 100 farms per annum by postcode, Tamworth Base Hospital, Sep 1997-Aug 1998

Postcode	Name	No. Injuries - Residence	No. Injuries - Location	No. of farms in postcode [a]	Rate per 100 farms - Residence	Rate per 100 farms - Location
2340	Tamworth	191	196	438	43.6	44.7
2341	Werris Creek	7	8	95	7.4	8.4
2342	Currabubula	6	6	52	11.5	11.5
2343	Quirindi	10	10	319	3.1	3.1
2344	Duri	12	12	12	100.0	100.0
2345	Attunga	11	12	64	17.2	18.8
2346	Manilla	4	6	185	2.2	3.2
2347	Barraba	6	6	176	3.4	3.4
2352	Kootingal	36	37	104	34.6	35.6
2353	Moonbi	10	9	98	10.2	9.2
2354	Walcha	9	11	366	2.5	3.0
2355	Bendemeer	6	6	34	17.6	17.6
2360	Inverell	4	4	395	1.0	1.0
2380	Gunnedah	9	9	469	1.9	1.9
2382	Boggabri	4	5	69	5.8	7.2
2387	Rowena	3	2	14	21.4	14.3
2390	Narrabri	6	6	430	1.4	1.4
2402	Warialda	4	4	203	2.0	2.0
2404	Bingara	9	10	145	6.2	6.9
Other [b]		26	23			
Out of State [c]		4	2			
Unknown		7	0			
Tamworth and Surrounds		272	278	802	33.9	34.5
Identified postcodes		347	359	3,668	9.5	9.8
Total		384	384			

a = This information is based on concordances from Ag stats [191]
b = Includes all other known postcodes where the number of injuries in that postcode were <=3 and have been grouped for confidentiality reasons
c = Includes cases where postcode was <2000 or >=3000
Residence = where the person resides, Location = where the injury occurred

There were three possible outcomes from being treated in the ED: being admitted to hospital (either Tamworth or other), dying and being discharged (including against medical advice). Predominantly (68.8%) people were discharged from the ED, the remainder were admitted to hospital except for four deaths in the study period. In this study there was 1 death for every 29 people who were admitted to hospital and 1 death for every 96 people treated in the ED (Table 6).

The general activity coding provides information about the different types of activities being undertaken at the time the person was injured. The most common activities being under taken were *working for income* (56.0%) and *leisure activity* (32.3%) (Table 6).

Table 6 General activity being undertaken at time of injury by outcome, Tamworth Base Hospital, Sep 1997-Aug 1998

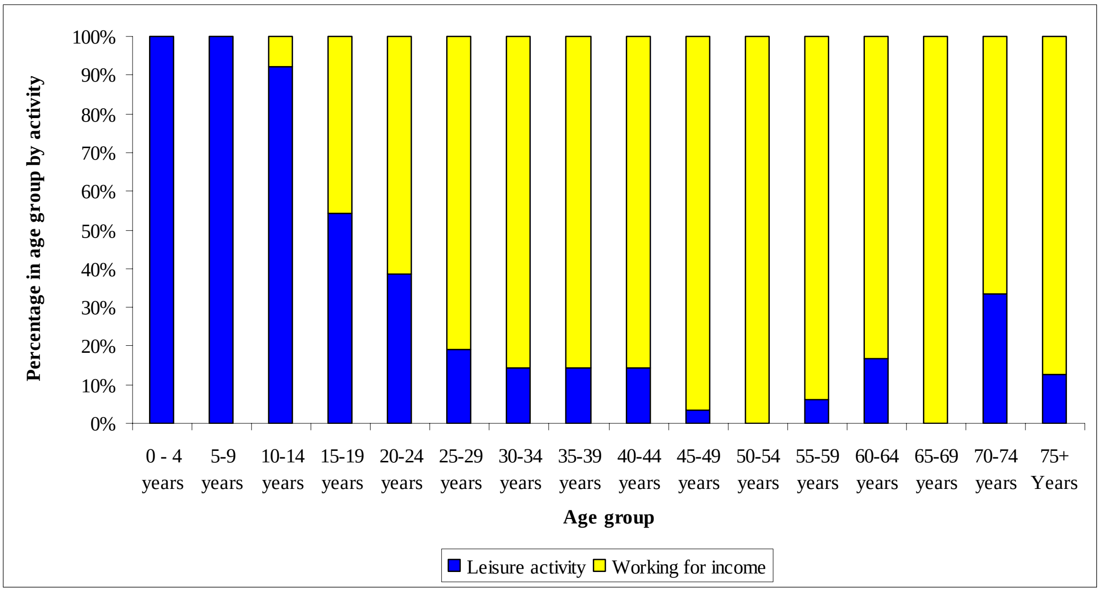
General activity	Admitted to Hospital			Died	Discharged			Total
	Male	Female	Total	Male	Male	Female	Total	
Working for income *	57	14	71	3	103	38	141	215
Leisure activity	22	9	31	0	59	34	93	124
Other type of work (incl housework)	3	3	6	0	8	0	8	14
Other specified activity	2	0	2	0	6	1	7	9
Sports activity	2	0	2	1	5	0	5	8
Unspecified activity	3	0	3	0	2	3	5	8
Engaged in formal education activity	0	0	0	0	2	1	3	3
Being cared for	1	0	1	0	0	1	1	2
Resting, eating, sleeping, other personal activity	0	0	0	0	1	0	1	1
Total	**90**	**26**	**116**	**4**	**186**	**78**	**264**	**384**

Notes: * Working for income includes all people undertaking work that results in pay either to the farm or an individual, this includes those family members who are unpaid. A child injured as a bystander would be included in the 'working for an income' category.

For people who presented to the ED due to injuries sustained on a farm, it was found that 25.0% of people who were undertaking leisure activities and 33.0% of people working for an income were admitted to hospital, which was not significantly different (χ^2 = 2.67; 1df; P = 0.10). There were three people who died while working on a farm. For people who presented to the ED due to injuries sustained on a farm it was found that 25.0% of females and 32.1% of males were admitted to hospital, this difference was not statistically significant (χ^2 = 2.06; 1df; P = 0.15).

The two main activities were working for income and leisure activities (88.3% of all injuries) (Table 6). The average age of people injured during leisure activities was 18.0 years (SE=1.32) and for people working was 40.5 years (SE=1.06); this was statistically significant (F=7.033; 337df; p=0.008). Figure 7 clearly shows how as people get older, they are more likely to be injured on farms while working than while undertaking leisure activities.

Figure 7 Age group by selected activities, Tamworth Base Hospital, Sep 1997-Aug 1998 (n=339)



In the following three tables (Table 7, Table 8, Table 9) the external cause of injury is examined by gender, mechanism of injury and selected activities of leisure and working for an income. There were clear differences according to gender, with more females than males injured as motorcycle passengers, in horse related incidents, fall incidents, and dog related incidents (Table 7).

Table 7 External cause of injury by gender, Tamworth Base Hospital, Sep 1997-Aug 1998

External cause of injury	Male		Female		Total External Causes	% External Causes	Admitted to Hospital	
	No.	%	No.	%			No.	%
Horse related	33	11.8	46	44.2	79	20.6	21	26.6
Motorcycle - driver	54	19.3	8	7.7	62	16.1	18	29.0
Animal related (not horse or dog)	38	13.6	9	8.7	47	12.2	15	31.9
Cutting, piercing object	35	12.5	8	7.7	43	11.2	7	16.3
Machinery in operation	30	10.7	3	2.9	33	8.6	14	42.4
Struck by object or person	24	8.6	3	2.9	27	7.0	6	22.2
Fall - low (same level, or <1m, or no info re: height)	6	2.1	7	6.7	13	3.4	4	30.8
Other specified external cause	11	3.9	2	1.9	13	3.4	2	15.4
Fall-high	9	3.2	3	2.9	12	3.1	5	41.7
Motor Vehicle - driver	9	3.2	2	1.9	11	2.9	5	45.5
Pedestrian	6	2.1	2	1.9	8	2.1	2	25.0
Other transport related circumstance	7	2.5	1	1.0	8	2.1	3	37.5
Motor Vehicle - passenger	4	1.4	1	1.0	5	1.3	2	40.0
Motorcycle - passenger	2	0.7	3	2.9	5	1.3	3	60.0
Hot drink, food, water, other fluid, steam, gas or vapour	4	1.4	1	1.0	5	1.3	3	60.0
Dog related	1	0.4	3	2.9	4	1.0	2	50.0
Fire, flames, smoke	2	0.7	1	1.0	3	0.8	2	66.7
Pedal cyclist or pedal cycle passenger	1	0.4	1	1.0	2	0.5	1	50.0
Electricity	2	0.7	0	0.0	2	0.5	1	50.0
Firearm	1	0.4	0	0.0	1	0.3	0	0.0
Other unspecified external cause	1	0.4	0	0.0	1	0.3	0	0.0
Total	**280**	**100.0**	**104**	**100.0**	**384**	**100.0**	**116**	**30.2**

Note: ATV's have been included in the motorcycles section, however it should be noted that ATV's are a unique piece of equipment to motorcycles.

Table 8 External cause of injury by mechanism of injury, Tamworth Base Hospital, Sep 1997-Aug 1998

External cause of injury	Falls, trips and slips of a person	Hitting objects with a part of the body	Being hit by moving objects	Body stressing	Heat, radiation and electricity	Chemicals and other substances	Biological substances	Other and unspecified mechanisms of injury	Total
Horse related	55	4	14	6	0	0	0	0	79
Motorcycle – driver	45	9	3	1	4	0	0	0	62
Animal related (not horse or dog)	7	4	26	7	0	0	3	0	47
Cutting, piercing object	2	26	15	0	0	0	0	0	43
Machinery in operation	1	1	24	0	4	1	1	1	33
Struck by object or person	1	4	22	0	0	0	0	0	27
Fall – low (same level, or <1m, or no info re: height)	10	1	0	2	0	0	0	0	13
Other specified external cause	0	0	1	4	5	1	0	2	13
Fall – high	10	1	0	1	0	0	0	0	12
Motor Vehicle – driver	3	5	3	0	0	0	0	0	11
Pedestrian	6	0	1	1	0	0	0	0	8
Other transport related circumstance	2	0	3	3	0	0	0	0	8
Motor Vehicle – passenger	3	1	1	0	0	0	0	0	5
Motorcycle – passenger	4	0	0	0	1	0	0	0	5
Hot drink, food, water, other fluid, steam, gas or vapour	0	0	1	0	4	0	0	0	5
Dog related	0	0	2	1	0	0	0	1	4
Fire, flames, smoke	0	0	0	0	3	0	0	0	3
Pedal cyclist or pedal cycle passenger	0	1	1	0	0	0	0	0	2
Electricity	0	0	0	0	2	0	0	0	2
Firearm	0	0	1	0	0	0	0	0	1
Other unspecified external cause	0	0	0	1	0	0	0	0	1
Total	**149**	**57**	**118**	**27**	**23**	**2**	**4**	**4**	**384**
% Admitted to hospital	**31.5**	**19.3**	**34.7**	**18.5**	**34.8**	**100.0**	**25.0**	**25.0**	**30.2**

The most common mechanism of injury were falls, trips and slips of a person (38.8%) predominantly from farm animals and farm vehicles and being hit by a moving object (30.7%), mainly by animals (Table 8). The two main activities of leisure and working for an income were selected and examined against external cause of injury, motor vehicle passengers, motorcycle drivers and passenger, pedestrians and falls related injuries were more likely to occur during leisure activity (Table 9).

Table 9 External cause of injury by selected activities, Tamworth Base Hospital, Sep 1997-Aug 1998

External cause of injury	Leisure activity		Working for income		Total	% of External Causes
	No.	%	No.	%		
Horse related	34	27.4	37	17.2	71	20.9
Motorcycle – driver	40	32.3	18	8.4	58	17.1
Animal related (not horse or dog)	7	5.6	35	16.3	42	12.4
Cutting, piercing object	8	6.5	29	13.5	37	10.9
Machinery in operation	1	0.8	26	12.1	27	8.0
Struck by object or person	0	0.0	26	12.1	26	7.7
Other specified external cause	4	3.2	8	3.7	12	3.5
Fall – high	6	4.8	5	2.3	11	3.2
Motor Vehicle – driver	3	2.4	6	2.8	9	2.7
Fall - low (same level, or <1m, or no info re: height)	3	2.4	6	2.8	9	2.7
Pedestrian	4	3.2	3	1.4	7	2.1
Other transport related circumstance	3	2.4	4	1.9	7	2.1
Motorcycle – passenger	3	2.4	2	0.9	5	1.5
Hot drink, food, water, other fluid, steam, gas or vapour	0	0.0	5	2.3	5	1.5
Motor Vehicle – passenger	3	2.4	0	0.0	3	0.9
Fire, flames, smoke	1	0.8	2	0.9	3	0.9
Dog related	2	1.6	1	0.5	3	0.9
Pedal cyclist or pedal cycle passenger	2	1.6	0	0.0	2	0.6
Electricity	0	0.0	2	0.9	2	0.6
Total	**124**	**36.6**	**215**	**63.4**	**339**	**100.0**

Agricultural enterprise was known for 237 (61.7%) of the people injured. The most common agricultural enterprise type was meat cattle (25.5%). There was no difference between males and females. The activities of leisure and working for income were examined by agricultural enterprise type; there was no large variation in enterprise type except that leisure activities had more unknown enterprise type. (Table 10)

Table 10 Agricultural enterprise type by gender and selected activities, Tamworth Base Hospital, Sep 1997-Aug 1998

Agricultural Enterprise Type	Male		Female		Total	% of commodities	Leisure activity		Working for income	
	N	%	N	%			N	%	N	%
Poultry	11	57.9	8	42.1	19	4.9	0	0.0	18	8.4
Cereal grain, sheep, cattle and pigs	2	50.0	2	50.0	4	1.0	0	0.0	4	1.9
Cereal grains (incl oilseeds NEC)	10	76.9	3	23.1	13	3.4	1	0.8	10	4.7
Sheep-cereal grains	3	100.0	0	0.0	3	0.8	0	0.0	3	1.4
Meat cattle-cereal grains	17	70.8	7	29.2	24	6.3	7	5.6	16	7.4
Sheep-meat cattle	9	75.0	3	25.0	12	3.1	5	4.0	5	2.3
Sheep	7	53.8	6	46.2	13	3.4	3	2.4	9	4.2
Meat cattle	75	76.5	23	23.5	98	25.5	27	21.8	63	29.3
Pigs	3	75.0	1	25.0	4	1.0	2	1.6	2	0.9
Cotton	6	100.0	0	0.0	6	1.6	0	0.0	5	2.3
Agriculture NEC	20	55.6	16	44.4	36	9.4	17	13.7	15	7.0
Other	5	100.0	0	0.0	5	1.3	0	0.0	2	0.9
Agricultural enterprise unknown	112	76.2	35	23.8	147	38.3	62	50.0	63	29.3
Total	**280**	**72.9**	**104**	**27.1**	**384**	**100.0**	**124**	**100.0**	**215**	**100.0**

An examination of agricultural enterprise type by agency group is presented in Table 11. There were two agency groups associated with the majority (61.7%) of events and further examination revealed three agents, motorcycles (both two- and four-wheeled), horses, and cattle accounted for three quarter (74.7%) of events and 46.1% of all injuries (Table 11). Horse and motorcycles are explored in greater detail further in section 4.4.2 Horses vs Motorcycles.

Table 11 Agricultural enterprise type by grouped agency, Tamworth Base Hospital, Sep 1997-Aug 1998

Agricultural Enterprise Type	Farm Vehicles	Mobile farm machinery / plant	Fixed plant / equipment	Workshop equipment	Hand tools	Powered Implements	Materials	Farm Structure	Animal	Working environment	Working motion and postures	Other	Total
Poultry	1	0	3	1	1	0	0	4	9	0	0	0	19
Cereal grains, sheep, cattle and pigs	0	2	1	0	0	0	0	0	1	0	0	0	4
Cereal grains (incl oilseeds NEC)	1	3	2	1	0	0	1	0	1	4	0	0	13
Sheep-cereal grains	0	1	0	1	0	0	0	0	1	0	0	0	3
Meat cattle-cereal grains	8	4	0	2	1	0	0	3	5	1	0	0	24
Sheep-meat cattle	1	0	0	2	1	0	0	1	7	0	0	0	12
Sheep	1	0	1	0	2	0	0	1	8	0	0	0	13
Meat cattle	27	3	2	2	2	2	5	13	38	3	0	1	98
Pigs	0	0	0	0	0	0	0	3	1	0	0	0	4
Cotton	3	0	1	2	0	0	0	0	0	0	0	0	6
Agriculture NEC	5	1	0	4	0	0	3	2	19	2	0	0	36
Other	1	0	1	0	0	0	0	1	2	0	0	0	5
Agricultural enterprise unknown	53	5	1	6	6	8	5	13	44	4	1	1	147
Total	**101**	**19**	**12**	**21**	**13**	**10**	**14**	**41**	**136**	**14**	**1**	**2**	**384**
% Admitted to Hospital	**34.7**	**42.1**	**66.7**	**0.0**	**7.7**	**40.0**	**28.6**	**39.3**	**27.2**	**42.9**	**0**	**50.0**	**30.2**

Note: Powered implements refer to those implements that are self powered such as a chainsaw and not connected to a tractor or similar.

The most common location on the farm where injuries occurred was the paddock (59.9%), while there was slight variation by gender and selected activity these were not statistically significant differences (Table 12).

Table 12 Location on farm where injury occurred by gender and selected activities, Tamworth Base Hospital, Sep 1997-Aug 1998

Location on Farm	Male		Female		Total		Leisure activity		Working for income	
	N	%	N	%	N	%	N	%	N	%
Paddock	159	56.8	71	68.3	230	59.9	98	79.0	108	50.2
Clear for grazing	74	26.4	40	38.5	114	29.7	54	43.5	53	24.7
Unspecified	76	27.1	30	28.8	106	27.6	44	35.5	47	21.9
Paddock under crop	6	2.1	1	1.0	7	1.8	0	0.0	7	3.3
Natural Vegetation	3	1.1	0	0.0	3	0.8	0	0.0	1	0.5
Stockyards incl horse yards	27	9.6	3	2.9	30	7.8	5	4.0	22	10.2
Animal shed other incl. broiler shed	12	4.3	8	7.7	20	5.2	2	1.6	18	8.4
Roads and lanes	12	4.3	7	6.7	19	4.9	7	5.6	9	4.2
Machinery shed	14	5.0	2	1.9	16	4.2	1	0.8	14	6.5
Farm excluding residence NEC	14	5.0	2	1.9	16	4.2	2	1.6	11	5.1
Workshop	14	5.0	0	0.0	14	3.6	0	0.0	12	5.6
Farm yard/ garden	5	1.8	2	1.9	7	1.8	3	2.4	1	0.5
Shed / farm building NEC	5	1.8	1	1.0	6	1.6	0	0.0	6	2.8
Farm house	3	1.1	2	1.9	5	1.3	0	0.0	2	0.9
Woolshed / shearing shed	3	1.1	1	1.0	4	1.0	1	0.8	3	1.4
Hay shed	1	0.4	2	1.9	3	0.8	1	0.8	2	0.9
Piggery	3	1.1	0	0.0	3	0.8	1	0.8	2	0.9
Farm excluding residence	1	0.4	1	1.0	2	0.5				
River / creek	2	0.7	0	0.0	2	0.5	1	0.8	1	0.5
Dairy	2	0.7	0	0.0	2	0.5	0	0.0	1	0.5
Windmill incl troughs	2	0.7	0	0.0	2	0.5	0	0.0	2	0.9
Road	1	0.4	1	1.0	2	0.5	1	0.8	1	0.5
Farm residence NEC	0	0.0	1	1.0	1	0.3	1	0.8	0	0.0
Total	**280**	**100.0**	**104**	**100.0**	**384**	**100.0**	**124**	**100.0**	**215**	**100.0**

There were some slight differences between males and females (slightly higher proportion of females were students and slightly higher proportion of males were employed) but these were not statistically significant. However there was a significant difference ($\chi^2 = 274.2$; 4df; $P < 0.0001$) between leisure activity and working for an income as expected due to the age differences of the two groups. (Table 13)

There was a statistically significant difference in the occupation of males and females ($\chi^2 = 27.9$; 6df; $P < 0.0001$) and in the selected activities ($\chi^2 = 149.8$; 6df; $P <= 0.0001$). Females (62.5%) and people undertaking leisure activities (62.1%) tended to be residents of the farm.

People who were working for an income at the time of their injury were commonly employees (41.4%), residents (32.6%) or owners (18.1%). There were differences in ages by occupation for leisure activities (visitors were older) and people injured while working for an income (contractors were the youngest, then employees, resident, farm owner, visitor and farm manager). (Table 14)

Table 13 Employment status by gender and selected activities, Tamworth Base Hospital, Sep 1997-Aug 1998

Employment status	Male		Female		Total		Leisure activity		Working for income	
	N	%	N	%	N	%	N	%	N	%
Employed	159	57.0	48	46.2	207	54.0	3	2.4	200	93.5
Student	54	19.4	31	29.8	85	22.2	72	58.1	5	2.3
Other	45	16.1	19	18.3	64	16.7	35	28.2	4	1.9
Child not at school	10	3.6	4	3.8	14	3.7	9	7.3	4	1.9
Unemployed	9	3.2	1	1.0	10	2.6	5	4.0	1	0.5
Home duties	2	0.7	1	1.0	3	0.8	-	-	-	-
Total	**279**	**100.0**	**104**	**100.0**	**383**	**100.0**	**124**	**100.0**	**214**	**100.0**

Note: there was one male where their employment status was unknown.

Table 14 Occupation by gender and selected activities, Tamworth Base Hospital, Sep 1997-Aug 1998

Occupation	Male		Female		Total		Leisure activity			Working for income		
	N	%	N	%	N	%	N	%	Av. Age	N	%	Av. Age
Resident	100	35.7	65	62.5	165	43.0	78	62.9	12.4	70	32.6	41.8
Employee	74	26.4	16	15.4	90	23.4	0	0.0		89	41.4	35.2
Visitor	49	17.5	17	16.3	66	17.2	41	33.1	25.9	5	2.3	47.6
Farm owner	40	14.3	3	2.9	43	11.2	2	1.6	68.9	39	18.1	48.6
Farm manager	7	2.5	2	1.9	9	2.3	0	0.0		7	3.3	50.1
Contractor	6	2.1	0	0.0	6	1.6	0	0.0		5	2.3	33.7
Other	4	1.4	1	1.0	5	1.3	3	2.4	24.1	0	0.0	
Total	**280**	**100.0**	**104**	**100.0**	**384**	**100.0**	**124**	**100.0**	**18**	**215**	**100.0**	**40.5**

There were over 472 different types of injuries sustained from the 384 presentations, of these 66 people sustained two or more injuries and 22 people sustained three or more injuries (the coding framework only allowed for the three injuries to be coded). The three most common injury types seen in the ED were fracture (22.0%), open wound (21.4%) and crushing injury (13.1%). The most common body part injured was the hand (15.7%). (Table 15)

Table 15 Body location by injury type, Tamworth Base Hospital, Sep 1997-Aug 1998

Body Location	Superficial	Open wound (excl. eye)	Fracture (excl. tooth)	Dislocation	Sprain or strain	Injury to muscle or tendon	Crushing injury	Traumatic amputation	Injury to internal organ	Burn or corrosion	Other	Total
Hand (incl fingers)	9	28	9	1	3	0	10	9	0	5	0	74
Lower Leg	3	16	7	0	0	0	5	0	0	7	0	38
Head (excl. face)	1	7	4	0	0	0	2	0	21	0	0	35
Thorax	0	1	13	0	3	0	6	0	8	2	0	33
Forearm	1	8	17	0	2	0	1	0	0	2	0	31
Ankle	2	0	11	2	12	0	3	0	0	0	0	30
Knee	2	5	3	3	10	0	2	1	0	1	0	27
Face	4	13	5	0	0	0	1	0	0	2	0	25
Shoulder	0	1	9	4	5	1	4	0	0	0	0	24
Wrist	1	6	7	0	6	0	2	0	0	1	0	23
Lower Back	0	0	2	0	13	0	3	0	0	1	0	19
Foot	0	2	2	0	4	0	6	0	0	3	0	17
Thigh	2	5	4	0	0	0	3	0	0	1	0	15
Elbow	2	1	5	1	1	0	4	0	0	0	0	14
Eye injury	0	0	0	0	0	0	0	0	0	0	13	13
Neck	0	3	0	0	7	0	1	0	0	1	0	12
Foreign body in external eye	0	0	0	0	0	0	0	0	0	0	11	11
Abdomen	0	1	0	0	1	0	4	0	0	2	0	8
Hip	2	1	1	1	0	0	3	0	0	0	0	8
Upper arm	0	3	2	0	0	0	0	0	1	1	0	7
Pelvis	0	0	3	0	0	0	1	0	0	0	0	4
Multiple injuries (involving >1 body region)	1	0	0	0	0	0	1	0	1	0	0	3
Unspecified body region	0	0	0	0	0	0	0	1	0	0	0	1
Total	**30**	**101**	**104**	**12**	**67**	**1**	**62**	**11**	**31**	**29**	**24**	**472**

4.4.1 Children

There were 79 children injured in farm related injuries who presented to the Tamworth Base Hospital Emergency Department between 1 September 1997 and 31 August 1998. The majority of the injured children were male (60.8%), however the gender ratio varied with age. In the 0-4 year age group the ratio of males was less than females (1:1.75), whereas in the 5-9 years age group the male: female ratio was 2:1 (this difference was not statistically significant) (Table 16). The median age was 10.1 years (mean 9.7 years, range 0-14 years).

Table 16 Age group by gender of children, farm-related injuries, Tamworth Area, Sep 1997 – Aug 1998

Age group	Male		Female		Total		Ratio Male: Female
	N	%	N	%	N	%	
0-4 years	4	36.4	7	63.6	11	13.9	1:1.75
5-9 years	18	66.7	9	33.3	27	34.2	1:0.5
10-14 years	26	63.4	15	36.6	41	51.9	1:0.6
Total	**48**	**60.8**	**31**	**39.2**	**79**	**100.0**	

Of the children injured, the majority were residents of the farm (86.1%). The number of injured visitors increased with age; all visitors injured were over 5 years of age. Children were commonly injured during *leisure activity* (88.6%); others were *working for an income* (3.8%), *other types of work* (2.5%) and e*ngaged in sport* (2.5%).

The two most common external causes of injury were *horse* related (29.1%), predominantly females (19 of 23 - 83%) and *motorcycle* (27.9%), predominantly males (18 of 22 – 82%). Of the 22 injured motorcycle riders, 21 were riding two-wheeled motorcycles and one a four-wheeled motorcycle.

Of the 23 horse related injuries, two were bystanders who were trodden on, suffering contusions to the lower limb. One mounted rider suffered a crushed finger – while closing a gate. The other 20 (87%) were falls from the horse resulting in 12 arm injuries, six head and face injuries, an ankle fracture and a back injury. Of the motorcycle related injuries (21 riders and one pillion passenger), 15 (71%) fell from the motorcycle, four hit an object, and three suffered burns. Of the 15 who fell from the motorcycle, seven had fractures (five of the forearm) and five had a joint sprain or a strain. The ATV driver aged 13 years suffered a fracture of the radius and ulna in his fall. The pillion passenger on a motorcycle suffered a partial thickness burn to the leg from an unprotected muffler.

The other common external cause of injury was *cutting, piercing object*, which mainly affected males (6 of 8) and was spread evenly across the age groups. Three of these involved use of tools e.g. knife, axe or fish hook. Five involved coming into *contact with the environment* e.g. sharp surfaces in poultry shed, hedge and stationary tractor. None of these were major injuries likely to cause permanent disability.

In total there were 15 different locations on the farm where the injury incident occurred. The predominant location was *paddocks*, either *clear for grazing* (36.7%), or *paddock unspecified* (35.4%). Other locations were *hay sheds* (10.1%), *stockyards* (5.1%), *roads & lanes* (3.8%) and *farm residence* (5.1%). These last were associated with a dog bite to an infant, a bonfire (5 years old child) and a fall from a tree (5 years old child). Seven of eleven children under 4 years were injured in *paddocks*. Only one child in the 10-14 years age group was injured in the farm residence or garden.

The most common types of farm injuries sustained by children who presented to the Tamworth ED were: *open wound excluding ey*e (26.1%), *fracture excluding tooth* (25.0%), and *crushing injury* (17.0%). The most common anatomical sites of injuries were *lower leg* (14.8%), *forearm* (13.6%), *head excluding face* (10.2%) and *hand including finger* (10.2%). The most common lower leg injuries were *open wound* (38.5%) and *burn* (30.8%). These latter were partial thickness and were caused by pressure of the leg against the hot exhaust muffler in a motorcycle accident. The majority of forearm injuries were *fractures* (91.7%). Of *head excluding the face* injuries, the majority were *concussion* (injury to internal organ) (55.6%). Of the nine injuries to the *hand including fingers* 40.4% were *open wound*, and 22.2% were *crushing injury* (Table 17).

Table 17 Injury type by anatomical site of children, farm-related injuries, Tamworth Area, Sep 1997 – Aug 1998†

	Superficial	Open wound (excl. eye)	Fracture (excl. tooth)	Sprain or strain	Crushing injury	Injury to internal organ	Burn or corrosion	Eye Injury	Total	Percent
Lower Leg	-	5	2	-	2	-	4	-	13	14.8
Forearm	-	-	11	1	-	-	-	-	12	13.6
Head (excl. face)	-	2	1	-	1	5	-	-	9	10.2
Hand (including fingers)	-	4	1	1	2	-	1	-	9	10.2
Face	2	6	-	-	-	-	-	-	8	9.1
Shoulder	-	-	3	1	1	-	-	-	5	5.7
Foot	-	-	-	1	3	-	1	-	5	5.7
Ankle	1	-	-	2	1	-	-	-	4	4.5
Abdomen	-	1	-	1	1	-	-	-	3	3.4
Wrist	-	-	1	2	-	-	-	-	3	3.4
Thigh	-	2	-	-	-	-	1	-	3	3.4
Eye	-	-	-	-	-	-	-	2	2	2.3
Neck	-	2	-	-	-	-	-	-	2	2.3
Thorax	-	-	1	-	1	-	-	-	2	2.3
Upper arm	-	1	1	-	-	-	-	-	2	2.3
Elbow	-	-	1	-	1	-	-	-	2	2.3
Knee	-	-	-	1	-	-	1	-	2	2.3
Lower Back	-	-	-	-	1	-	-	-	1	1.1
Hip	-	-	-	-	1	-	-	-	1	1.1
Total	**3**	**23**	**22**	**10**	**15**	**5**	**8**	**2**	**88**	**100.0**
Percent	**3.4**	**26.1**	**25.0**	**11.4**	**17.0**	**5.7**	**9.1**	**2.3**	**100.0**	

†Note: Includes all injuries, there were nine children who sustained two injuries in the same event.

The most common mechanism was *falls, trips and slips* by the victim (58.0%), which resulted predominantly in *fractures* (39.2%), *open wound* (17.6%) and *sprains or strains* (15.7%). Other common mechanisms included being *hit by moving objects* (15.9%) and *hitting objects with body part* (14.8%).

The percentage of children admitted to hospital according to injury type ranged from zero for some injuries such as *superficial* and *eye injury* to 72.7% for *fractures*. There were some noticeable differences for admission between males and females - males were more likely to be admitted for *fractures* and *injury to internal organs*, whereas females were more likely to be admitted for *open wounds* and *burns*. During the study period no males less than five years of age were admitted to hospital, however for females in this age group, 57.1% were admitted to hospital (Table 2). There were no deaths of children injured on farms during the study period.

Table 18 Injury, age and common agents by admission to hospital of children, farm-related injuries, Tamworth Area, Sep 1997 – Aug 1998

	Admitted		Total		% Admitted	
	M	F	M	F	M	F
Injury						
Superficial	-	-	1	1	-	-
Open wound (excl. eye)	3	3	13	8	23.1	37.5
Fracture (excl. tooth)	7	3	10	13	70.0	23.1
Sprain or strain	-	-	7	2	-	-
Crushing injury	1	-	8	5	12.5	0.0
Injury to internal organ	2	1	3	2	66.7	50.0
Burn or corrosion	-	1	4	2	-	50.0
Eye injury	-	-	2	-	-	-
Age Group						
0-4 years	-	4	4	7	-	57.1
5-9 years	5	1	18	9	27.8	11.1
10-14 years	8	1	26	15	30.8	6.7
Common Agents						
Car	1	-	1	-	100.0	-
Motorcycle – two-Wheeled	2	-	17	4	11.8	-
Motorcycle – four-Wheeled	1	-	1	-	100.0	-
Fence	2	-	4	-	50.0	-
Cattle	-	-	3	-	-	-
Horse	3	2	4	19	75.0	10.53
Total	**13**	**6**	**48**	**31**	**27.1**	**19.4**

Children were more likely to be injured during weekends. Overall children presented with an injury every 4.6 days, however the frequency of injury varied for school term (one injury presentation every 8.8 days), holidays (one every 5.2 days) and term weekends plus public holidays (one injury per 2.4 days).

4.4.2 Horses vs Motorcycles

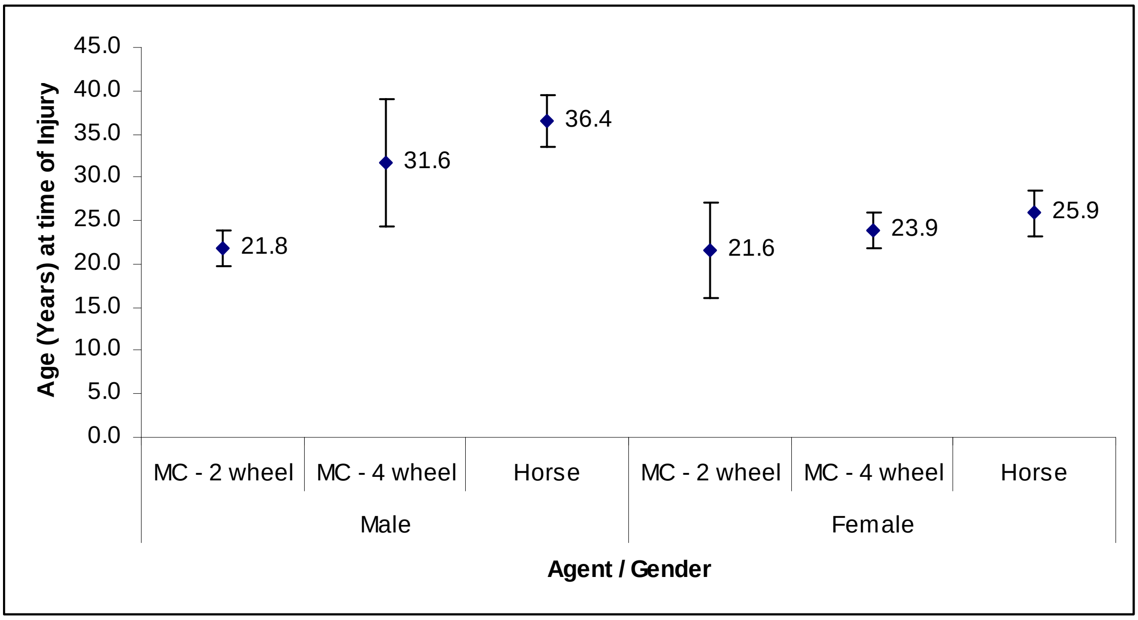
Horses and motorcycles were the most common agents of injury in the study. They can also often be used to undertake similar operations (i.e. they are both ridden and used for transport). There were 148 (38.5%) people injured where the primary agent was a horse (80) or motorcycle (58 two-wheeled and 10 four-wheeled) over the 12-month study period (1 September 1997 to 31 August 1998). Females were more likely to be injured on horses and males on motorcycles (χ^2=25.096, $p<0.0001$) (Table 19).

Table 19 Age and gender distribution of persons injured in horse and motorcycle-related injuries on farms, Tamworth area, Sep 1997 - Aug 1998

	Two-wheel motorcycle		Four-wheel motorcycle		Horse		Total	
Age group	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
0 - 4 years	-	1	-	-	1	3	1	4
5-14 years	17	3	1	-	3	16	21	19
15-24 years	19	2	3	1	6	8	28	11
25-34 years	7	2	1	1	5	1	13	4
35-44 years	3	-	1	-	9	8	13	8
45-54 years	2	-	1	-	7	5	10	5
55-64 years	-	1	-	-	3	3	3	4
65+ years	1	-	1	-	1	1	3	1
Average Age (years)	21.8	21.6	31.6	23.9	36.4	25.9	28.2	25.1
95% Confidence Interval (years)	17.9-25.7	16.9-26.3	15.9-37.4	23.0-24.7	31.6-41.3	20.8-30.9	24.7-31.8	20.4-29.8
Total	**49**	**9**	**8**	**2**	**35**	**45**	**92**	**56**

The majority (53%) of people injured on farms by motorcycles (both two- and four-wheeled) and horses were aged between 5 and 24 years. Males injured while horse riding tended to be older than those injured while riding two-wheeled motorcycles (T=-4.293, P<0.0001) (Figure 8).

Figure 8 Average age at time of injury by gender and agent, Tamworth area, Sep 1997 - Aug 1998



Horse related injuries were predominantly sustained while the injured person was working (46%) or undertaking leisure activity (43%). People injured while riding two-wheeled motorcycles usually did so during leisure activities (69%), however a quarter were injured while working (26%). The majority of people injured while riding four-wheeled motorcycles were either working (60%) or undertaking leisure activities (40%). (Table 20)

Table 20 Activity undertaken at time of accident by persons injured in horse and motorcycle-related injuries on farms, Tamworth area, Sep 1997 - Aug 1998

Activity	Horse		2-wheel motorcycle		4-wheel motorcycle		Total	
	N	%	N	%	N	%	N	%
Leisure activity	34	42.5	40	69.0	4	40	78	52.7
Working for income	37	46.3	15	25.9	5	50	57	38.5
Sports activity	5	6.3	0	0.0	0	0	5	3.4
Engaged in formal education activity	2	2.5	1	1.7	0	0	3	2
Other type of work (including housework)	1	1.3	0	0.0	1	10	2	1.4
Being cared for	0	0	1	1.7	0	0	1	0.7
Other specified activity	1	1.3	0	0	0	0	1	0.7
Unspecified activity	0	0	1	1.7	0	0	1	0.7
Total	**80**	**100.0**	**58**	**100.0**	**10**	**100.0**	**148**	**100.0**

People who were injured while riding four-wheeled motorcycles were more likely to be admitted to hospital or die than people injured while riding horses (χ^2=7.939, P<0.01) or two-wheeled motorcycles (χ^2=6.855, P<. 01). Admission rates to hospital were similar, regardless of whether the injured person was riding a horse or two-wheeled motorcycle (28% and 26% respectively) (Table 21).

People who were employed (working for an income) at the time of injury were more likely to be admitted to hospital than people who were not employed (χ^2=6.122, P<0.05) (Table 21).

The number of injuries per incident involving horses was 110/80 = 1.375; two-wheeled motorcycles was 69/58 =1.189; and four-wheel motorcycles was 15/10 = 1.5. There were 194 injuries collected from the 148 incidents, of these 115 people sustained only one injury, 20 people sustained two injuries and 13 people who sustained at least three injuries (Table 22).

Injuries with the highest potential morbidity are “crushing injury”, “injury to internal organ” and “amputation”. For injuries to farmers from horses and four-wheeled motorcycles, 38 of the 110 (35%) and 6 out of 15 (40%) respectively were either a crushing injury, injury to internal organ or amputation whereas injuries to farmers from two-wheeled motorcycles resulted in 9 out of 69 (13%) of this severity. Thus two-wheeled motorcycle injuries were less severe (χ^2=11.190, P<0.005) (Table 22).

Table 21 Employment status of persons injured in horse and motorcycle-related injuries on farms, Tamworth area, Sep 1997 - Aug 1998

		Mode of Separation				
Agent	**Employment Status**	**Admitted**	**Died**	**Discharged**	**Total**	**% Admitted**
Horse	Employed	13	0	22	35	37.1
	Other	7	1	37	45	17.8
	Total	*20*	*1*	*59*	*80*	*26.3*
Two-wheel motorcycle	Employed	7	0	8	15	46.7
	Other	9	0	34	43	20.9
	Total	*16*	*0*	*42*	*58*	*27.6*
Four-wheel motorcycle	Employed	2	1	2	5	60.0
	Other	4	0	1	5	80.0
	Total	*6*	*1*	*3*	*10*	*70.0*
Total	Employed	22	1	32	55	41.8
	Other	20	1	72	93	22.6
	Total	*42*	*2*	*104*	*148*	*29.7*

Note: People who died or were transferred were counted as admitted to hospital.

Table 22 Anatomical site and nature of injuries suffered by of persons injured in horse and motorcycle-related injuries on farms, Tamworth area, Sep 1997 - Aug 1998

	Head & Face	**Trunk**	**Lower Back**	**Upper limb**	**Lower limb**	**Total**
Two-Wheeled Motorcycle	**5**	**5**	**3**	**22**	**34**	**69**
All wounds open and superficial	3	3	0	4	3	13
Fracture (excl. tooth), Dislocation, Sprain, Strain	0	0	2	17	20	39
Crushing injury, injury to internal organ and amputation	2	2	1	1	3	9
Burn or corrosion	0	0	0	0	8	8
Four-Wheeled Motorcycle	**3**	**6**	**1**	**4**	**1**	**15**
All wounds open and superficial	2	1	0	0	0	3
Fracture (excl. tooth), Dislocation, Sprain, Strain	0	1	1	4	0	6
Crushing injury, injury to internal organ and amputation	1	4	0	0	1	6
Horse	**23**	**22**	**3**	**38**	**24**	**110**
All wounds open and superficial	7	1	0	8	3	19
Fracture (excl. tooth), Dislocation, Sprain, Strain	4	11	2	22	13	52
Injury to muscle or tendon	0	0	0	1	0	1
Crushing injury, injury to internal organ and amputation	12	10	1	7	8	38
Total	**31**	**33**	**7**	**64**	**59**	**194**

Note: Numbers refer to number of recorded injuries.

An examination of males who were injured while working found that 6 of 7 (85.7%) people injured while riding two-wheeled motorcycles and 9 of 10 (90.0%) people riding horses were admitted to hospital. This difference was not statistically significant. The males who were admitted to hospital were on average older (44.5 years for two-wheeled motorcycles and 47.0 years for horses) than those who were discharged (29.3 years for two-wheeled motorcycles and 41.7 years for horses); however, these differences were not statistically significant. Examining the admission rate to hospital by horse (30%) and two-wheeled motorcycles (55.6%) for the activity 'mustering' (n=19) there was a difference but it was not statistically significant.

Head and face injuries were 2.6 times more common in horse related injuries (23 of 110) than two-wheeled motorcycle injuries (5 of 69) (χ^2=5.998, $P<0.05$). Head injuries sustained in horse and four-wheeled motorcycle accidents were more often associated with cerebral concussion or more severe head injury than those sustained when using two-wheeled motorcycles. Four-wheeled motorcycles were associated with two head injuries from ten events. In this study, cerebral concussions from two-wheeled motorcycles tended to be minor and transient (there were 2). (Table 22)

Contusion injuries to the trunk were superficial in the two-wheeled motorcycles related accidents (2% of injuries) and there were no internal organ injuries. In horse-related accidents, trunk contusions (7%) were associated with internal organ injury (3 of 11). (Table 22)

There were two fatalities: one each from a four-wheeled motorcycle and a horse accident (fall from a horse on a race track on a farm). Both occurred with massive head, chest and other internal organ injuries.

Of the six pillion passengers injured, four fell off two-wheel motorcycles and two fell off four-wheel motorcycles. Three of the pillion passengers were admitted to hospital. Two pillion passengers suffered limb fractures and, two suffered Haemo-pneumothorax and one of these, a myocardial contusion.

The most common work-phase in which people were injured was mustering / herding. This was regardless of which form of riding was used (Table 23).

Table 23 Work-phase of persons injured in horse and motorcycle-related injuries on farms, Tamworth area, Sep 1997 - Aug 1998

Work-phase activity	Horse	Two-wheeled motorcycle	Four-wheeled motorcycle	Total
Mustering / herding	21	10	3	34
Feeding / watering	1	0	0	1
Shoeing	2	0	0	2
Breaking in	2	0	0	2
Loading / unloading	2	0	0	2
Inspecting	0	2	1	3
Animal related	2	0	0	2
Animal related activity unknown	7	1	1	9
Pesticide application / aerial spraying	0	0	1	1
Cropping activity unknown	0	1	0	1
Total	**37**	**14**	**6**	**57**

Note includes other type of work

4.5 Discussion

The Results describe one year of people injured on farm presenting to the Tamworth Base Hospital. Of the 384 people who presented to the Tamworth Base Hospital for a farm injury, four died, 166 were admitted to hospital, 79 (20.6%) were children and the most common agents were horses, motorcycles and cattle.

4.5.1 Rate of injury

Unfortunately in Australia there is no reliable denominator data except for number of farms. For 1997 the number of farms by postcode is available via a concordance method undertaken by the ABS [191]. Garnaut and Lim-Applegate examined the number of people living on farms in Australia in 1995 and found for the 140,700 farm business there were 220,000 households and 630,000 people. That is on average that there are 1.6 households per farm and 4.5 people per farm [190]. How generalisable this information is to specific regions of Australia is unknown.

Defining the geographic boundary of this study is difficult. It can be seen in Figure 2 that the location where people were injured was predominantly from around the Tamworth area. There were however six other towns, each of which has an ED where people who sustained an injury could have sought treatment. Thus this study does not represent all people injured on farms and treated in an ED in the identified postcodes, adding to the difficulty of defining the exposed population.

As the at-risk population is definitely not all farms in the postcodes where people were injured, seven postcodes (Tamworth, Currabubula, Duri, Attunga, Kootingal, Moonbi and Bendemeer) were chosen as areas with the highest probability of all people attending the Tamworth ED if injured. The seven identified postcodes cover three quarters (77.4%) of all the people injured on farm in the study. The rate of injury per 100 farms for the selected area was 34.7.

To calculate a rate per 1,000 people, the 278 people injured on farms in the seven selected postcodes was divided by the number of farms (802) multiplied by the average number of people on farms (4.5), and then multiplied by 1,000 to get a rate per 1,000 people. Thus there are 77.0 injuries per 1000 people per annum in the selected area.

Although the figure of 77.0 injuries per 1000 people is a rough estimate of the magnitude of the problem it does not accurately reflect the exposed population or even exposure. The study showed that males were approximately three times more likely to be injured than females, however this did not hold true for all situations such as injuries associated with horses.

4.5.2 Gender

Overall there was a difference in the number of males to females treated in the ED for farm injuries, which was expected [15 74]. There was a slight variation in the percentage of females (25.0%) and males (32.6%) admitted to hospital, however this was not statistically significant. There was also no statistically significant variation in the ratio of males to females by general activity.

Examination of the external cause of injury by gender revealed very little difference between males and females except for those people injured by horses, falling on the same level and dogs, where females were more common than males. The interpretation of these findings is not clear from the data, however it is known that females are more likely than males to be injured while riding horses and this has been reported as being due to the higher number of females riding horses [134 140 192-195]. Fall related injuries to older people have also been found to be more common in females than males but the results are somewhat mixed depending on the population being studied and the number were small in this study [21 196-198]. There were only four dog related injuries in this study.

There were variations in the percentage of males and females by location and employment status but these were not statistically significant. There was however a significant difference in the occupation with females, who were more likely to be residents of the farm than employees or farm owners. This difference is not altogether unexpected, as females on farms have been found to contribute to the economic livelihood of the farm, via a voluntary contribution rather than a paid position [199].

The small differences between patterns of injuries in males and females may imply that exposure to hazards plays a significant role in people being injured on farms and as such further work is needed to accurately document exposure to risk and the probability of an injury. In the short term, programs that target males are likely to have a greater impact due to the overall higher rate of injuries in males.

4.5.3 Activity at time of injury

General activity at the time of injury is an important construct for developing prevention activities that have a behavioural theme [200]. The delineation between sport, leisure, and work places the responsibility for the prevention of the injury to a particular person. For example, work related injuries need to be addressed via the employer and employee, whereas leisure related activities need to be targeted at the individual.

There were two main groups of activities people were undertaking when injured on farms, leisure activities (32.3%) and working (56.0%). These two activity categories were used for further analysis. There was a significant difference in ages, the leisure group was significantly younger (av.18.0 years) than the working group. As people age they are more likely to be injured on farm from work related activities than leisure, by the time they are in their mid 30's only 15% of injuries are due to leisure related activities.

For leisure activities motorcycle drivers and horse related external injuries causes predominated. For working activities the external causes of 'horse related', 'cutting, piercing object', 'animal related (not dog or horse)', 'struck by object' and 'machinery in operation' were common. There was very little variation in the agricultural enterprise or the location on the farm where the injury occurred, reflecting that work and leisure activities occur on all types of farms.

There was a statistically significant difference in the occupation of the person injured on a farm by working for an income and leisure activity. Those who were injured while undertaking leisure activities were residents or visitors, whereas those injured while working for an income were employees, residents and farm owners. The difference in age of those injured while undertaking leisure activities means that different prevention strategies are going to be required.

4.5.4 Admission to hospital

When planning for prevention activities there are a number of possible strategies that can be used to prioritise the activities that are going to be used, such as the number of injuries caused by a particular event, the event with the most severe outcome, the event most easily prevented, or the event with the greatest cost (financial) [201]. Most people try to develop strategies that are going to have the greatest impact. Admission to hospital was used as a measure of severity in this study. Thus a reduction in the severity of injury from an intervention (i.e. less people being hospitalised) would be seen as an indication of success.

In this study just under a third (30.2%) of people were admitted to hospital and a further four died. The admission rate is double what was found in a Wisconsin study (15%), but approximately the same as is found in Victoria (24.8%) [74 202]. People injured while working on a farm and who presented to the ED were hospitalised one-third (33.0%) of the time, whereas people undertaking leisure activities were hospitalised a quarter (25.0%) of the time.

Haddon described injury in terms of energy transfer and as such one would expect that as the amount of energy transferred increases the severity of the injury would also increase [123]. To this extent an examination of external cause, mechanism and agent may shed some light on this. There was some variation in the admission rate for external cause of injury. The mechanism ‘body stressing’ and ‘being hit by moving objects’ had a lower admission rate than ‘falls, trips and slips of a person’, ‘being hit by moving objects’ and ‘heat radiation and electricity’. For grouped agents ‘workshop equipment’ and ‘hand tools’ had very low admission rates (0% and 7.7% respectively), whereas ‘mobile farm machinery/plant’ and ‘fixed plant/equipment’ had high admission rates (42.1% and 66.7% respectively).

Thus it could be concluded that those agents that generate more energy (plant equipment) cause more severe injuries. As such, to reduce the severity of farm injuries, strategies that are aimed at reducing farm machinery injuries and their severity would reduce the overall number of farm injuries requiring hospitalisation. However due to the relative number of these injuries (8.1% of all injuries), the impact would be minimal and strategies aimed at farm vehicles and animal would see greater gains in the reduction of farm injuries overall.

Admission to hospital as a proxy for severity should be used with some caution as there may be other reasons why people are, and are not, admitted to hospital. There was no statistically significant difference in the male and female admission rate to hospital, this also held true for the activities they were undertaking.

4.5.5 Children

In this study, 79 children were injured out of a total of 384 farm injury presentations to the Tamworth ED during the 12 month study period; this represents a proportion of 20.6 %, which is similar to what has been found in other studies [14 15 52 77 203 204]. Fortunately during the study period there were no fatal child injuries. The majority of the children were injured during what was reported as leisure activity (88.2%). A small number of the children (6.3%) were injured while being occupied in farming activities that derive income; (they were aged between 12-14 years). This number may be an under representation as people may be reluctant to let hospital staff know what their children were doing at the time they were injured, though it is similar to an other Australian study [73]. Children who are injured as bystander to work may also not be collected as part of the data, as parents may not provide a full explanation of the circumstances surrounding the injury, however in this study we were unable to elucidate any further cases. Studies from North America usually find higher numbers of injured children engaged in work on the farms [45 49 141 205].

The most common agents of injury were horse and motorcycle, accounting for 29.1% and 27.9% of farm-related injuries respectively. The injury commonly occurred due to a fall from the agent to the ground (53.6%). Males were more likely to be injured while riding motorcycles, and females while riding horses. This may be due to horse riding being a more common sport and leisure activity for females [134 192]. Other studies have also found that motorcycle riding injuries commonly involve males [17-18].

Fractures and lacerations were the most common injuries (25% and 26% respectively), followed by crushing and internal organ injury (20%) which was similar to that found for all farm injuries [176].

For children 0-4 years of age, the case admission rate was 57% compared with 19% for the two older age groups. The case admission rate for different agents ranged from 0% to 100% depending on the agent and gender.

This study found that children in this setting were more likely to have a farm accident on a school term weekend/public holiday with an injury every 2.4 days. This result has not been observed previously. This is probably a function of exposure where children are on the farm all day as opposed to part of a day during school term times.

4.5.5.1 Preventative actions for child injuries

Based on the injuries sustained in this study, there are several preventative strategies that could be employed to reduce the number of injuries to children. Fragar and Franklin have shown that for a child to be a bystander (i.e. watching but not actually involved in the work activity) is not sufficient protection from a potential workplace/exposure hazard [15]. Involvement by the child in the farm workplace whether for work or leisure should be based on competency, and be closely supervised [122]. Farm safety education needs to be taught to children by parents and schools in rural areas [206]. Education does not protect very young children and as such a "safe play area" has been identified as a solution where children are separated by a physical barrier from the farm environment but have an outdoor play area [207 208]. The Marshfield Clinic has developed guidelines for creating safe play areas on farms, which have been considered in development of Australian Guidelines [207 208].

Horse and motorcycle injuries often result in head injuries. In this study there were nine (12.3%) of which five were due to horses and none from motorcycle use. Other studies have shown similar rates [134 139 205]. If helmets were being worn, then the incidence of head injury may have been lower [134 180]. Other measures such as supervision, properly conducted riding lessons, well-maintained tack, better education of bystanders as well as riders and an awareness of the specific dangers of the environment are also important [134 178 180].

Children should not ride four-wheeled motorcycles until they are 16 years of age, unless the bike has been specifically designed for a smaller person [180]. There is an increasing body of knowledge available that indicates that four-wheel motorcycle riding requires different skills to that of two-wheeled motorcycles. Appropriate training and wearing of safety equipment should also be considered [209]. Burns due to contact with hot motorcycle mufflers are totally preventable either by improved design, which is the best solution, or by using protective clothing. Clothing *per se* is not the ideal solution as synthetic materials can aggravate the burn.

As the farmers' partner becomes more involved in the operation of the farm, competing pressures will be placed on child education and supervision [210]. Risks of injury on farms need to be managed using the known hazard identification, risk assessment and risk control protocols [122]. There is a need to increase the safety of the child's immediate environment, while not protecting them to such an extent that normal development is stultified. At present it would appear that the balance is not appropriate, and thus supervision and protection need to be increased [15]. Supervision arrangements would need to be flexible given that farmers' wives are often working either on the farm or away from home and the farmer is working long hours away from the farmhouse [203].

4.5.6 Agents (Horse and Motorcycles)

Haddon in 1973 proposed a ten level hierarchy of control for managing risk [60], this has subsequently been refined by many agencies including Farmsafe Australia to provide practical advice about how to reduce the risk of injury [122]. The first two levels in the Farmsafe Australia model are eliminating the hazard or substituting for a lesser hazard. Often it is not possible to eliminate the hazard (e.g. mustering animals still needs to be undertaken) as such a substitution for a lesser hazard may be possible, however this requires an understanding of the risk involved in the initial and the substitute element.

An examination of the two most common agents (horses and motorcycles) was undertaken to explore the difference to see if one is more dangerous than the other, however without information on exposure, it is difficult to make a determination. It should be noted however that All Terrain Vehicles (ATV) are different from motorcycles, however the coding used in the FIOD identifies them as four-wheeled motorcycles, this description should be revised to current practice of using ATV.

In this study there were 80 (54%) horse, 58 (39%) two-wheeled motorcycle and 10 (7%) four-wheeled motorcycle related injuries. Similar to other studies, females were significantly more likely to be injured while riding horses and males more likely to be injured while riding motorcycles [134 180]. This is probably partially due to exposure as other authors have found more females ride horses than motorcycles and vice versa for motorcycles [15 180].

Males were significantly older when injured riding horses than when injured riding motorcycles. This finding is unexpected, as this has not been found in other studies. The activity being undertaken when the horse related injury occurred fell into two categories, working for an income or undertaking leisure, whereas two-wheeled motorcycle injuries occurred mainly during leisure activities. While Schalk and Fragar examined activity at time of injury, they did not explore if this was work related or due to leisure activities [180].

Due to the large number of the two-wheeled motorcycle injuries being leisure related, strategies that target males who ride motorcycles for leisure will be more relevant in this area than work-related strategies.

Those injured while riding four-wheeled motorcycles were significantly more likely to be admitted to hospital than those riding horses or motorcycles; this has been found elsewhere [104 178 180 211]. People injured while riding horses or two-wheeled motorcycles had similar admission rates (26% and 28% respectively) from the Emergency Department. Injuries sustained while riding pillion had a relatively high admission rate (50%) and four-wheeled motorcycle related injuries had the highest (70%). Work-related injuries appeared to be more severe as those *employed* at the time of injury were more likely to be admitted to hospital than any other group. For males who were working there was no difference in admission rates between horses and two-wheeled motorcycles.

There were two fatalities during the study period involved with horses and motorcycles; both were associated with severe head and trunk injury (one each after a horse and four-wheeled motorcycle injury). In this study injuries associated with two-wheeled motorcycles were less severe than those associated with horse or four-wheeled motorcycles.

The group of two-wheeled motorcycle related injuries were relatively benign compared with other series [15 180] – there were no two-wheeled motorcycle fatalities (due to small numbers this should be interpreted with caution). However, this study had higher admission rates than in the study by Schalk & Fragar [180]. A possible explanation might be because the Tamworth Base Hospital is a level 4 trauma centre habitually dealing with more serious trauma than the district hospitals analysed in their paper [180].

The eight burns that occurred from two-wheeled motorcycle incidents were unexpected, as an incidence of this magnitude has not been previously reported [180]. They were partial thickness and resulted from contact of an unprotected leg against a hot exhaust muffler. Typically this occurred as a result of a fall from the motorbike. There is not likely to be complications other than cosmetic.

4.5.6.1 Preventative actions for horses and motorcycle

Characteristically fatal accidents while riding two-wheeled motorcycles occur at relatively high speed and are caused by a head injury [14 180]. They tend to be more likely to occur on roads or tracks, rather than while mustering in the paddock, where the speed tends to be lower. Crash helmets are likely to offer considerable protection and it would be useful to consider speed regulators that do not allow the bike to travel over a set speed [178 180 212].

This study did not record the incidence of wearing crash helmets. Although one of the fatalities occurred while riding a race horse on a racetrack on a farm and the rider did suffer a head injury. However, his thoracic and abdominal injuries would also have caused the fatal outcome; and he would have most probably have been wearing a crash helmet.

The wearing of non-synthetic clothing would have reduced the likelihood of the burn injuries occurring or at the very least reduced the severity of the burn [213]. Guarding the muffler may also reduce burn injuries [180].

This study was unable to distinguish between agbikes (those designed for agricultural activity) and the faster and more powerful trail bikes. Of relevance is Schalk and Fragar’s finding that the latter caused more severe injuries due to greater potential velocity at impact [180].

The findings therefore suggest that it may be safer to use a two-wheel motorcycle around farms in the Tamworth region, however when working there was no difference between admission rates and a slight difference when only examining mustering. Motorcycles will still be associated with accidents; but they may not carry the same potential morbidity as those associated with horses or four-wheeled motorcycles [14 104 180]. This finding should be interpreted with some caution as exposure (i.e. number of people who ride, amount of time spent riding and what is ridden), rider skill, and equipment quality were not examined [14 15 180].

4.5.7 Utility, comparison and replication across States and Territories

The use of the FIOD with ED data provides a complete picture of farm injuries presenting to ED. However, on this occasion the approach was somewhat labour intensive with the clerical staff entering the information on the form and the information being checked and followed up by a project officer. The level of detail provided enable appropriate decisions to be made about prevention activities. If the information was collected over a longer period it would also allow for the monitoring of the intervention and their success or otherwise.

Detailed ED information such as was collected for this study provides more specific detail about a small number of cases. From this it was possible to see if proposed solutions by Farmsafe or other agencies would have an effect on the number and severity of injuries. Replication of this information across a State or Australia as a whole would be expensive, time consuming, with dubious reliability [214]. Use of the Farm Injury Optimal Dataset information about farm injuries can be compared to similar studies adding to our knowledge about farm injuries and prevention solutions [73 117 167]. Similar studies tend to be initiated on an ad hoc basis (i.e. a person in the local area wants to know more, funds are provided for an intervention and evaluation, or a student is collecting information for their studies) and as such there is a clear benefit in such studies using a comparable classification system and the information being stored in a data warehouse, to allow for further analysis at a future date. The National Farm Injury Data Centre of the Australian Centre for Agricultural Health and Safety currently provides this function and information from this Thesis now resides with the Centre.

There are some elements of the Farm Injury Optimal Dataset that are not easy to present and have limited meaning when examining all injuries such as agricultural context and work phase, however when examined for a particular industry or agent do provide a much better picture of when injury events are occurring and as such allow for the tailoring of prevention programs.

4.5.8 Limitations

The definition of farm injury used in this paper ‘those injuries or illnesses that occurred on a farm or during the production of farm outputs (not necessarily on farm)’ is a reasonably robust definition of farm injuries, however not all studies use the same definition. In the case of the number of agricultural establishments used by the ABS a farm needs to have an economic value of agricultural output (EVAO) of $5,000 per annum to be included, thus farms with an EVAO less than $5,000 or in particular ‘hobby farms’ are not included in the ABS data but would be included in this study of farm injuries [215].

The collection of data was probably more reliable when the patient was admitted (i.e. they would have spent more time in the ED or hospital to allow for collection), thus any missed farm injury patients would be of a relatively minor nature and would not have been admitted (hospital records were also checked to ensure people were not missed). This would tend to bias the collection towards an over representation of the more severe injuries. However, as most hospital based farm injury data in Australia is limited to admissions data, this Emergency Department dataset increased reporting by a factor of 79:19 (i.e. ED cases : hospital cases).

For legal or insurance reasons people may or may not tell the data collectors that their injury was sustained on a farm or while working.

The occupation category (resident, employee, visitor, farm owner, farm manager, contractor, other) is unfortunately not mutually exclusive as a person can be a resident, employee, or a resident and farm manager, etc. This needs to be described in greater detail in the next version of the FIOD.

One year of data exploring farm injuries may not be enough to provide an accurate picture of farm injury. Variations in the climate such as drought or rain may cause different exposure patterns, commodity prices may influence the hire of labour or the decision making process about what to produced causing different exposure patterns.

The ED is only one place where injuries can be treated and as such location variations in availability of other medical services (such as number and availability of doctors, physiotherapists, chiropractors, etc) may affect the number of people treated in the ED.

4.5.9 Data Quality

There are always a number of areas where data quality can be compromised, these include incorrect or inaccurate collection of the information from the injured person (i.e. the person injured tells the collector incorrect information or the collector writes down the information inaccurately), data entry mistakes (the person entering the data does so incorrectly), coding decisions (for cases where there is a lack of information or the information is ambiguous the coder may incorrectly code the data), and missing data (where information is unknown or was not recorded).

To reduce the probability of data entry problems the information was collected by a trained person in the Emergency Department and this information was then checked against hospital records for accuracy by a member of the research team. This information was then entered into the database and then checked, for obvious mistakes such as date of birth subsequent to injury event, children being farm managers or employees, coding numbers that do not exist, etc.

Missing information is hard to gauge and as such hospital in-patient records were checked to see if any people were admitted to the hospital who were not included in the study from the ED collection. This method yielded an additional two cases.

The coding of information is problematic where this information is missing or ambiguous, as such all coding was checked another person for accuracy and where information was lacking a broader field was used.

4.6 Conclusion

The aim of the study to collect information about farm injuries using the FIOD on ED data to increase the body of knowledge about patterns of injury that occur on farms was successful. It is appropriate to use ED data for the surveillance of people who are injured on a farm or while undertaking agricultural production. The FIOD allows for a comprehensive picture of the circumstances surrounding the event when the person was injured to be describe upon presentation to the ED. Using hospital admission data alone to examine people injured on the farm, not only underestimates the number of people injured but also misses particular types of agents involved in farm injuries.

4.7 Summary - Emergency Department Data

1. An analysis of all farm-related injury cases that presented to the Tamworth base hospital between 1 September 1997 and 31 August 1998 was conducted. This emergency based study used standard epidemiological records collected by staff at the Tamworth Base Hospital.
2. The information was checked against hospital records to ensure completeness of the data and a pilot of the collection tool and methods was undertaken between 1 June 1997 and 31 August 1997. During the pilot period 34 people presented to the Emergency Department (ED) of which 61.8% were males and an average age of 32 years. The pilot identified a number of areas where improvement in data collection needed to be made:
    a. Agricultural context / work phase
    b. Place of occurrence on the farm
    c. Farm enterprise
    d. Decreasing the number of cases with unspecified or unknown fields.
3. There were 384 people who suffered farm-related injuries and presented to the Tamworth Base Hospital during the study period of which 72.9% were males. One in five (20.6%) were aged less than 15 years and one third were aged 30-49 years. The majority (97.1%) of people were born in Australia and spoke English (99.0%). The rate of injury per 100 farms was 34.7 (range 9.2 to 100) for those postcodes identified as being more likely to attend the TBH for health care.
4. The majority (66.8%) of people were discharged from the ED. There was 1 death for every 29 people who were admitted to hospital and 1 death for every 96 people only treated in the ED. The two most common activities being undertaken immediately prior to being injured were working for an income (56.0%) and leisure activities (32.3%). The proportion of injures due to leisure activities decreased as people aged, whereas the proportion of work related increased.
5. The three most common external causes of injury were horse related (20.6%), motorcycle – driver (16.1%) and animal related (12.2%). The most common agricultural enterprise was meat cattle (25.5%), however in 147 cases the agricultural enterprise was unknown. The most common location on the farm where the incident occurred was the paddock (59.9%).
6. Over half (54.0%) of the people injured were working at the time of injury and 43.0% were residents of the farm. There were 472 different types of injures sustained (however

there were 22 people who sustained three injuries, the maximum allowable in the coding framework).

a. The three most common types of injuries were:
    i. Fractures (22.0%)
    ii. Open wound (21.4%)
    iii. Crushing injury (13.1%)
b. The three most common body parts injured were
    i. Hand (15.7%)
    ii. Lower leg (8.1%)
    iii. Head (7.4%)

7. There were 79 children injured of which the majority were: males (60.8%), residents of the farm (86.1%), and injured during leisure activities (88.6%). The two most common external causes of injures were horse (29.1%) and motorcycle (27.9%).
8. A detailed analysis of horses vs motorcycles was also undertaken. This found:
    a. Females were more likely to be injured on horses and males on motorcycles.
    b. Males injured while riding horses were more likely to be older in years than those injured while riding two-wheeled motorcycles.
    c. There was a more even mix of work-related and leisure activities being undertaken while riding horses than motorcycles which were more likely to be during leisure activities.
    d. People injured while riding four-wheeled motorcycles were more likely to be admitted to hospital or die. People who were employed at the time of injury were more likely to be admitted to hospital.
9. This study identified a number of areas for preventative actions such as motorcycle and horse riding, children, people working on farms, males. However due to the lack of appropriate expression of risk factors (i.e. number of hours spent riding a horse, amount of time spent engaging in agricultural activities, exposed population), it is not possible to accurately rank the risk factors.
10. Using the FIOD provided a detailed picture of the circumstances surrounding the event for people injured on farms and presenting to the ED. It provided information on the geographical location, activity immediately prior, and agent involved Due to the amount of information collected and that a paper based system was used it was labour intensive, however the information was extremely detailed and useful for informing prevention activities.

Chapter 5 Farm Trauma – A 10 year total population study of hospital admissions

> It is a capital mistake to theorize before one has data. Insensibly one begins to twist facts to suit theories, instead of theories to suit facts. - Sir Arthur Conan Doyle, *British mystery author & physician (1859 - 1930)*

5.1 Introduction

Farming has been recognised as one the most dangerous industries in which to work in Australia [159 203 216]. The farm also represents more than just a business, it is the place where people live and undertake recreational activities. As such there are many injuries that occur on farms that are not recorded as part of Workers' Compensation data. Hospital separations provide an invaluable insight into all injuries that occur on farms using the place of occurrence code for 'farm'.

Hospital separation data has been a source of information for injury prevention in Australia for many years [31 32 37]. It has been used to define priorities, costs, and research. Such primary data are significant sources of ongoing information about injury and provides a baseline against which to measure success or failure of prevention programs [31 217 218]. There are a large number of studies both internationally and in Australia that have examined injury information from hospital separation data including examination of farm injuries [160 219-224]. However little is known about the usefulness of this information from a farm injury prevention perspective in Australia.

Several audits have been undertaken of the quality of data obtained from hospital separation records overseas and in Australia and all hospitals in Australia have their own audit system to check the data [220 225-235]. Specific audits of hospital-based information in Australia have been undertaken in a wide range of areas such as asthma, perinatal conditions, aboriginal status, and endophthalmitis [225 233 234 235]. Studies that have examined hospital data about injuries collected as part of the ongoing hospital separations reporting system used in Australia are rare [218 236]. The only peer-review published study that has examined external cause codes in Australia is by MacIntyre et al examining Victorian data [236]. MacIntyre et al found that while there are some errors, overall the information is usable and reliable for injury surveillance [236].

Surveillance is described by Klaucke et al as "… the ongoing and systematic collection, analysis, and interpretation of health data … used for planning, implementing, and evaluating public health interventions and programs…" (p S5) [8]. From a farm injury prevention perspective, surveillance is the examination of all injuries occurring on farm or from activities undertaken as part of agricultural production for information relevant to the reporting of the injuries, surrounding event(s) and control of the injuries [66].

Harrison and Steenkamp examined hospital separations data used for 11 of the 34 injury indicators, used as part of the National Health Priority Areas (NHPA) to report on the progress of the reduction of injuries [218]. As part of the examination they found the following issues relevant to information from the NSW Hospital separations data:

- Some injuries result in more than one 'hospital separation' and as such this needs to be addressed when examining injury data.
- External cause information (including place of occurrence) is not used to derive the diagnosis related groups and as such has not received the same level of attention as those data items that make up the diagnosis related groups.
- Not all private hospital separations are included. [218]

Klaucke et al in their 1998 paper provide some guidelines for evaluating a surveillance system [8]. Primarily hospital separation data is collected for administrative purposes such as calculating financial reimbursement to the hospital. However assuming hospital separations data provides a surveillance system for people injured in NSW, it can then be examined to see how well it provides surveillance for farm injuries.

In the Klaucke et al guidelines there are six tasks involved in evaluating a surveillance system:

A. Describe public health importance
B. System description
C. Usefulness
D. System attributes
    a. Simplicity
    b. Flexibility
    c. Acceptability
    d. Sensitivity

e. Predictive value positive
f. Representativeness
g. Timeliness

E. Resources for system operation

F. Conclusions and recommendations [8]

While all of the tasks are important some are not possible to describe, have been covered in other studies or are not useful as part of this study [233 237 238]. In particular the resources for operating the system are not available as farm injuries represent a small proportion of the overall system and separating out the costs are outside the scope of this PhD. The components that will be examined are usefulness, simplicity, flexibility, acceptability, and representativeness.

The current coding for the hospital data in Australia is based on International Classification of Diseases (ICD) Version 10, which started in NSW in the 1998-99 financial year, prior to this ICD9 was used [19 55]. Farms as a specific location are identified in the ICD coding versions, however very little work has gone into understanding hospital data and its meaning.

5.2 Aim

1. To test the quality of NSW hospital separations information for people injured on farms, defining limitations and strengths, and to see where improvements could be made
2. To describe the nature and extent of the injury from information collected from people admitted to hospital
3. To demonstrate the application of this data to farm injury prevention initiatives

5.3 Methods

Separation is defined "…as the process by which an episode of care for an admitted patient ceases. A separation may be formal or statistical. Formal separation is the process by which a hospital records the cessation of treatment and/or care and/or accommodation of a patient. Statistical separation is the administrative process by which a hospital records the cessation of an episode of care for a patient within the one hospital stay…" p387 [7]

Information for this study is based on a set of records from the NSW Health Department Separations data for people admitted to hospital in NSW. Each annual file in the collection included records for all episodes of in-patient care in NSW that ended ('separated') during a particular 12 month period, to 30 June. The data items and coding generally accord with the National Minimum Dataset for Institutional Care, as specified in the National Health Data Dictionary [169] .

Data from the files for ten years 1990-91 to 1999-2000 was extracted to provide a time series with consistent data, after this period ICD10 [55] was used solely to code diagnosis. In 1998-99 financial year, coding of NSW hospital separations data was coded to ICD10 and back coded to ICD9 to allow for comparison over time. For this study ICD9 codes were used.

Cases where the principal diagnosis, secondary, third, fourth or fifth diagnosis had a classification of injury (i.e. ICD9 code of 800-999.99) were initially extracted. This resulted in 1.6 million cases [19].

The records included for analysis were those which met the following criteria: the episode in hospital ended on a date from 1 July 1990 to 30 June 2000, the principal diagnosis was an injury or poisoning (i.e. ICD9 code of 800-999.99)[19], an ICD9CM External Cause code had been recorded (ICD9CM E880-E999) and an ICD9CM Place of occurrence code had been recorded (ICD9CM 0-9), this resulted in 1,241,471 cases.

The following E-codes were excluded: due to medical misadventures (E870-E876) or surgical and medical procedures as the cause of abnormal reaction of patient or later complication, without mention of misadventure at the time of procedure (E878-879), drugs, medicinal and biological substances causing adverse effects in therapeutic use (E930-949), where the intent was suicide (E980-959), homicide & injury purposely inflicted by other person (E960-969), legal intervention (E970-978) and injury resulting from operations of war (E990-E999). The E-codes of E889 (Sports Injury) were used in the 1996-97 and 1997-98 financial years. As these do not relate to other years coding they have been excluded and the E-codes of 849 (Location), which are supposed to be used for location rather than for external cause were also removed. This left 916,614 injury related hospital separation cases over the 10 years.

For analysis of farm cases the ICD9CM Place of Occurrence code had to be recorded and was given a value of 1, (meaning "farm", excluding farm house and home premises).

In the 1997-8 financial years a dual coding system was used to code the data using ICD9 to ICD10, in the 1998-9 and 1999-2000 years ICD10 was back coded to ICD 9 [239]. There appears to be very little change in the numbers in the first financial year. The ICD10 Place of Occurrence information has greater detail with an extra digit for coding the additional information. It can be seen that the change from ICD9 to ICD10 does not map neatly across (Table 24).

Table 24 ICD9 and ICD10 Coding for Place of Occurrence

Code	ICD9 Location	Code	ICD10 Location
0	Home	Y92.0	Home
1	Farm	Y92.2	School, other institution, a public administrative area
2	Mine and quarry	Y92.1	Residential Institution
3	Industrial place and premises	Y92.3	Sport and athletics area
4	Place for recreation and sport	Y92.4	Street and Highway
5	Street and highway	Y92.5	Trade and services area
6	Public building	Y92.6	Industrial and construction area
7	Residential institution	Y92.7	Farm
8	Other specified places	Y92.8	Other
9	Unspecified	Y92.9	Unspecified

Farmsafe Australia (FSA) and the Australians Centre for Agricultural Health Safety (ACAHS) has also defined a subset of ICD codes (Table 25) on the basis of examining trends over time [76]. The development of the subset was based on information provided from NSW Hospital Admissions data where the location was farm. When an initial examination of the data was undertaken there were a large number of cases which were miscoded as having occurred on farm. An example of such confusion was between motor traffic accidents and off road accidents. As much of the coding for this information was undertaken away from the hospital where the person was being treated there was less capacity to understand the circumstances surrounding the event. As such a number of selected items (Farmsafe Australia subset) were identified as having a greater probability of occurring on farms to provide even though it was known there were some errors and some key injury events (such as falls) excluded [77 240].

The FSA subset was modified by ACAHS to have two sections. The first section for those FSA codes that had been used over time and a second section which included information on the other E-cause codes [77]. In keeping with the historical way of presenting this data, the tables in this Thesis also present the Farmsafe Australia subset (first section) in the top half of the table and the other E-code groups (second section) in the bottom half.

The tables - Table 26,Table 27, Table 28, Table 29, refer to ICD9 External Cause codes and their likelihood of occurring on the farm (this does not necessarily mean that they would occur during farm work activity). This classification was made based on the E-code and the Farmsafe Australia subset as determined by the author and were classified into: probably farm; either; and probably not farm.

Table 25 Farmsafe Australia E-code groups

E-code	Description
E820-829	Motor vehicle non traffic accident and other road vehicle accidents
	Motorcycle
	Other vehicles
	Animal Ridden
E862	Poisoning by petroleum products
E863	Poisoning by Agricultural Chemicals
E864	Accidental poisoning by corrosives and caustics, not elsewhere classified
E866-869	Poisoning by other solids, gases and liquids
E891-899*	Fire and flames
E905	Venomous animal and plants
E906.0	Dog bites
E906.8	Injury by other animal
E919.0	Agricultural machinery
E919.1-.9	Accidents cause by machinery excluding agricultural
E920	Accidents cause by cutting and piercing instruments or objects
E922	Firearms
E810-819	Motor vehicle accidents
E850-865**	Poisoning
E880-E888	Falls
E900-909#	Natural & Environmental Factors
E910	Drowning
	Other E-code##

*Excluding E893.0, E895.0-9 and E898.0 (if included are in other E-codes). ** Excludes E863.0-9, E864.0-9
E905.0-9, E906.0 & E906.8. ## Includes all E-codes not elsewhere represented

Table 26 E-codes that are only used where location is farm or are more likely to occur on a farm

Highly likely to be on a farm		Likely to be on a farm	
Code	**Description**	**Code**	**Description**
919.0	Agricultural machines	E827	Animal-drawn vehicle accident
		E828	Accident involving animal being ridden
		E863	Accidental poisoning by agricultural and horticultural chemical and pharmaceutical preparations other than plant foods and fertilizers
		E980.7	Agricultural and horticultural chemical and pharmaceutical preparations other than plant foods and fertilizers

Table 27 E-codes that could occur on a farm or not

E-code	Description
E821	Non-traffic accident involving other off-road vehicle
E822	Other motor vehicle non-traffic accident involving collision with moving object
E823	Other motor vehicle non-traffic accident involving collision with stationary object
E824	Other motor vehicle non-traffic accident while boarding and alighting
E825	Other motor vehicle non-traffic accident of other and unspecified nature
E826	Pedal cycle accident
E829	Other road vehicle accident
E830	Accident to watercraft causing submersion
E831	Accident to watercraft causing other injury
E840	Accident to powered aircraft at takeoff and landing
E841	Accident to powered aircraft, other and unspecified
E842	Accident to un-powered aircraft
E843	Fall in, on or from aircraft
E844	Other specified air transport accidents
E848	Accidents involving other vehicles not elsewhere classifiable
E853	Accidental poisoning by tranquilizers
E856	Accidental poisoning by antibiotics
E857	Accidental poisoning by anti-infectives
E858	Accidental poisoning by other drugs
E860	Accidental poisoning by alcohol, not elsewhere classified
E861	Accidental poisoning by cleansing and polishing agents, disinfectants, paints and varnishes
E862	Accidental poisoning by petroleum products, other solvents and their vapours, NEC
E864	Accidental poisoning by corrosives and caustics, not elsewhere specified
E865	Accidental poisoning from foodstuff and poisonous plants
E866	Accidental poisoning by other and unspecified solid and liquid substances
E867	Accidental poisoning by gas distributed by pipeline
E868	Accidental poisoning by other utility gas and other carbon monoxide
E869	Accidental poisoning by other gases and vapours
E880	Fall on or from stairs or steps
E881	Fall on or from ladders or scaffolding
E882	Fall from or out of building or other structure
E883	Fall into hole or other opening in surface
E884	Other fall from one level to another
E885	Fall on same level from slipping, tripping, or stumbling
E886	Fall on same level from collision, pushing, or shoving, by or with other person
E887	Fracture, cause unspecified
E888	Other and unspecified fall
E891	Conflagration in other and unspecified building or structure
E892	Conflagration not in building or structure
E893 Excl E893.1	Accident caused by ignition of clothing
E894	Ignition of highly inflammable material
E896	Accident caused by controlled fire in other and unspecified building or structure
E897	Accident caused by controlled fire not in building or structure
E898	Accident caused by other specified fire and flames
E899	Accident caused by unspecified fire
E900	Excessive heat
E901	Excessive cold
E902	High and low air pressure and changes in air pressure
E903	Travel and motion
E904	Hunger, thirst, exposure, and neglect
E905	Venomous animals and plants as the cause of poisoning and toxic reaction
E906	Other injury caused by animals
E907	Lightning
E908	Cataclysmic storms, and floods resulting from storms
E909	Cataclysmic earth surface movements and eruptions
E910 Excl E910.4	Accidental drowning and submersion

E-code	Description
E911	Inhalation and ingestion of food causing obstruction of respiratory tract or suffocation
E912	Inhalation and ingestion of other object causing obstruction of respiratory tract or suffocation
E913 Excl E913.0	Accidental mechanical suffocation
E914	Foreign body accidentally entering eye and adnexa
E915	Foreign body accidentally entering other orifice
E916	Struck accidentally by falling object
E917 Excl E917.0 & E917.1	Striking against or struck accidentally by objects or persons
E919 Excl E919.0	Accidents caused by machinery
E920	Accidents caused by cutting and piercing instruments or objects
E921	Accident caused by explosion of pressure vessel
E922	Accident caused by firearm missile
E923	Accident caused by explosive material
E924	Accident caused by hot substance or object, caustic or corrosive material, and steam
E925	Accident caused by electric current
E926	Exposure to radiation
E927	Overexertion and strenuous movements
E928 Excl 928.0	Other and unspecified environmental and accidental causes
E929 Excl E929.0	Late effects of accidental injury
E980 Excl E980.7	Poisoning by solid or liquid substances, undetermined whether accidentally or purposely inflicted
E981	Poisoning by gases in domestic use, undetermined whether accidentally or purposely inflicted
E982	Poisoning by other gases, undetermined whether accidentally or purposely inflicted
E983	Hanging, strangulation, or suffocation, undetermined whether accidentally or purposely inflicted
E984	Submersion (drowning), undetermined whether accidentally or purposely inflicted
E985	Injury by firearms and explosives, undetermined whether accidentally or purposely inflicted
E986	Injury by cutting and piercing instruments, undetermined whether accidentally or purposely inflicted
E987 Excl E987.0	Falling from high place, undetermined whether accidentally or purposely inflicted
E988	Injury by other and unspecified means, undetermined whether accidentally or purposely inflicted
E989	Late effects of injury, undetermined whether accidentally or purposely inflicted

Table 28 E-codes where it is unlikely that they would occur on a farm

Code	Description
E806	Other specified railway accident
E807	Railway accident of unspecified nature
E820	Non-traffic accident involving motor-driven snow vehicle
E832	Other accidental submersion or drowning in water transport accident
E833	Fall on stairs or ladders in water transport
E834	Other fall from one level to another in water transport
E835	Other and unspecified fall in water transport
E836	Machinery accident in water transport
E837	Explosion, fire or burning in water craft
E838	Other and unspecified water transport accident
E846	Accidents involving powered vehicles used solely within the buildings and premises of an industrial or commercial establishment
E847	Accident involving cable cars not running on rails
E850	Accidental poisoning by analgesics, antipyretics, antirheumatics
E851	Accidental poisoning by barbiturates
E852	Accidental poisoning by other sedatives and hypnotics
E854	Accidental poisoning by other psychotropic agents
E855	Accidental poisoning by other drugs acting on central and automic nervous system
E917.0	In sports
E917.1	Caused by a crowd, by collective fear or panic

Table 29 E-codes where it is not possible for the place of occurrence to be farm

E-code	Description
E800	Railway accident involving collision with rolling stock
E802	Railway accident involving derailment without antecedent
E803	Railway accident involving explosion, fire or burning
E804	Fall in, on or from railway train
E810	Motor vehicle traffic accident involving collision with train
E811	Motor vehicle traffic accident involving re-entrant collision with another motor vehicle
E812	Other Motor vehicle traffic accident involving a collision with another vehicle
E813	Motor vehicle traffic accident involving collision with other vehicle
E814	Motor vehicle traffic accident involving collision with pedestrian
E815	Other Motor vehicle traffic accident involving collision on the highway
E816	Motor vehicle traffic accident due to loss of control, without collision on the highway
E817	Non-collision Motor vehicle traffic accident while boarding or alighting
E818	Other non-collision Motor vehicle traffic accident
E819	Motor vehicle traffic accident of unspecified nature
E845	Accident involving spacecraft
E870	Accidental cut, puncture, perforation or haemorrhage during medical care
E871	Foreign object left in body during procedure
E872	Failure of sterile precautions during procedure
E873	Failure in dosage
E874	Mechanical failure of instrument or apparatus during procedure
E875	Contaminated or infected blood, other fluid, drug, or biological substance
E876	Other and unspecified misadventures during medical care
E878	Surgical operation and other surgical procedures as the cause of abnormal reaction of patient, or of later complication, without mention of misadventure at the time of operation
E879	Other procedures, without mention of misadventure at the time of procedure, as the cause of abnormal reaction of patient, or of later complication
E890	Conflagration in private dwelling
E893.0	From controlled fire in private dwelling
E895	Accident caused by controlled fire in private dwelling
E910.4	In bathtub
E913.0	In bed or cradle
E928.0	Prolonged stay in weightless environment
E929.0	Late effects of motor vehicle accident
E930	Antibiotics (including those in therapeutic use)
E931	Other anti-infectives
E932	Hormones and synthetic substitutes
E933	Primarily systemic agents
E934	Agents primarily affecting blood constituents
E935	Analgesics, antipyretics, and antirheumatics
E936	Anticonvulsants and anti-Parkinsonism drugs
E937	Sedatives and hypnotics
E938	Other central nervous system depressants and anaesthetics
E939	Psychotropic agents
E940	Central nervous system stimulants
E941	Drugs primarily affecting the autonomic nervous system
E942	Agents primarily affecting the cardiovascular system
E943	Agents primarily affecting gastrointestinal system
E944	Water, mineral, and uric acid metabolism drugs
E945	Agents primarily acting on the smooth and skeletal muscles and respiratory system
E946	Agents primarily affecting skin and mucous membrane, ophthalmological, otorhinolaryngological, and dental drugs
E947	Other and unspecified drugs and medicinal substances
E948	Bacterial vaccines
E949	Other vaccines and biological substances
E987.0	Residential premises

5.3.1 Length of Stay

The length of stay in hospital is calculated in whole days i.e. if the person was admitted on the 28th of a month and separated on the same day the length of stay would be 1 day, if the person was admitted on the 28th of a month and separated on the 29th the length of stay would also be 1 day. To examine length of stay the days have been grouped as following, 1 day, 2 days, 3-7 days, 8-14 days, 15-21 days, 22-28 days, 29-60 days and 61+ days.

An additional code was also produced for same day admission and separation where 1= same day stay and 0 = overnight stay.

5.3.2 Mode of Separation

Harrison and Steenkamp [218] identified that some people who are injured result in more than one hospital separation, as such this needs to be addressed as part of the examination of hospital information.

In the NSW Hospital Separations data a field called “Readmission within 28 Days” collects information about whether the patient has been readmitted as an inpatient within 28 days of last being admitted. It also collects information on whether this readmission is from/to the same hospital. The collection of this information started in July 1993. The coding for readmission is presented in Table 30.

Table 30 Coding of readmission within 28 days

Value	Used for
1	Not formally readmitted within 28 days
2	Readmitted within 28 days to same facility
3	Readmitted within 28 days to another facility
9	Unknown

Coding for readmission commenced in 1993 and has to date not been used to examine farm injuries separated from hospital. On average for those years where the information was collected 6.1% of the farm cases were readmitted within 28 days of being separated (Table 31). Thus the farm injury information presented in this study may overestimate the number of injuries occurring on farms by 6.1%.

Table 31 Readmission of farm injuries within 28 days

Financial Year	Not coded	Not a readmission	Readmitted to same hospital	Readmitted to another hospital	Unknown	Total
90-91	1,279	0	0	0	0	1,279
91-92	2,109	0	0	0	0	2,109
92-93	1,686	0	0	0	0	1,686
93-94	0	1,386	21	43	80	1,530
94-95	0	1,390	28	34	88	1,540
95-96	0	1,457	33	68	8	1,566
96-97	60	1,377	37	79	12	1,565
97-98	82	1,368	37	60	0	1,547
98-99	0	783	24	46	0	853
99-00	0	764	12	39	0	815
Total	**5,216**	**8,525**	**192**	**369**	**188**	**14,490**

5.3.3 Calculations

When calculating the rate of injury on farms there is unfortunately no denominator data that allows for a rate based on people living on farm, even such a rate would be a crude index of risk. The appropriate denominator is the number of individuals exposed to the feature specific risk, usually by nature of occupation (see section 5.5.3.2 Exposed Population for more detail). As such a rate is calculated per 1,000 farms, where the number of agricultural establishments with an Estimated Value of Agricultural Output (EVAO) of more than $5,000 based on information from the Australian Bureau of Statistics [54] is used as the number of farms (Table 32).

Table 32 Number of agricultural establishments in NSW with an estimated value of agricultural output of more than $5,000 by year

Year	Number of Farms
1990*	37,536
1991*	36,812
1992	44,443
1993	43,227
1994	42,817
1995	42,287
1996	42,497
1997	42,758
1998	42,496
1999	43,302
2000	43,654

*Establishments having an EVAO of $20,000 or more, Confidence intervals were calculated using the standard error of the mean and trends over time were estimated using a linear regression to the mean.

5.3.4 Testing of quality of data

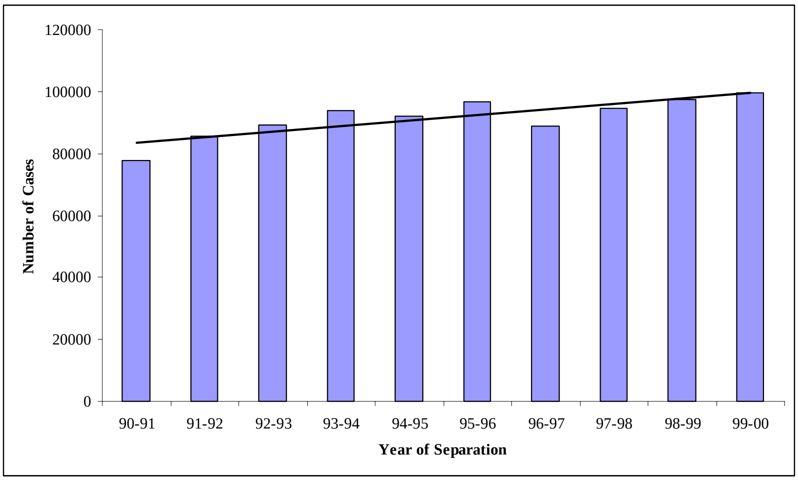
Unfortunately it was outside the scope of this study to go back to the original case files of people injured to see if the information provided was correct. To test for quality in this study a check of coding was undertaken, i.e. was the correct code used in a particular section (e.g. if 1=Male and 2=Female, there were no 5's, etc). As part of the analysis an examination of those codes that could not occur on farm but had a place of occurrence as a farm were also examined.

5.4 Results

5.4.1 Injuries presenting to NSW Hospitals

Between 1 July 1990 and 30 June 2000 there were 916,164 people separated from hospitals in NSW, this was an average 91,616 people per annum. There was an increase in the number of people separated from hospital where their principal diagnosis was injury and who had an unintentional external cause code.

Figure 9 Number of people separated with a principal diagnosis of injury from NSW Hospitals, 1-Jul-90 to 30-Jun-00



An initial analysis of the location code revealed some discrepancies over time. To see if this was due to particular E-codes, an analysis of the E-codes over time by likelihood of occurring on farm and grouped E-codes was undertaken (Table 33, Table 34).

The changes in coding does appear to have affected those E-codes that occur or are likely to occur on farm being less in the last two years than in the previous eight years. While there was an increase in the number of injuries that could occur both on and off farm, there was also a decrease in the number of injuries that can not occur on a farm (Table 33).

Table 33 E-code likelihood of occurring on a farm over time, NSW 1-Jul-90 to 30-Jun-00

E-code likelihood of being on a farm	90-91	91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-00	Total
Highly likely to be on a farm	150	171	151	178	137	207	199	224	176	144	1737
Likely to be on farm	1,416	1,655	1,667	1,652	1,391	1,321	1,314	1,309	1,096	1,059	13,880
On farm or elsewhere	62,962	70,083	73,900	78,426	77,595	81,948	74,034	78,178	83,827	85,270	766,223
Unlikely to be on farm	2518	2928	2,787	2,223	2,077	2,363	2,656	3,780	3,809	3,626	28,767
Can not be on a farm	10,863	10,871	10,690	11,215	10,973	10,913	10,629	11,117	8,668	9,618	105,557
Total	**77,909**	**85,708**	**89,195**	**93,694**	**92,173**	**96,752**	**88,832**	**94,608**	**97,576**	**99,717**	**916,164**

In examining the grouped E-codes, there was little change in railway accidents, other road vehicle accidents, water transport accidents, air and space transport accidents, accidental poisoning by other solid and liquid substances, gases and vapours, and accidents caused by submersion and foreign bodies. All of the other groups increased except for motor vehicle traffic accidents, and late effects of accidental injury which decreased.

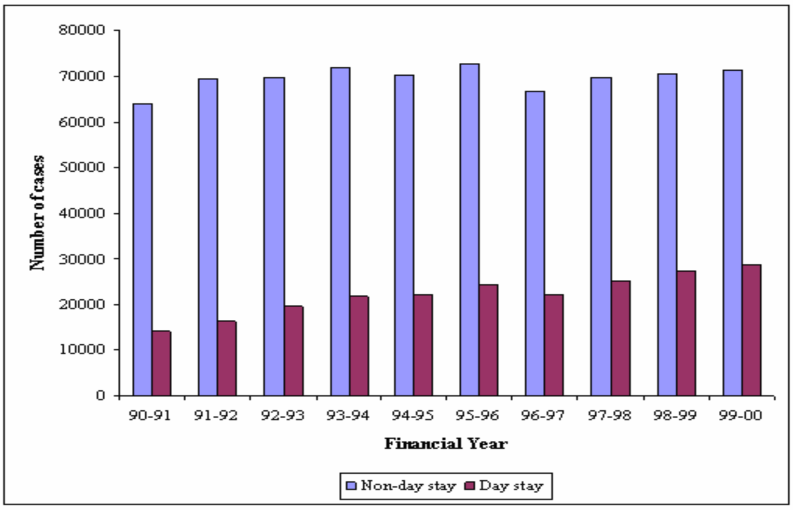
It has been noted that over time accidental injuries can vary due to admission procedures and other factors (such as availability of after hours medical care) [218]. To reduce the fluctuations in case numbers those cases which were day stays have been removed from the analysis of the location. Figure 10 displays the day stay cases separately to those that spent one or more nights in hospital and while there is a slight increase in the number of overnight stays (mainly due to the low number in the 1990-91 financial year), there was a sustained increase in the number of same day admissions over the same period.

Table 34 E-code grouped over time, NSW 1-Jul-90 to 30-Jun-00

E-codes grouped	90-91	91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-00	Total
Railway accidents	140	121	124	132	91	84	100	106	84	112	1094
Motor vehicle traffic accidents	10,482	10,421	10,274	10,835	10,537	10,481	10,248	10,720	8,464	9,440	101,902
Motor vehicle non-traffic accidents	1,277	1,435	1,504	1,431	1,505	1,527	1,583	1,766	3,517	3,318	18,863
Other road vehicle accidents	2,857	3,016	3,173	3,203	3,049	3,400	3,335	3,443	2,725	2,960	31,161
Water transport accidents	304	335	319	372	334	383	327	330	317	285	3,306
Air and space transport accidents	122	153	96	126	149	124	128	123	76	97	1,194
Vehicle accidents not elsewhere classifiable	974	1,338	1,842	1,524	1,600	1,745	1,069	1,028	1,876	2,018	15,014
Accidental poisoning by drugs, medicaments and biological	4,335	5,029	4,728	3,547	3,302	3,647	3,673	3,816	3214	3,072	38,363
Accidental poisoning by other solid and liquid substances, gases and vapours	943	1,071	1,048	916	835	839	798	809	842	804	8,905
Accidental falls	27,414	31,149	32,863	34,944	35,312	37,820	38,653	41,399	40,778	41,799	362,131
Accidents caused by fire and flame	650	681	691	661	688	755	664	730	728	731	6,979
Accidents due to natural and environmental factors	2,064	2,328	2,465	2,567	2,379	2,487	2,646	2,899	2,886	2,636	25,357
Accidents caused by submersion, suffocation and foreign bodies	1,944	2,170	2,152	2,170	2,194	2,247	2,098	2,292	2,227	2,137	21,631
Other accidents	23,454	25,505	27,151	30,426	29,367	30,464	22,938	24,703	29,207	29,631	272,846
Late effects of accidental injury	640	703	584	549	673	596	435	314	100	71	4,665
Injury undetermined whether accidentally or purposely inflicted	309	253	181	291	158	153	137	130	535	606	2,753
Total	**77,909**	**85,708**	**89,195**	**93,694**	**92,173**	**96,752**	**88,832**	**94,608**	**97,576**	**99,717**	**916,164**

Length of stay provides an approximate indicator of severity [241]. Same day and over night admission can be highly susceptible to variations in hospitals procedures. As such it has been suggested to capture those cases that are more severe and less likely to be subject to hospital admission procedures you remove same day and over night stays to provide a case series over time [241].

Figure 10 Day stay and longer stay by year, NSW 1-Jul-90 to 30-Jun-00



The 'same day separations' have been removed from the analysis and a further examination of the place of occurrence undertaken (Table 35). While the removal of same day stays removed some of the variation, there are still inconsistencies within the data, in particular farm, street and highway, public building, and residential institution.

Table 35 Place of occurrence without same day stays, NSW 1-Jul-90 to 30-Jun-00

Place of occurrence	90-91	91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-00	Total
Home	16,563	19,076	18,828	18,667	18,136	18,543	18,040	18,939	22,316	22,163	191,271
Farm	1,142	1,826	1,475	1,312	1,313	1,329	1,318	1,228	653	625	12,221
Mine and Quarry	141	240	193	134	160	142	172	139	0	0	1,321
Industrial place and premises	2,812	3,117	2,967	3,009	3,396	3,526	3,390	3,575	4,102	4,250	34,144
Place for recreation and sport	4,774	5,865	6,167	6,386	6,086	6,311	2,906	3,953	4,892	4,883	52,223
Street and highway	8,472	9,074	9,099	9,299	9,017	9,019	8,786	8,950	2,684	2,846	77,246
Public building	2,111	2,618	2,634	2,623	2,497	2,462	2,484	2,509	5,947	6,379	32,264
Residential institution	1,902	2,482	2,770	2,735	3,199	3,195	3,311	3,362	4,430	4,516	31,902
Other specified places	4,518	2,361	2,108	2,417	2,408	2,723	2,691	2,789	2,727	2,519	27,261
Unspecified	21,452	22,697	23,482	25,264	23,945	25,290	23,681	24,132	22,697	23,059	235,699
Total	**63,887**	**69,356**	**69,723**	**71,846**	**70,157**	**72,540**	**66,779**	**69,576**	**70,448**	**71,240**	**695,552**

The results of an examination of grouped length of stay by year with same day cases removed continue to display an increase in the number of one day stay cases from year to year.

However, there was a reduction in the number of cases where the length of stay was more than 29 days (Table 36).

Table 36 Grouped length of stay by year without same day stays, NSW 1-Jul-90 to 30-Jun-00

Length of Stay grouped	90-91	91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-00	Total
1 Day	22,636	25,292	26,614	27,543	27,056	28,727	25,475	27,822	28,488	29,541	269,194
2 days	9,172	10,323	10,232	10,523	10,442	10,916	9,555	10,153	10,595	10,558	102,469
3-7 days	16,611	17,926	17,913	18,485	17,769	18,285	15,976	16,905	16,917	16,696	173,483
8-14 days	7,350	7,921	7,733	7,911	7,735	7,692	7,089	7,470	7,435	7,435	75,771
15-21 days	3,240	3,314	3,085	3,107	3,119	2,983	2,997	2,930	3,017	3,011	30,803
22-28 days	1,665	1,631	1,511	1,586	1,517	1,478	1,458	1,578	1,568	1,516	15,508
29-60 days	2,481	2,324	2,137	2,192	2,049	2,014	2,130	2,264	2,045	2,100	21,736
61+ days	732	625	498	499	470	445	433	454	383	383	4,922
Total	**63,887**	**69,356**	**69,723**	**71,846**	**70,157**	**72,540**	**65,113**	**69,576**	**70,448**	**71,240**	**693,886**

Note: There were 1,666 cases where the admission, separation or both dates was missing.

There appears to be a systematic bias in the data for farm cases, as removing those cases where the stay was one night or less reduces the number in all years (Table 37).

Table 37 Place of occurrence by year where stay was more than 1 night, NSW 1-Jul-90 to 30-Jun-00

Place of occurrence	90-91	91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-00	Total
Home	10,681	12,142	12,016	12,105	11,753	11,992	11,537	12,277	14,476	14,228	123,207
Farm	704	1,084	891	792	786	784	731	705	389	386	7,252
Mine and Quarry	92	139	113	86	105	90	109	82	0	0	816
Industrial place and premises	1,857	2,020	1,846	1,868	1,991	2,087	1,814	1,844	2,324	2,308	19,959
Place for recreation and sport	2,638	3,249	3,286	3,381	3,073	3,075	1,329	1,923	2,315	2,220	26,489
Street and highway	6,314	6,598	6,497	6,467	6,309	6,224	5,970	6,247	1,810	1,933	54,369
Public building	1,123	1,433	1,333	1,391	1,286	1,236	1,333	1,358	3,462	3,699	17,654
Residential institution	1,652	2,133	2,314	2,301	2,618	2,593	2,700	2,771	3,549	3,586	26,217
Other specified places	3,153	1,618	1,355	1,571	1,512	1,666	1,547	1,666	1,562	1,455	17,105
Unspecified	13,037	13,648	13,458	14,341	13,668	14,066	12,568	12,881	12,073	11,884	131,624
Total	**41,251**	**44,064**	**43,109**	**44,303**	**43,101**	**43,813**	**39,638**	**41,754**	**41,960**	**41,699**	**424,692**

5.4.2 Bias in the data

An examination of the place of occurrence by the probability of the external cause occurring on a farm shows that there is some bias in the system (Table 38).

Table 38 Place of occurrence by likelihood of the injury by E-code occurring on a farm (all cases).

Place of occurrence	Highly likely to be on a Farm	Probably on farm	On farm or elsewhere	Unlikely to be on farm	Can not be on a farm	Total
Home	162	2,710	223,073	12,531	2,777	241,253
Farm	1,151	1,913	10,465	236	725	14,490
Mine and Quarry	15	52	1,533	44	97	1,741
Industrial place and premises	130	87	41,389	188	3,878	45,672
Place for recreation and sport	12	1,763	65,159	3,023	469	70,426
Street and highway	4	203	23,144	393	74,325	98,069
Public building	5	47	35,652	771	7,112	43,587
Residential institution	1	33	34,653	530	2,629	37,846
Other specified places	14	755	29,773	2,251	1,984	34,777
Unspecified	243	6,317	30,1382	8,800	11,561	328,303
Total	**1,737**	**13,880**	**76,6223**	**28,767**	**10,5557**	**916,164**

Further examination of the external cause codes for those E-codes that are likely to occur on farm (Table 39) shows that they can occur anywhere, showing some bias in the data. Examination of the E-code E828.2 over time, it can be seen that while the number of cases over time remains relatively consistent for the last two financial years, the number occurring at home increases and all others decrease (Table 40).

Table 39 External cause code by the place of occurrence for cases identified as likely to occur on farms, NSW 1-Jul-90 to 30-Jun-00

External cause	Name	Home	Farm	Mine and Quarry	Industrial place and premises	Place for recreation and sport	Street and highway	Public building	Residential institution	Other specified places	Unspecified	Total
E827.0	Animal drawn vehicle accident - Pedestrian	0	1	0	0	4	0	1	0	0	2	8
E827.2	Animal drawn vehicle accident - Rider of animal	1	3	0	0	24	0	0	0	1	5	34
E827.3	Animal drawn vehicle accident - Occupant of animal-drawn vehicle	8	13	0	1	115	8	0	0	9	68	222
E827.8	Animal drawn vehicle accident - other specified person	1	1	0	0	8	1	2	0	0	5	18
E827.9	Animal drawn vehicle accident - Unspecified person	3	2	0	2	5	1	0	0	0	16	29
E828.0	Accident involving animal being ridden - Pedestrian	17	38	6	1	37	4	0	0	9	85	197
E828.2	Accident involving animal being ridden - Rider of animal	2,042	1,679	38	48	1,515	174	25	16	701	5,634	11,872
E828.3	Accident involving animal being ridden - Occupant of animal-drawn vehicle	0	0	1	0	1	0	0	0	0	2	4
E828.4	Accident involving animal being ridden - occupant of streetcar	1	1	0	0	10	1	0	1	2	6	22
E828.8	Accident involving animal being ridden - Other specified person	7	11	2	1	11	0	1	2	10	34	79
E828.9	Accident involving animal being ridden - Unspecified person	26	30	2	2	29	3	0	1	6	192	291
E863.0	Accidental poisoning by insecticides of organochlorine compounds	12	3	0	0	0	0	1	0	1	9	26
E863.1	Accidental poisoning by insecticides of organophosphorus compounds	167	60	2	14	2	6	7	5	5	86	354
E863.2	Accidental poisoning by Carbamates	11	0	0	1	0	0	0	0	0	4	16

External cause	Name	Home	Farm	Mine and Quarry	Industrial place and premises	Place for recreation and sport	Street and highway	Public building	Residential institution	Other specified places	Unspecified	Total
E863.3	Accidental poisoning by Mixtures of insecticides	8	1	0	0	1	0	0	0	0	2	12
E863.4	Accidental poisoning by other and unspecified insecticides	137	18	0	5	0	0	3	2	4	46	215
E863.5	Accidental poisoning by herbicides	39	15	1	0	0	2	0	0	2	25	84
E863.6	Accidental poisoning by fungicides	5	2	0	0	0	0	0	0	0	4	11
E863.7	Accidental poisoning by rodenticides	111	7	0	0	0	0	4	4	2	41	169
E863.8	Accidental poisoning by fumigants	4	3	0	1	0	0	0	0	0	2	10
E863.9	Accidental poisoning by other and unspecified agricultural and horticultural chemical and pharmaceutical preparations other than plant foods and fertilizers	102	25	0	10	1	2	3	2	3	42	190
E980.7	Poisoning by agricultural and horticulture chemical and pharmaceutical preparations other than plant foods and fertilizers	8	0	0	1	0	1	0	0	0	7	17
Total		**2,710**	**1,913**	**52**	**87**	**1,763**	**203**	**47**	**33**	**755**	**6,317**	**13,880**

Table 40 Place of occurrence by year where the external cause code was E828.2 - Accident involving animal being ridden - Rider of animal, NSW 1-Jul-90 to 30-Jun-00

Place of Occurrence	90-91	91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-00	Total
Home	80	84	99	76	60	59	44	55	718	767	2,042
Farm	187	249	247	221	217	188	186	150	16	18	1,679
Mine and Quarry	1	18	6	1	2	2	5	3	-	-	38
Industrial place and premises	9	11	4	6	5	3	1	9	-	-	48
Place for recreation and sport	148	196	227	210	163	193	176	202	-	-	1,515
Street and highway	28	27	23	26	23	18	15	14	-	-	174
Public building	4	10	3	2	-	3	1	2	-	-	25
Residential institution	3	-	-	-	-	-	2	-	3	8	16
Other specified places	124	61	80	82	112	74	70	69	17	12	701
Unspecified	608	732	734	769	583	570	599	615	252	172	5,634
Total	**1,192**	**1,388**	**1,423**	**1,393**	**1,165**	**1,110**	**1,099**	**1,119**	**1,006**	**977**	**11,872**

The other issue that needs to be examined is where cases are readmitted within 28 days. Coding for this item started in 1993. On average for those years where the information was collected, 7.4% of the farm cases were readmitted within 28 days of being separated (Table 41).

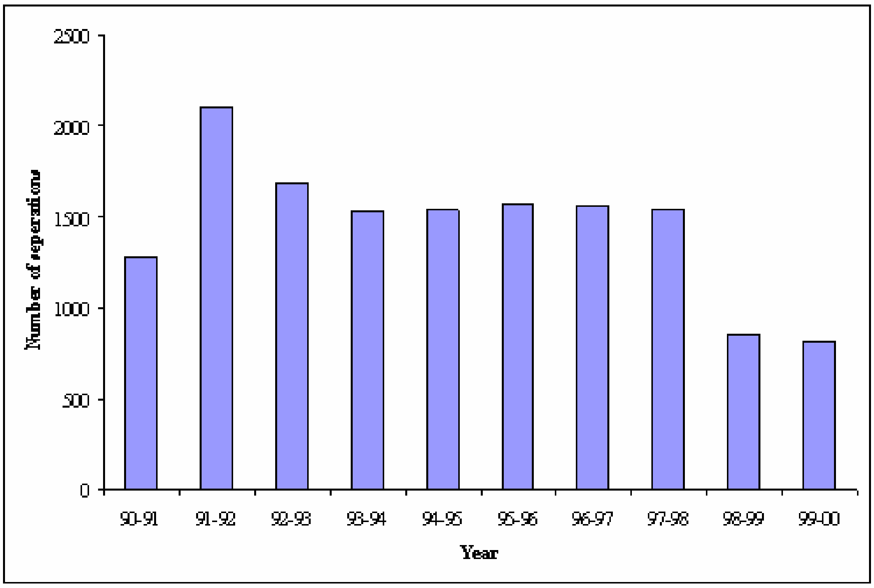
Table 41 Readmission to hospital within 28 days, NSW 1-Jul-90 to 30-Jun-00

Financial Year	Not coded	Not a readmission	Readmitted to same hospital	Readmitted to another hospital	Unknown	Total
90-91	77,909	0	0	0	0	77,909
91-92	85,708	0	0	0	0	85,708
92-93	89,195	0	0	0	0	89,195
93-94	0	83,010	3,675	3,186	3,823	93,694
94-95	0	83,246	2,843	3,361	2,723	92,173
95-96	0	89,741	3,005	3,859	147	96,752
96-97	2,151	79,803	2,862	3,926	90	88,832
97-98	2,522	84,893	2,971	4,222	0	94,608
98-99	0	90,352	2,930	4,294	0	97,576
99-00	0	91,891	3,269	4,557	0	99,717
Total	**257,485**	**602,936**	**21,555**	**27,405**	**6,783**	**916,164**

5.4.3 Farm Injuries

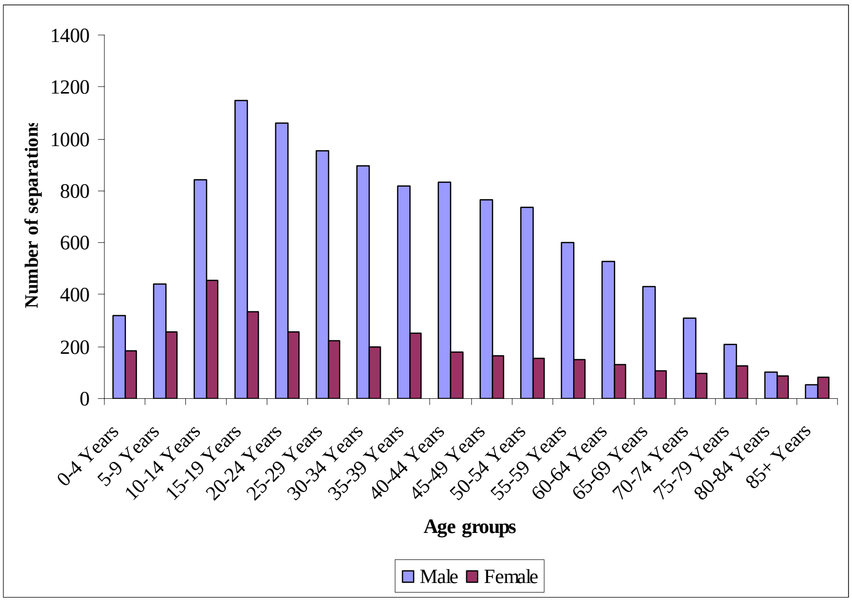
It is clear that there is a change in the NSW Hospital Separations data for the financial years 1998-99 and 1999-2000 for place of occurrence. While this may be due to the changes in coding from ICD9 to ICD10, it is not clear exactly why there is a decrease in the number of injuries sustained on a farm. It does however appear that the number of injuries occurring on farms was stable for the years 93-94 to 97-98 and 98-99 to 99-2000 (Figure 11), one possible explanation is that farm cases were coded to home or vice versa. Where reporting on trends these two time frames will be used. All farm cases were examined and not changed for same day admissions made.

Figure 11 Farm injuries separated from NSW Hospitals, 1 July 1990 to 30 June 2000



Three-quarters (76.3%) of the people separated from NSW hospitals and coded as being injured on farms were males. The average age of males injured was 36.5 years ($CI_{95\%}$ 36.1-36.8) and for females was 35.1 years ($CI_{95\%}$ 34.3-35.9). The age group with the largest number of cases was the 15-19 years age group, followed by the 20-24 years age group. People age between 15 and 29 years represented one-quarter (27.4%) of all cases. The male to female ratio was highest in the 50-54 years age group (4.76:1) and lowest in the 85+ years age group (0.64:1) where more females were injured than males. (Figure 12)

Figure 12 Farm injuries separated from NSW Hospitals by age groups and gender, 1 July 1990 to 30 June 2000



There were 9,137 hospital separations resulting from injuries that occurred on farms that could be classified into the top section of the Farmsafe Australia (FSA) E-code grouping. It is noticeable that in the 98-99 and 99-00 years the groups most affected by the change were the motor vehicle non-traffic accident and other road vehicle accident groups, reducing the total number of FSA primary E-code group to approximately one-third their pre 98-99 levels. The other group affected was the other animal group which had two-thirds of its pre 98-99 levels in the last two years. Prior to 98-99 the four largest E-code groups were 'animal ridden', 'motorcycle', 'other vehicle' and 'agricultural machinery'. Poisoning and dog bites had low number across all years. Fire and flames, other machinery and firearms were consistent across all years. (Table 42)

Table 42 Farmsafe Australia (FSA) E-code groupings by year, 1 July 1990 to 30 June 2000

FSA E-code	Description	90-91	91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-00	Total
E820-829	Motor Vehicle Non-Traffic Accident & Other Road Vehicle Accidents											
	Animal Ridden	188	250	247	221	222	188	186	151	16	18	1,687
	Motorcycles	185	229	263	231	249	272	253	276	0	0	1,958
	Other Vehicles	130	140	140	118	136	114	145	129	15	27	1,094
E862	Poisoning by Petroleum Products	1	5	1	0	3	2	0	1	0	0	13
E863	Poisoning by Agricultural Chemicals	9	16	18	18	14	11	13	17	9	9	134
E864	Poisoning by Corrosive & Caustics	0	2	1	2	0	0	1	0	0	0	6
E866-869	Poisoning by Other Solids, Gases & Liquids	1	6	3	2	5	3	1	3	13	5	42
E891-899*	Fire and Flames	25	27	16	16	18	14	20	17	9	19	181
E905	Venomous Animal Plants	31	75	43	41	42	50	46	56	37	31	452
E906.0	Dog Bite	5	9	6	6	1	2	5	5	3	1	43
E906.8	Injury by Other Animal	101	130	121	125	126	121	137	107	3	5	976
E919.0	Agricultural Machinery	102	112	108	121	95	135	137	131	115	95	1,151
919.1-.9	Other Machinery	21	42	47	25	42	33	46	35	44	33	368
E920	Cutting and Piercing	86	135	109	101	83	105	92	96	63	59	929
E922	Firearms	12	17	18	15	13	10	3	8	0	7	103
Sub total		**897**	**1,195**	**1,141**	**1,042**	**1,049**	**1,060**	**1,085**	**1,032**	**327**	**309**	**9,137**
E801-819	Motor Vehicle Traffic Accidents	67	102	94	92	81	80	76	68	21	24	705
E850-865**	Poisoning	7	92	22	9	2	12	7	8	3	2	164
E880-888	Falls	143	417	200	155	194	175	170	193	138	107	1,892
E900-909#	Natural & Environmental Factors	17	26	20	25	32	32	35	28	124	150	489
E910	Drowning	2	4	7	0	1	2	4	1	0	1	22
Other##	Other E-codes##	146	273	202	207	181	205	188	217	240	222	2,081
Sub total		**382**	**914**	**545**	**488**	**491**	**506**	**480**	**515**	**526**	**506**	**5,353**
Total		**1,279**	**2,109**	**1,686**	**1,530**	**1,540**	**1,566**	**1,565**	**1,547**	**853**	**815**	**14,490**

*Excluding E893.0, E895.0-9 and E898.0 (if included are in other E-codes). ** Excludes E863.0-9, E864.0-9 # E905.0-9, E906.0 & E906.8. ## Includes all E-codes not elsewhere represented

The FSA E-code group with the longest average length of stay were those injured by fire and flames (6.15 days), followed by falls (5.71 days), whereas poisoning and injuries from venomous plants and animals had the shortest average stay (Figure 13). There was very little difference in the average length of stays by gender when examining by age group, however average length of stay increases as the people being injured age (Figure 14). Age was a far greater predictor of length of stay than the grouped external cause codes (Figure 15).

Figure 13 Farmsafe Australia E-code grouping by average length of stay (95% confidence intervals), 1 July 1990 to 30 June 2000

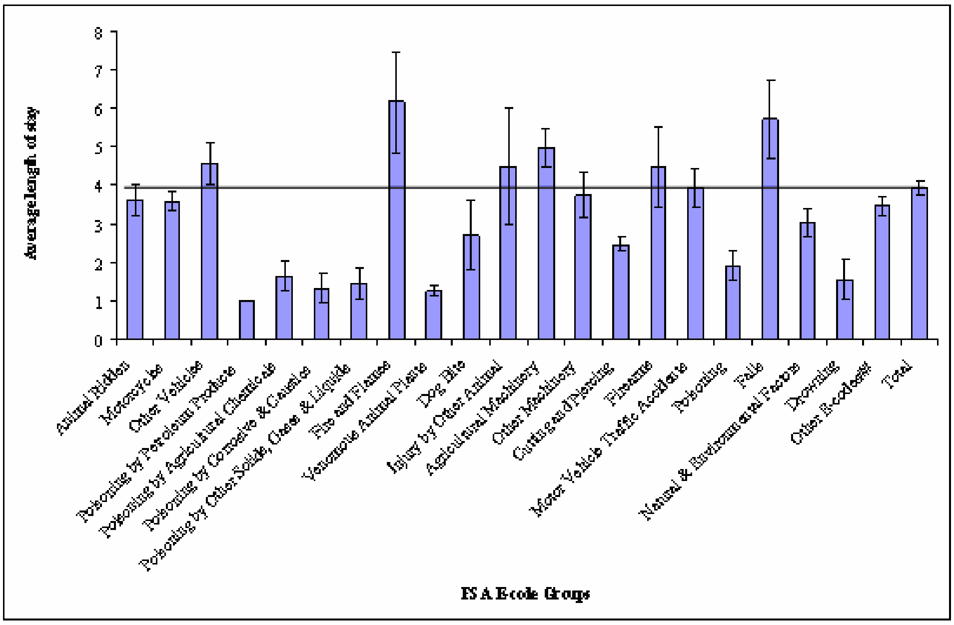


Figure 14 Age groups by average length of stay (95% confidence intervals), 1 July 1990 to 30 June 2000

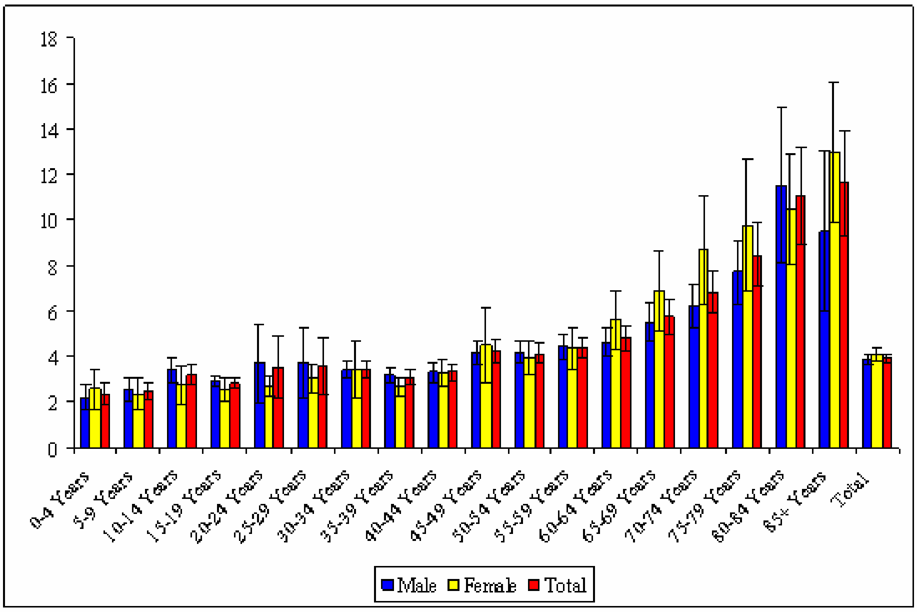
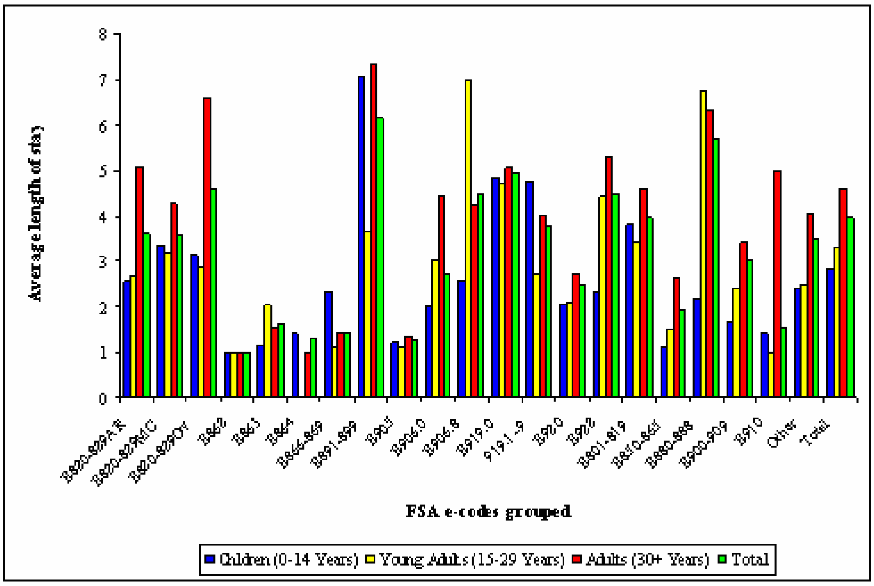
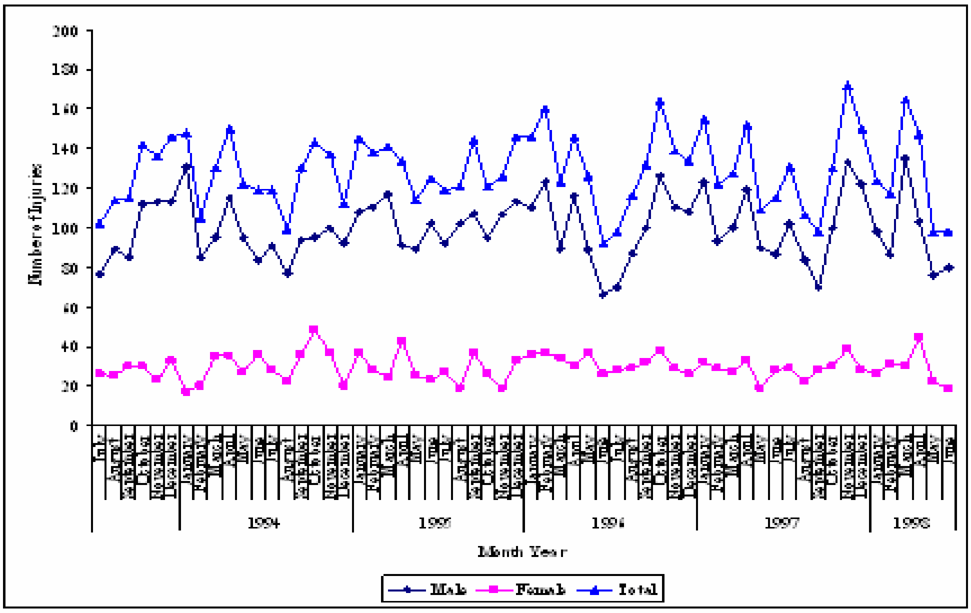


Figure 15 Three age groups by Farmsafe Australia grouped E-codes by average length of stay, 1 July 1990 to 30 June 2000



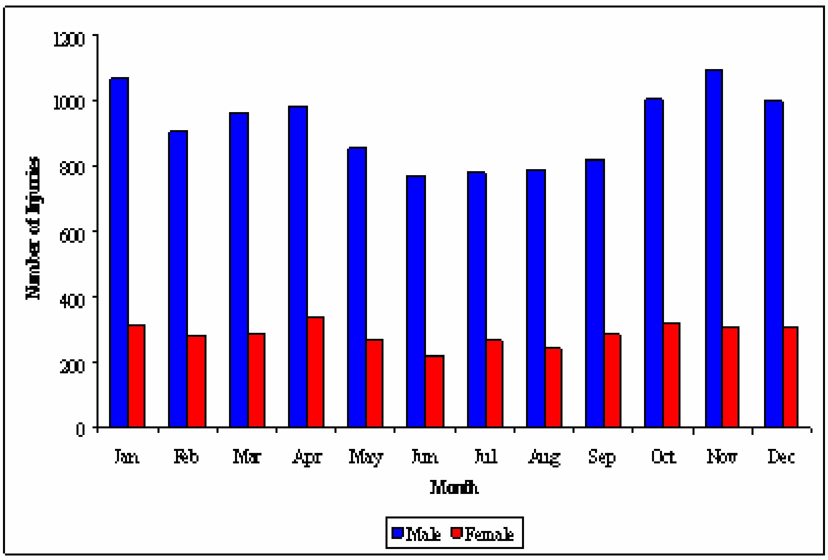
Between 1 July 1993 and 30 June 1998 there was very little overall change in the number of injuries hospitalised for both males and females. While there was some monthly variation, the variation did not fluctuate in the same months each year (Figure 16).

Figure 16 Number of farm injuries hospitalised by month, 1 Jul 1993 to 30 June 1998 (n=7735)



Overall October to January were when the highest numbers of people were injured on farms requiring hospitalisation. June to September were the months with the lowest number of people injured on farms requiring hospitalisation. The number of females injured on farms by month was reasonably consistent all year round. (Figure 17)

Figure 17 Number of farm injuries by month requiring hospitalisation in NSW, 1 July 1990 to 30 June 2000 (n=7735)



The rate per 1,000 farms ranged from 19.1 in 1999 to 41.8 in 1992.

Table 43 Annual rate per 1,000 farms for injuries requiring hospitalisation in NSW

Year	Number of Farms	Number of Injuries	Rate per 1,000 farms
1990[a]	37,536	620	
1991[a]	36,812	1,762	47.86
1992	44,443	1,856	41.76
1993	43,227	1,597	36.94
1994	42,817	1,514	35.36
1995	42,287	1,574	37.22
1996	42,497	1,576	37.08
1997	42,758	1,567	36.65
1998	42,496	1,176	27.67
1999	43,302	827	19.10
2000	43,654	410	

[a] Number farms based on an EVAO of $20,000 or more not $5,000 or more as for the rest of the years

Note: rates not calculated for 1990 and 2000 as only half the year has data

In Table 44 the type of injury (grouped) and in Table 45 body location (grouped) are examined by Farmsafe Australia E-code groups for number and mean length of stay. The type of injuries that resulted in the longest mean length of stay in hospital were due to complications of surgical care (10.7 days), followed by injuries to internal organs (6.2 days), fractures (5.7 days) and burns (5.5 days). Fractures (36.1%), open wounds (19.3%) and intracranial injuries (10.5%) were the three most common types of injuries. (Table 44)

The body location injured that resulted in longest mean length of stay in hospital was spine and trunk (6.93 days) followed by lower limbs (5.84 days). The three most common locations of body injured were upper limbs (27.8%), lower limbs (25.8%) and head (including face excluding eye) (18.1%). (Table 45)

Table 44 Farmsafe Australia E-code grouping and injury type by mean length of stay (days), NSW Hospital separations, 1 July 1990 to 30 June 2000

	Fracture		Dislocation		Sprains and strains		Intracranial injury		Internal injury		Open wound		Injury to blood vessels		Late effects		Superficial		Contusion	
FSA Australia Code numeric	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**
E820-829AR	4.8	774	6.7	66	2.5	39	2.1	433	5.2	40	2.6	59	1.5	2			1.7	27	2.1	117
E820-829MC	4.4	945	2.6	62	2.9	50	2.0	292	6.8	54	2.9	291	3.0	6			2.5	46	2.3	108
E820-829Ov	6.7	454	3.9	32	2.8	33	2.2	184	5.3	49	3.6	136	1.0	3	2.0	1	1.9	35	2.4	73
E862																				
E863																				
E864																				
E866-869																				
E891-899*																				
E905					1.0	3					1.2	5			2.0	1	1.0	3	1.0	1
E906.0					3.0	1					2.4	40								
E906.8	6.8	384	1.8	50	2.3	42	1.8	100	5.3	48	3.9	145	1.5	2	14.0	1	3.6	17	2.6	112
E919.0	6.2	381	4.3	27	2.8	32	6.1	40	7.7	40	4.2	392	13.5	4	1.0	1	2.3	16	3.4	61
919.1-.9	5.9	81	2.3	4	3.7	9	1.0	6	31.0	1	2.8	204	2.5	2			1.3	4	3.0	3
E920	2.8	58	2.0	1	1.9	27	1.0	2			2.5	713	2.5	19			1.9	34	1.0	1
E922	7.2	13					1.0	1	8.0	5	4.0	77					1.0	1	2.3	4
E801-819	5.5	307	1.7	29	2.4	22	2.0	103	6.6	29	3.4	96	1.2	5			1.8	28	2.3	43
E850-865**	6.5	2					1.0	3			1.0	1								
E880-888	7.2	1,103	2.4	109	4.5	104	2.4	181	4.2	23	3.9	119	4.0	4	14.0	1	3.3	18	3.5	102
E900-909[#]	4.7	137	1.9	8	3.5	15	1.7	26	7.4	20	2.4	112					1.6	40	2.3	35
E910							1.0	1			3.0	2								
Other[##]	4.8	577	1.8	140	3.0	237	1.6	146	7.4	24	2.8	397	19.3	3	8.3	10	2.2	36	2.7	93
Total	**5.7**	**5,216**	**2.9**	**528**	**3.1**	**614**	**2.1**	**1,518**	**6.2**	**333**	**3.1**	**2,789**	**4.3**	**50**	**7.7**	**15**	**2.1**	**305**	**2.6**	**753**

*Excluding E893.0, E895.0-9 and E898.0 (if included are in other E-codes). ** Excludes E863.0-9, E864.0-9 [#] E905.0-9, E906.0 & E906.8. [##] Includes all E-codes not elsewhere represented

Table 44 Farmsafe Australia E-code grouping and injury type by mean length of stay (days), NSW Hospital separations, 1 July 1990 to 30 June 2000 con't

FSA Australia Code numeric	Crushing		Effects of foreign body entering through objects		Burns		Injury to nerves and spinal cord		Certain complications & Unspecified injuries		Poisonings		Toxic effects		Other and unspecified		Complications of surgical care		Total	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
E820-829AR	2.5	2					1.0	4	2.0	117					3.0	1	1.5	2	3.6	1,683
E820-829MC	2.0	4			3.5	11	6.8	14	2.6	65									3.6	1,948
E820-829Ov	7.9	15			1.8	4	2.3	7	2.4	58			1.0	1	7.0	2	15.0	1	4.6	1,088
E862													1.0	13					1.0	13
E863					1.0	1					1.0	1	1.7	127	1.6	5			1.6	134
E864													1.3	6					1.3	6
E866-869					2.8	5							1.2	32	1.3	4	3.0	1	1.5	42
E891-899*					6.4	171			3.0	1			1.6	8					6.2	180
E905									1.0	1			1.3	423	1.5	11	1.0	2	1.3	450
E906.0									9.5	2									2.7	43
E906.8	1.7	11					2.5	2	2.9	55					1.0	1			4.5	970
E919.0	5.1	76			4.0	9	6.3	11	2.6	47					2.0	3	1.0	2	5.0	1,142
919.1-.9	2.2	24			9.8	4	6.0	6	5.4	17					1.0	1			3.8	366
E920	2.0	3	2.5	2	18.0	1	1.7	38	3.4	22	3.0	1			2.0	1			2.5	923
E922			4.0	1							2.0	1							4.5	103
E801-819	1.0	1			6.6	8	4.5	4	1.8	27									3.9	702
E850-865**											2.0	133	1.5	22	1.5	2	1.0	1	1.9	164
E880-888							9.1	9	4.7	107					1.0	1	18.3	6	5.7	1,887
E900-909#	2.7	3					1.0	1	2.3	23			1.1	10	1.6	57			3.0	487
E910													1.0	1	1.4	18			1.5	22
Other##	3.4	51	1.4	48	4.7	155	5.3	18	2.6	85	1.0	1	1.5	6	1.5	41	13.3	9	3.5	2,077
Total	**4.1**	**190**	**1.5**	**51**	**5.5**	**369**	**4.2**	**114**	**2.9**	**627**	**1.9**	**137**	**1.3**	**649**	**1.6**	**148**	**10.7**	**24**	**3.9**	**14,430**

*Excluding E893.0, E895.0-9 and E898.0 (if included are in other E-codes). ** Excludes E863.0-9, E864.0-9 # E905.0-9, E906.0 & E906.8. ## Includes all E-codes not elsewhere represented

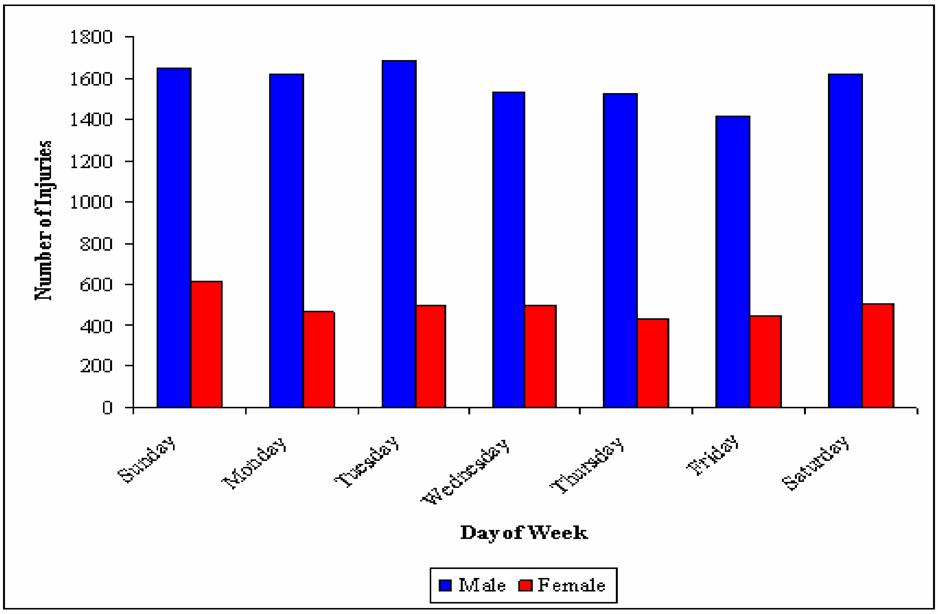
Table 45 Farmsafe Australia E-code grouping body location by mean length of stay, NSW Hospital separations, 1 July 1990 to 30 June 2000

FSA Australia Code numeric	Description	Head (including face excluding eye)		Spine and trunk		Upper limb		Lower limb		Eye		Systems (e.g. nervous)		Other, multiple & ill-defined		Total	
		Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
E820-829AR	*Animal Ridden*	2.30	520	6.49	330	1.89	413	5.38	271					3.39	149	3.61	1,683
E820-829MC	*Motorcycles*	2.27	469	5.37	264	2.34	464	4.86	641	1.44	9			2.78	101	3.58	1,948
E820-829Ov	*Other Vehicles*	2.51	315	8.06	206	2.36	217	6.74	255	2.83	6	1.50	2	3.15	87	4.57	1,088
E862	Poisoning by Petroleum Products											1.00	13			1.00	13
E863	Poisoning by Agricultural Chemicals									1.00	1	1.65	128	1.60	5	1.64	134
E864	Poisoning by Corrosive & Caustics											1.33	6			1.33	6
E866-869	Poisoning by Other Solids, Gases & Liquids	5.00	2	1.00	1	2.00	1			1.00	1	1.22	32	1.60	5	1.45	42
E891-899*	Fire and Flames	4.18	44	4.27	11	6.56	41	9.36	47	1.25	4	1.63	8	5.96	25	6.15	180
E905	Venomous Animal Plants			1.00	1	1.00	3	1.17	6			1.26	424	1.38	16	1.26	450
E906.0	Dog Bite	2.05	20	1.00	1	2.82	11	3.33	3	2.25	4			6.00	4	2.70	43
E906.8	Injury by Other Animal	1.89	198	4.44	193	2.12	155	7.47	337	2.20	10	14.00	1	3.13	76	4.48	970
E919.0	Agricultural Machinery	4.65	91	7.03	156	3.25	549	7.87	268	3.33	9	1.00	1	3.35	68	4.97	1,142
919.1-.9	Other Machinery	2.35	20	11.08	13	2.72	227	5.84	76	2.00	4			4.35	26	3.75	366
E920	Cutting and Piercing	1.96	26	1.67	9	1.87	568	3.71	253	3.40	25	3.00	1	2.98	41	2.47	923
E922	Firearms	3.00	3	5.19	16	3.56	27	5.14	43	1.86	7	2.00	1	6.17	6	4.48	103
E801-819	Motor Vehicle Traffic Accidents	2.72	186	6.10	107	2.41	144	5.38	215	1.00	2			2.06	48	3.94	702
E850-865**	Poisoning	1.00	3			4.67	3					1.89	155	1.33	3	1.91	164
E880-888	Falls	2.70	291	12.05	276	2.73	522	6.96	644	2.40	5	14.00	1	4.93	148	5.71	1,887
E900-909#	Natural & Environmental Factors	2.00	71	5.59	68	2.20	105	3.93	138	1.14	7	1.10	10	1.83	88	3.03	487
E910	Drowning	1.00	1			1.00	1	5.00	1			1.00	1	1.44	18	1.55	22
Other##	Other E-codes##	2.14	348	5.49	258	2.25	565	4.90	520	2.66	93	4.62	21	3.26	272	3.47	2,077
Total		**2.44**	**2,608**	**6.93**	**1,910**	**2.45**	**4,016**	**5.84**	**3,718**	**2.53**	**187**	**1.56**	**805**	**3.30**	**1,186**	**3.94**	**14,430**

*Excluding E893.0, E895.0-9 and E898.0 (if included are in other E-codes). ** Excludes E863.0-9, E864.0-9 # E905.0-9, E906.0 & E906.8. ## Includes all E-codes not elsewhere represented

Overall more people were injured on weekends per day than on weekdays. This was predominantly due to the high number of females injured on weekends (Figure 18).

Figure 18 Day of week of farm injury by gender, NSW Hospital separations, 1 July 1990 to 30 June 2000 (N=14,479)



5.4.3.1 Distribution of Farm injuries across NSW

The distribution of farm injuries covers the whole of NSW; however the number of people injured by postcode (Figure 19) or SLA (Figure 20) varies from 0 to 321. There are some issues with consistency of codes particularly for SLA's where some SLA's had no injuries (due to coding changes). The three postcodes with the highest number of people injured were the Griffith area - 2680 (290 people injured), the Bathurst area - 2795 (233 people injured), and the Deniliquin area – 2710 (224 people injured). The three SLA's with the highest number of people injured were 3450 – Griffith (C) (321 people injured), 5300 Moree Plains (A) – (256 people injured), and 5750 – Narrabri (A) (248 people injured).

Figure 19 Distribution of farm injuries by postcode, NSW 1 July 1990 to 30 June 2000 (n=13,732)

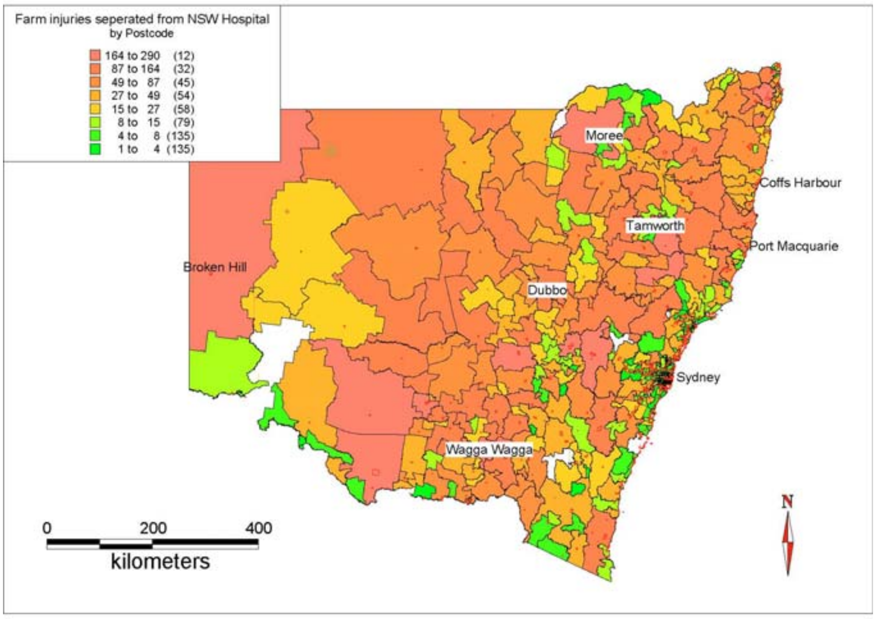
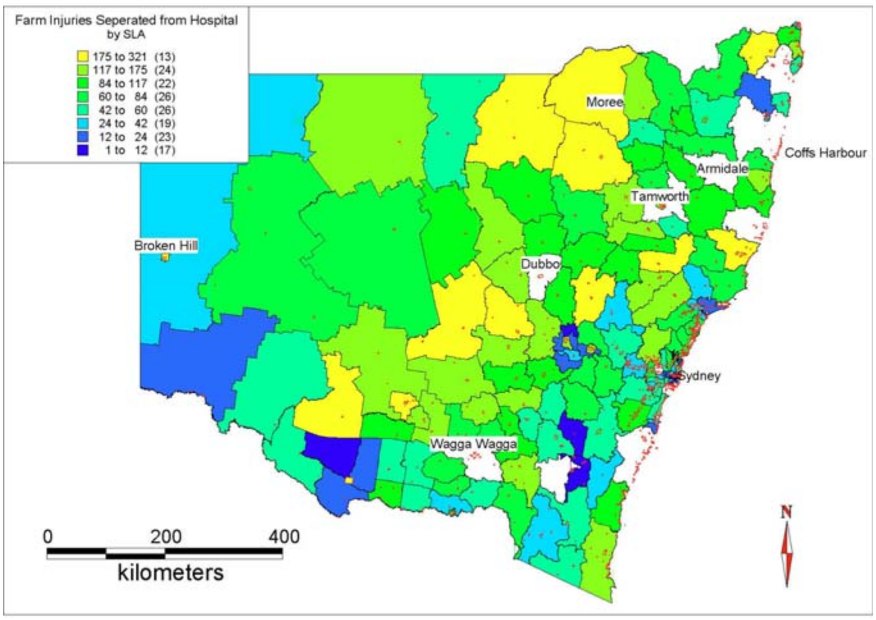


Figure 20 Distribution of farm injuries by SLA, NSW 1 July 1990 to 30 June 2000 (n=14,490)



5.4.3.2 Children (0-14 years) and 65+ years injured on farms

Females injured on farms were more likely to be younger (35.8%) or older (31.2%) (P<0.001) than of working age (19.6%) (Table 46). The number of children being injured increases with age; however, the ratio of males to females for children is consistent (Table 47).

Table 46 Gender by age groups, 0-14 years, 15 – 64 years and 65+ years, NSW Hospital separations, Farm Injuries, 1 July 1990 to 30 June 2000

Age Groups	Male		Female		Total	
	N	%	N	%	N	%
0-14 Years	1,607	14.5	897	26.1	2,504	17.3
15-64 Years	8,342	75.5	2,044	59.4	10,386	71.7
65+ Years	1,100	10.0	500	14.5	1,600	11.0
Total	**11,049**	**100.0**	**3,441**	**100.0**	**14,490**	**100.0**

Table 47 Gender by 5 year age groups for children, NSW Hospital separations, 1 July 1990 to 30 June 2000

Age Groups	Male		Female		Total	
	N	%	N	%	N	%
0-4 Years	322	20.0	186	20.7	508	20.3
5-9 Years	441	27.4	256	28.5	697	27.8
10-14 Years	844	52.5	455	50.7	1,299	51.9
Total	**1,607**	**100.0**	**897**	**100.0**	**2,504**	**100.0**

Different age groups have different external cause patterns (i.e. are being injured differently as represented by the grouping of external cause codes). Children were more likely to be injured while riding animals, motorcycles, and other vehicles and from falling. The 65+ years were more likely to be injured from falls, other animals and agricultural machinery, whereas the working population were likely to be injured while riding motorcycles or animals, agricultural machinery and from falls.

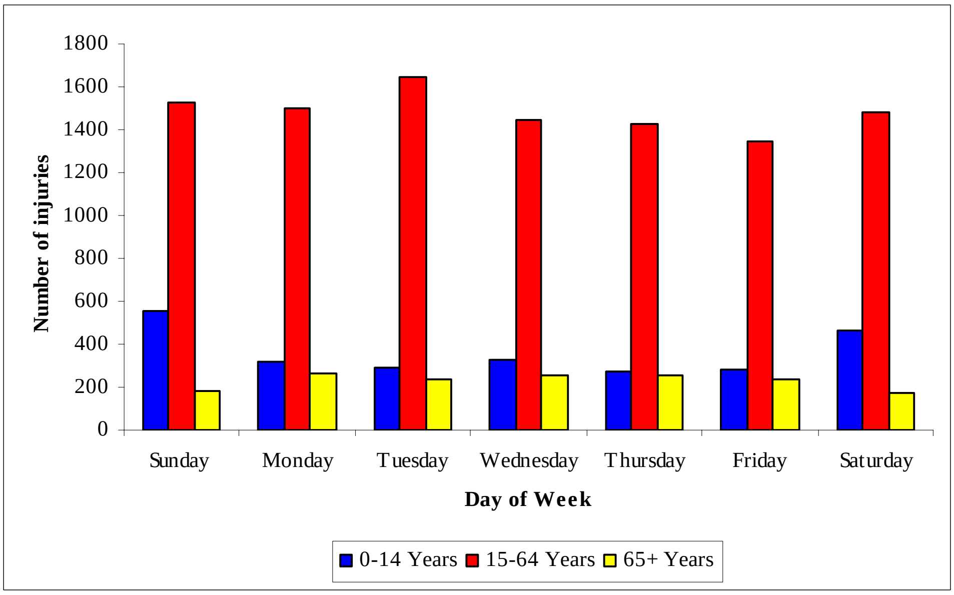
Table 48 Farmsafe Australia E-code groups by age groups, 0-14 years, 15 – 64 years and 65+ years, NSW Hospital separations, 1 July 1990 to 30 June 2000

Farmsafe Australia E-code groupings		**0-14 Year**		**15-64 Years**		**65+ Years**		**Total**
		N	**%**	**N**	**%**	**N**	**%**	**N**
E820-829	Motor Vehicle Non-Traffic Accident & Other Road Vehicle Accidents							
E820-829AR	*Animal Ridden*	451	18.0	1,164	11.2	72	4.5	1,687
E820-829MC	*Motorcycles*	491	19.6	1,400	13.5	67	4.2	1,958
E820-829Ov	*Other Vehicles*	278	11.1	721	6.9	95	5.9	1,094
E862	Poisoning by Petroleum Products	8	0.3	5	0.0	0	0.0	13
E863	Poisoning by Agricultural Chemicals	18	0.7	109	1.0	7	0.4	134
E864	Poisoning by Corrosive & Caustics	5	0.2	1	0.0	0	0.0	6
E866-869	Poisoning by Other Solids, Gases & Liquids	6	0.2	32	0.3	4	0.3	42
E891-899*	Fire and Flames	40	1.6	125	1.2	16	1.0	181
E905	Venomous Animal Plants	73	2.9	350	3.4	29	1.8	452
E906.0	Dog Bite	26	1.0	14	0.1	3	0.2	43
E906.8	Injury by Other Animal	111	4.4	714	6.9	151	9.4	976
E919.0	Agricultural Machinery	80	3.2	938	9.0	133	8.3	1,151
919.1-.9	Other Machinery	27	1.1	308	3.0	33	2.1	368
E920	Cutting and Piercing	82	3.3	762	7.3	85	5.3	929
E922	Firearms	13	0.5	86	0.8	4	0.3	103
Subtotal		**1,709**	**68.3**	**6792**	**64.8**	**699**	**43.7**	**9,137**
E801-819	Motor Vehicle Traffic Accidents	165	6.6	510	4.9	30	1.9	705
E850-865**	Poisoning	42	1.7	109	1.0	13	0.8	164
E880-888	Falls	291	11.6	1,029	9.9	572	35.8	1,892
E900-909#	Natural & Environmental Factors	50	2.0	346	3.3	93	5.8	489
E910	Drowning	20	0.8	2	0.0	0	0.0	22
Other	Other E-codes[##]	227	9.1	1,661	16.0	193	12.1	2,081
Total		**2,504**	**100.0**	**10,386**	**100.0**	**1,600**	**100.0**	**1,4490**

*Excluding E893.0, E895.0-9 and E898.0 (if included are in other E-codes). ** Excludes E863.0-9, E864.0-9 [#] E905.0-9, E906.0 & E906.8.
[##] Includes all E-codes not elsewhere represented

Children were on average more likely to be injured on a weekend day than a weekday, whereas people aged 65+ years were on average more likely to be injured on weekday than a weekend day (Figure 21).

Figure 21 Day of the week by age groups, 0-14 years, 15 – 64 years and 65+ years, NSW Hospital separations, 1 July 1990 to 30 June 2000



There was some tendency for farm injuries to children to decrease over the study period, whereas farm injuries to people 65+ years increased. This trend is seen in both timeframes examined (Figure 22 and Figure 23).

Figure 22 Number of farm injuries hospitalised by month and age groups (0-14 years and 65+ years), 1 Jul 1993 to 30 June 1998 (n=2158)

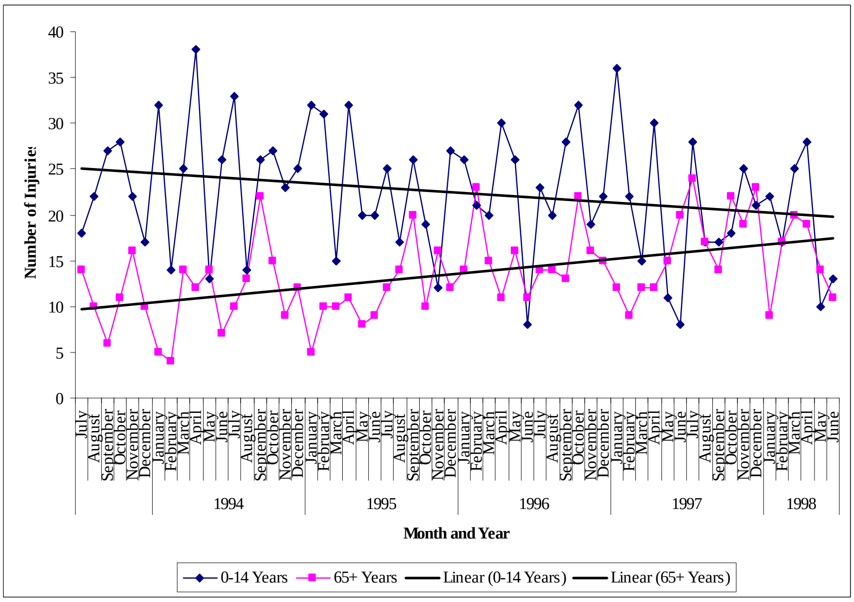
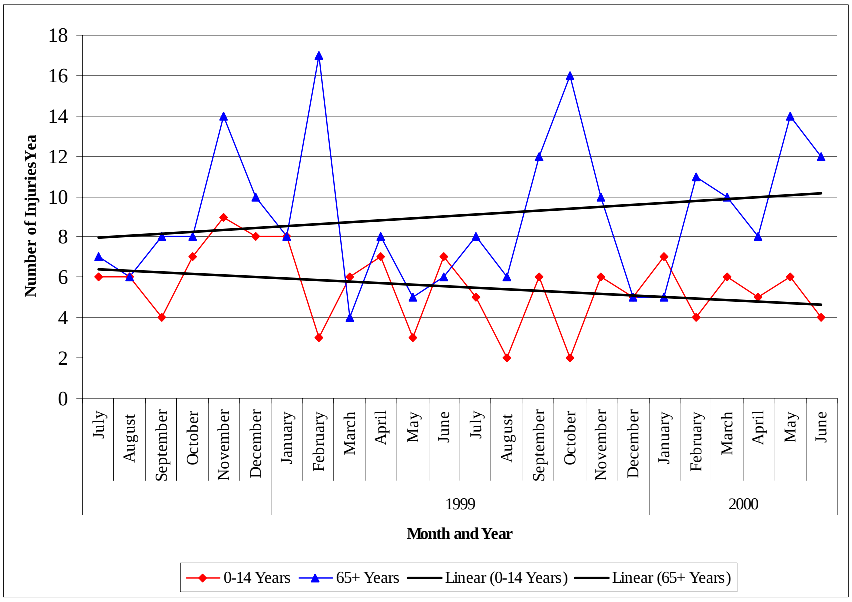
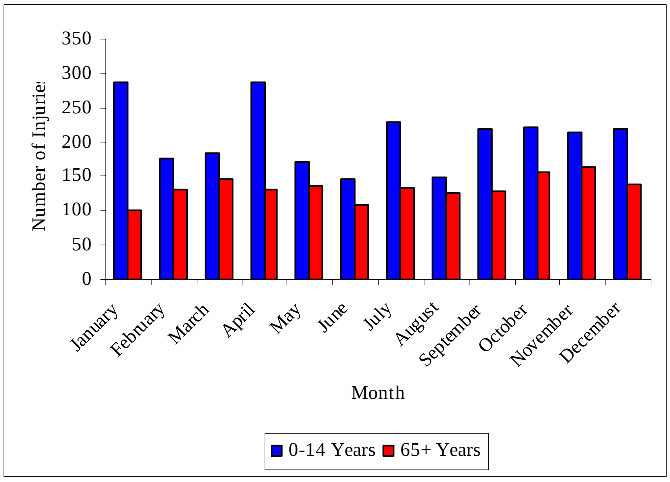


Figure 23 Number of farm injuries hospitalised by month and age groups (0-14 years and 65+ years), 1 Jul 1998 to 30 June 2000 (n=350)



The months where school holidays traditionally fall (April, January, July, September and December) and the months of October and November contain higher number of injuries on farms to children. Whereas for older people injured on farms there was a more consistent pattern across the year and were only slightly more likely to occur in the months of October to December (Figure 24).

Figure 24 Number of farm injuries requiring hospitalisation by month and age groups (0-14 years and 65+ years), 1 Jul 1998 to 30 June 2000 (n=4,130)



The most common injury type and body location was fracture of the upper limbs (23.0%), 85.6% of these were caused from falling (23.4%), riding animals (33.4%), motorcycles (18.5%) and other vehicles (10.3%). The other common injury type was intracranial injury (18.6%). Of these, 63.7% were from riding an animal (30.0%), motorcycle (19.3%) or other vehicle (14.4%).

Table 49 Injury type by body location injured, children, NSW Hospital separations, 1 July 1990 to 30 June 2000

Injury type	Head (including face excluding eye)	Spine and trunk	Upper limb	Lower limb	Eye	Systems (e.g. nervous)	Other, multiple & ill-defined	Total
Fracture	72	32	577	282	-	-	-	963
Dislocation	-	-	10	3	-	-	1	14
Sprains and strains	-	-	-	15	-	-	7	22
Intracranial injury	466	-	-	-	-	-	-	466
Internal injury	-	56	-	-	-	-	-	56
Open wound	114	23	106	163	10	-	17	433
Injury to blood vessels	3	1	-	1	-	-	-	5
Late effects	-	-	-	-	-	1	-	1
Superficial	18	5	9	10	4	-	15	61
Contusion	27	34	6	29	9	-	-	105
Crushing	-	2	5	6	-	-	-	13
Effects of foreign body entering through objects	5	6	-	-	1	4	-	16
Burns	19	6	15	40	-	-	5	85
Injury to nerves and spinal cord	-	5	1	1	-	-	-	7
Certain complications & Unspecified injuries	-	-	-	-	-	-	71	71
Poisoning	-	-	-	-	-	35	-	35
Toxic effects	-	-	-	-	-	116	-	116
Other and unspecified	-	-	-	-	-	-	34	34
Complications of surgical care	-	-	-	-	-	-	1	1
Total	**724**	**170**	**729**	**550**	**24**	**156**	**151**	**2,504**

5.5 Discussion

Hospital data is an excellent source for the overall surveillance of injuries [148 218-220]. Despite some limitations and weaknesses, hospital data has been found to be reasonably robust for other uses [148 218-220 236]. Having a place of occurrence code allows for the surveillance of injuries occurring in a particular setting like 'farm' and, with the addition of the activity code, allows for the differentiation of work injuries from other types of injuries [76 218].

While overall the quality of the hospital data is reasonable [233 236], there has not been an examination of the information at the place of occurrence level as it does not make up the diagnostic related group of data items that are used to calculate payment to hospital. In this study the use of the place of occurrence code appears to have changed when coding from ICD9 to ICD10 occurred.

While on the surface it appears that the change has been from farm to home, it is unknown if this was the case as there are a significant number of cases where the location is unspecified. A further examination of cases where the E-codes are highly likely to occur on farms or highly unlikely to occur on farms may elucidate further information about what is occurring. The use of trend data due to the change in coding is now compromised and only information from the change in coding will be useful, however further work needs to be undertaken to understand its meaning.

The high number of unspecified cases is also problematic, as it is unclear if this is a systematic bias (i.e. all cases at a particular location are coded unspecified) or a random occurrence (i.e. cases randomly do not have enough information to code but there is no one location that is affected that another). Further work needs to be undertaken to understand the nature of the unspecified cases.

There are some methods that are better than others when it comes to cleaning and checking data and this holds true with hospital data [242]. A better method of checking the data would have been to randomly select a number of hospital cases and check the coding against the original files or interview the injured person to see if the information in the file is correct. Unfortunately with over a million hospital separation per annum, the information being used for administration and less than 1% of these being farm, it is unlikely that this would occur on a regular basis. While checking farm cases will provide better information about the injuries as well as the robustness of the information, the cost and the time taken may not significantly improve our understanding of farm injuries that require hospitalisation.

Overall the information appears to be reasonably accurate at a state level except for the place of occurrence code for the years 1998-99 and 1999-00. To examine the hospital separations data a number of assumptions had to be made. Firstly – the majority of the coding is correct, in particular principal diagnosis and external cause coding, there is some evidence to suggest that this is the case [236]. Secondly – while there were discrepancies with the location code (primarily influenced by the changes in coding from ICD9 to ICD10), the overall information on injury was robust over time (i.e. those cases coded as occurring on farms occurred on the farm and it does not include any cases that did not occur on a farm).

There were an increasing number of injury cases over time. These were predominantly due to an increase in same day and one night stays. Removing these provided consistent numbers of injuries over time (with a small decrease in the longer stay cases). As such, NSW Hospital Separations data does provide an accurate trend of injury incidence in NSW over time. An examination of those cases that were readmitted within 28 days revealed 7.3% of injury cases were readmitted. What is unknown is if they were readmitted for the same injury or a different injury.

The analysis on the NSW hospital separations data revealed a problem with the place of occurrence coding, where the number of injuries on farms for the financial year 1998-99 and 1999-00 were a third of their previous numbers. It is not known what caused this decline in numbers. It could have been caused by an over representation in the earlier years, an under numeration in the later two years, a combination of both, or due to coding problems generated with the change from the ICD9 codes to the ICD10 codes. An over counting of farm cases is possible. Information from Victoria provided a rate less than half of the NSW rate per farm (Table 50), however rates in Western Australia are only slightly less than NSW [76 77].

Table 50 Rate of injury from hospital separations using FSA codes for Victoria (1July 1993 to 30 June 1998), NSW (1 July 1993 to 30 June 2000) and Western Australia (1 July 1993 to 30 June 1999)

Financial Year	Victoria			NSW			Western Australia		
	Number of Injuries[76]	Number of farms[54]	Rate per 1,000 farms	Number of Injuries	Number of farms[54]	Rate / 1,000 farms	Number of Injuries[77]	Number of farms[54]	Rate per 1,000 farms
93-94	440	37,773	11.65	1,042	43,227	24.11	273	14,910	18.31
94-95	351	37,330	9.40	1,049	42,817	24.50	259	14,555	17.79
95-96	328	37,070	8.85	1,060	42,287	25.07	266	13,973	19.04
96-97	301	36,905	8.16	1,085	42,497	25.53	306	13,987	21.88
97-98	332	36,656	9.06	1,032	42,758	24.14	254	13,872	18.31
98-99				327	42,496	7.69	264	13,990	18.87
99-00				309	43,302				

The average rate of injury per 100 farms presenting to the Tamworth Base Hospital Emergency Department was 34.7 per 100 farms and 30.2% of these were hospitalised. It was expected that a rate of 10.5 per 100 farms (or 105 per 1000) would be found; however a significantly higher rate was found [176].

When drilling down into the external cause information, there are particular ICD9 E-codes that are affected by the change such as E828.2 where the number of cases occurring at home increases and the number of cases at all other locations decreases.

A change in coding brings new challenges to our understanding of the data and how information is stored. It has been observed in the past that changes to coding can cause non-linear changes in incidence of rates of disease and injury [232]. On the whole ICD10 [55] is a better coding system allowing for more detailed information (extra levels to the codes) to be collected including additional place of occurrence codes (for example the street and highway field is now broken down into Y92.40 roadway, Y92.41 sidewalk, Y92.42 cycleway, Y92.48 Other specified public highway, street or road, and Y92.49 Unspecified public highway, street or road) and activity codes. The activity code is already being used to elucidate better information about work related injuries and the differences between hospital and Workers' Compensation data [243]. This extra information however may come at a cost, as additional information is required additional burden is placed on the system to collect this information.

The farm place code has not been expanded. The agricultural machinery code (W30 contact with agricultural machinery) has been expanded to separate out the agricultural machine from equipment they may be towing or powering [55]. The limitations to this code is that tractors has not been separated out and there could be some confusion between this code and ‘V84 Occupant of special vehicle mainly used in agriculture injured in transport accident’ as it only excludes vehicles in stationary use or maintenance, and as such a tractor working may be considered in this code even though it is not a transport accident [55]. Another limitation to the farm place code is the lack of a clear definition for those cases occurring on farm (i.e. what is a farm and where are it’s boundaries). This is an issue both in Australia and internationally [53].

What constitutes a farm and its boundaries is a problem for comparing farm injury studies and the collection and coding of information from multiple locations as no clear definition exists. This is particularly problematic when trying to separate out farm house (which includes the yard unless used for agricultural production) from the rest of the farm. This problem is not unique to Australia and an international approach may be more useful as different definitions can yield significantly different rates of injury [39 69].

Another problem with the farm definition is roadways, both within a property and bordering a property, and whether these should be included in the farm or in the street and road category. In Australia there are a large number of roadways which travel through a farm, roads which animals graze beside (stock routes), farms where the boundary of the farm goes all the way to the road with no fence, and farms with designated stock pathways across, under and over roads.

Injuries which occur in the course of farm work but not on the farm such as at stock yards, grain collection and storage points, and on road can be difficult to code or may not be coded to the farm locations, a problem not unique to hospital data or Australia [39]. In the ICD external cause codes there is also a lack of detail about the animal (W53-W59) involved, while rats, dogs and horses, marine animals, insects and reptiles have been separated out from other mammals the more common animals found on Australia farms (cattle, sheep, goats, and poultry) can not be separated out.

5.5.1 Farm Injury

Similar to all injuries in Australia and other farm injury studies males outnumber females by three to one for farm injuries in New South Wales [44 72 93 100 176 241 244 245]. The female to male ratio does vary by age with children and older people injured on farms having a higher proportion of females. For the 85+ years age group females out numbered males (0.64:1 males to females).

Except for the already identified decrease in the number of farm injuries in 1998-99 and 1999-00, the number of farm injuries being hospitalised overall were consistent over time. There were however an increase in the number of older people (65+ years) being injured on farms and a decrease in the number of children (0-14 years) being injured on farms. Due to the lack of information about the number, gender and age of people living on farms it is impossible to know if this difference is due to a higher proportion of females in this age group or an increased risk.

The ages with the highest number of injuries were males between 15 and 29 years, and for females aged between 10 and 24 years. As people aged their length of stay (LOS) in a hospital on average also increased, with people in the 80-84 years age group spending on average four times as long in hospital as people aged 15-19 years. There is also a difference in the types of external causes for which people are injured as they age. For children it is while riding and falls, for those age 65+ years it is from falling, animals and agricultural machinery.

The most common external cause codes from the FSA grouping were motorcycles, animal ridden, agricultural machinery and other vehicles. LOS is only a proxy for severity and other studies have developed more accurate measures of severity [227 246-252]. LOS has been found to increase with injuries where there has been a large transfer of energy involved, such as with agricultural machinery [69]. While agricultural machinery and fire and flames had longer LOS than the average, so did falls. This was due to the number of falls sustained by older farmers.

Overall people are more likely to be injured during the warmer months (September to April), and children and more likely to be injured during months where school holidays fall. Females and older people injured on farms have a reasonably consistent injury pattern across months, with a slight increase in the number of injuries during the warmer months. The consistent pattern may be due to less exposure to hazards, consistent work patterns, or greater understanding of safety [245].

Children represent a unique group of individuals injured on farms. In Australia they are often not injured undertaking work-related activities (or are not undertaking work activities) but are often injured due to the hazards available on farm such as motorcycles and horses [50 71 72 76 176 253]. Child injuries occurring on farms are not well collected in other data collections and in most cases not collected at all. Consequently, hospital separations data is a unique opportunity to examine these injuries [53].

Child injuries represented 17.3% of all injuries and there was an increase in the number of injures as the age groups increased. They were on average more likely to be injured on a weekend than on a weekday. Fractures to the upper limbs and intracranial head injuries were the most common types of injuries.

The other age group that is not well understood in the farm injury data are those people injured on farm who are older than 65 years as they are also usually not included in Workers' Compensation data. They may be described as retired in the deaths information yet still contribute to the farm enterprise. Older people injured on farms had a higher proportion of females injured than compared to the working population and were more likely to be hospitalised for a fall than for any other external cause. This group is likely to increase in the future with the ageing of Australia's population.

5.5.2 Prevention of farm injuries requiring hospitalisation

As farm injuries were distributed throughout the whole State to varying levels, preventing these injuries requires a State wide strategy (or National strategy). When planning a State or National strategy, the most logically priorities would be strategies that address:

i. Injuries involving males
ii. Motorcycle injuries
iii. Animal riding
iv. Falls
v. Agricultural machinery
vi. Other vehicles

When planning farm injury prevention initiatives those people who are aged between 15 and 29 should be targeted as they represent a quarter of all people injured. The way these injuries are prevented will require a mixture of work-related strategies and other strategies as it was shown from the examination of Emergency Department data (Chapter 4) that one-third of these injuries are due to activities other than working.

If cost reduction is a major reason for trying to reduce the number of injuries occurring on farms that require subsequent hospitalisation, then older people injured on farms should be targeted and in particular injuries sustained from falling as they have the longest average LOS.

As mixes of external causes are involved for different age groups, targeting specific prevention measures at different age groups may provide greater results. It is known that people respond differently to different prevention messages and there are generational gaps that need to be considered [254]. Prevention messages should be developed and tested on the appropriate population before being used on a large scale [254].

Injuries sustained from agricultural machinery were both large in number and had on average a longer stay in hospital (more severe) than other injuries and as such should be targeted for prevention. While small in number, injuries due to fire and flame required a longer stay in hospital and thus should be part of prevention activities.

There is also a significant issue about the effectiveness of prevention actions in agriculture as many measures have been suggested but very few are supported by epidemiological evidence [69]. This is however slowly changing with some excellent studies such as DeRoo and Rautiainen, Pickett et al, Page and Fragar, Reynolds and Grove critically examining the effectiveness of prevention strategies [61 154 255 256].

5.5.3 Limitations

5.5.3.1 Denominator Data

Lack of appropriate denominator data limits the usefulness of this information over time. While the number of people living on farms by age and gender and the number of people working on farms by age and gender (including those who do not live on farms) each year would be a more useful denominator, it still is not the exposed population. Visitors, both those who visit due to work (e.g. electricity workers) but are not included in the agricultural working population, and those who visit for leisure are difficult to count and their exposure is also different.

The inclusion of activity in ICD10 will allow for the separation of those who were injured while working and those injured during other activities thus providing a more accurate picture of the size of work related injuries on farms [55]. This has been problematic with Workers' Compensation information as it only collects information on employees [68].

5.5.3.2 Exposed Population

Understanding of the population's exposure to a particular hazard or multiple hazards is difficult to measure. Farms are a dynamic environment and not all people who live on a farm are necessarily exposed to all the hazards on the farm or even all farms having the same hazards. For example farms without cattle will not have any cattle related injuries or large farms with workers who have individual jobs such as truck or tractor driver may never be exposed to a particular hazard.

5.5.3.3Accuracy of data

As this study does not go back to the original data it is hard to define the accuracy of the data. Other studies have shown that hospital data can be used to describe the nature and extent of injuries requiring hospitalisation[68 214 243]. However, the problem with place of occurrence highlighted in this study raises the issue of accuracy of the location code in the data.

Rather than using the hospital data as a surveillance source in a given year, a program of work that collects all farm cases ever three to five year may be better, as there may be additional information gleaned from the medical records, as found in the study by Langlois et al [220]. Work needs to be undertaken on improving the definition of what a farm is and feed back to the coders about how the information is being used.

5.6 Conclusion

Hospital Data is a valuable source of information about people who are injured on farms, the quality of the information provided allows for the identification of issues, including age groups and gender where prevention activities should be targeted. There are a number of strengths to using hospital data such as consistency over time, however there are also some weaknesses both in the coding and the information available. Similar to other data sources the lack of appropriate denominator data makes it difficult to compare hospital information with other data.

5.7 Summary – Hospital Admissions

1. An extensive analysis of hospital admissions and discharges, consequent upon on-farm trauma, has been undertaken. This hospital based study has used the standard epidemiological records as the primary dataset. The hospital based study was over a 10 year total population survey of all NSW hospital admissions and subsequent separations for the period 1 July 1990 to 30 June 2000.
2. A review of the quality of hospital-based separations data has been undertaken. This has revealed that the process of changing documentary codes (from ICD9 to ICD10) has resulted in, of itself, a significant (40-50% reduction) change in reported farm injury rates. In the absence of a gold standard for farm injury rates it is not possible to logically determine whether the injury rates (prior to 1 July 1998) was the correct estimate or not. Intuitively, however the most likely interpretation is that the change of coding has led to significant loss of primary (separations) data.
3. Primary cases finding for the farm injury study identified all cases (916,164) of injury (ICD 800-999). From this primary dataset the subset of farm-related injuries was generated. The later was undertaken by the author who compiled a comprehensive list of external cause codes (ICD9) which were relevant to every aspect of farm-based trauma.
4. The injury rate per farm at the mid point of the survey was 36.29 (average of 1994/1995 years) hospitalised victims per 1,000 farms. This represents an annual rate of 1 serious injury per year for every 27 farms (27.6).
5. A total of 14,490 injuries (victims) on farms or farm-related cases, requiring admission to hospital were identified
6. Detailed analysis of this dataset of 14,490 severe on–farm injuries has shown:
    a. A suggestive trend toward decreased rates in children; contrasted with a suggested trend of increased injury rates for older subjects (65+ years)
    b. The age group with the highest number of injuries for males was 15-19 years and for females was 10-14 years (the average age for males was 36.5 years and for females was 35.1 years)
    c. The rank order of the 'Top 5' serious farm injuries (i.e. necessitated admission to hospital was:
        i. Motorcycles
        ii. Animal ridden

iii. Agricultural machinery
iv. Other vehicles (e.g. utes, trucks, etc)
v. Injury by animal

7. The rank order of the ‘Top 6’ accidents causing prolonged hospital in-patient stays were:
   i. Fire and flames
   ii. Falls
   iii. Agricultural machinery
   iv. Motor vehicles
   v. Other vehicles
   vi. Animal injury and Firearms
8. The average inpatient stay for on-farm injuries was 6 days. It should be noted that length of stay in hospital may be shorter for those cases where the outcome is death.
9. Older victims of on-farm injuries required longer hospital in-patient care. The mean inpatient stay for 80-84 year olds was 12 days.
10. Spring and summer months were associated with increased admission rates.
11. Children represented 17.3% of all people injured on farms. While the proportion of children injured increased as they aged, overall the number of injuries of children on farm per month has been decreasing. One third of the children injured were females. Children are more likely to be injured while riding animals, motorcycles, and other vehicles.
12. People injured on farm aged 65 years and older represented just 11.0% of injuries occurring on farm, of these just over two-thirds (68.7%) were males. People aged 65 years and older were more likely to be injured in falls, by other animals and agricultural machinery. The number of injuries to older people on farms per month has been increasing.
13. This study has shown that reliable data can be obtained from using external cause codes, particularly with respect to relative ranking. However, there exists or persists a systematic problem in the primary coding (and therefore interpretation) of, the place of occurrence information with respect to all epidemiological studies of injury. Future studies focusing on ‘place of occurrence’ data must continue to rely on case specific records.
14. This research project has created a perspective of serious farms injuries under NSW conditions. This author believes that a state-wide or national strategy (for farm injury

prevention) would provide a focus for resource allocation, ranked priority interventions, target setting and outcome auditing.

15. Such a state or national strategy would most logically have priorities that address:
    i. Injuries involving males
    ii. Motorcycle injuries
    iii. Animal riding
    iv. Falls
    v. Agricultural machinery
    vi. Other vehicles
16. Care needs to be taken when using hospital data for the examination of farm injuries, the location code appears to have errors over time (particularly between the ICD9 period and the ICD10 period). There are a large number of cases where the location is unspecified casting further doubt about the validity of location code. Further work needs to be undertaken before hospital data could be seen as a reliable source of information for the surveillance of people injured on farms.
17. This chapter has identified a major epidemiological challenge encountered by all who work in the injury prevention field. This relates to the quantification of risk exposure, specified by age, sex, type of injury, and cause of injury. Accurate description of injury rates necessitates accurate specific exposure data. Where denominators are not available, the making of any policy using quantitative ranked risk data can not be generated. Such quantitative exposure data can be obtained by correctly sampled pilot studies and such are needed in the future.

Chapter 6 NSW Workers' Compensation reported injury in Agricultural industries

> You can use all the quantitative data you can get, but you still have to distrust it and use your own intelligence and judgment.
>
> **Alvin Toffler (1928-)**

6.1 Introduction

People who are employed and injured while at work (or working) are covered by Workers' Compensation insurance schemes in Australia [257 258]. These schemes are compulsory for all Australian workplaces that have employees and is managed at a state level. Each year WorkCover NSW release their statistical bulletin about the number of compensation claims in the previous financial year [259-261].

In the 2000/2001 financial year (the last year of data used for this study) there were 53,797 employment injuries and 81,357 lost time injuries in NSW of which Agriculture (1,897) made up 2.3%. The incidence rate overall was 20.3 per 1,000 workers (down from 28.6 in 1994/95) and for agriculture was 32.8 per 1,000 workers [259]. The male incidence rate (28.0) was twice the rate of females (13.1). The frequency rate overall was 11.8 per 1 million hours worked, down from 16.1 in 1994/95 (agriculture was 16.4). It should be noted the incidence rate refers to lost time claims (accepted claims), not to all claims made. [259]

In Australia Workers' Compensation statistics have been used to monitor occupational health and safety performance including those injured in an agricultural setting. The most significant publication examining Workers' Compensation claims in agriculture is by Cole and Foley, published in 1995 [80]. This publication provided information about the number of people injured who received Workers' Compensation in Australia for the financial year 1992-93. Fragar and Franklin have also used Workers' Compensation in agriculture to determine if Farmsafe Australia had achieved their goals and targets [262].

Cole and Foley examined the frequency of injury/disease for the agricultural subdivision per 1,000 wage and salary earners and the incidence of injury disease for agricultural groups per million hours worked. Their calculations include information on those industries which provide services to agriculture such as shearing and aerial agricultural services. The incidence of injury / disease for agricultural subdivisions varied from 18.7 for cereal grains to 73.9 for meat cattle per 1,000 wage and salary earners. The frequency of injury / disease varied from 13.0 for vegetable farmers to 38.5 for other agricultural farmers per million hours worked. The study went on to examine occupations, age, gender, time lost, nature, bodily location, mechanism, agency, time, day of week, and cost, all of which are considered in this study. The most telling part of the study was the cost, which was on average 1.23 times higher than the average for all industries and estimated to be between $0.52 and $1.29 billion dollars per annum for work-related injury and disease.[80]

There are limitations to using Workers' Compensation for a measure of injuries in agriculture. The most important of these being that not all farmers are covered, those farmers that are self-employed are not required to be part of the Workers' Compensation scheme [68]. Other issues are: it does not include all injuries, particularly those injuries of a minor nature (i.e. do not result in lost time); injuries with a long latency period such as noise, back or chemical related injury may also be missed; and there are some people who are eligible to make a claim but do not [243].

The Workers' Compensation premiums (percentage of an employee's salary) for agricultural industries in New South Wales for 2002/03 are displayed in Table 51. The premiums vary from 7.2% for grape growing to 12.1% for 'combined grain growing, sheep farming and beef cattle farming' and 'sheep farming'. Premiums are a proxy for industry performance in the OHS area. Those industries with higher premiums are more likely to have higher rates or numbers of people injured (i.e. more people injured means increased costs, which need to be recovered from the Workers' Compensation system).

Table 51 Workers' Compensation Premium Rates in NSW 2002/2003 – Agriculture and Services to Agriculture

Industry	Premium 2002/03 (%)
Horticulture	
Plant Nurseries	6.7
Cut Flower and Flower Seed Growing	7.2
Vegetable Growing	7.3
Grape Growing	7.2
Apple and Pear Growing	7.3
Stone Fruit Growing	7.3
Kiwi Fruit Growing	7.3
Fruit Growing NEC	7.4
Grain, Sheep and Beef Cattle Farming	
Grain Growing	11.1
Combined Grain Growing, Sheep Farming And Beef Cattle Farming	12.1
Sheep-Beef Cattle Farming	11.9
Sheep Farming	12.1
Beef Cattle Farming	10.5
Beef Cattle Feedlots	10.2
Dairy Cattle Farming	
Dairy Cattle Farming	9.9
Poultry Farming	
Poultry Farming (Meat)	8.3
Poultry Farming (Eggs)	8.3
Other Livestock Farming	
Pig Farming	9.9
Horse Farming	9.9
Deer Farming	9.9
Other Livestock Farming NEC	9.9
Other Crop Growing	
Sugar Cane Growing	9.9
Cotton Growing	9.9
Other Crop and Plant Growing NEC	9.0

Source: WorkCover NSW (2002). *Outline of the NSW Workers' Compensation Premium Scheme 2002/2003: How Worker' Compensation premium is calculated in NSW.* WorkCover NSW (http://www.workcover.nsw.gov.au/NR/rdonlyres/4A1FA196-5606-409A-8B3B-70317BA99A31/0/gen_outline_wcps_4165.pdf)

6.1.1 Rates

To allow for appropriate comparison of industries, injury rates for the particular industries will be estimated, based on the number of agricultural establishments, people employed and the total number of hours worked. There are strengths and limitations to each method for the calculation of the rates.

The number of agricultural establishments has been used elsewhere and is useful where the exposed population is unknown [15]. The number of people employed provides a better estimation of the exposed population for those who are injured while working. However, as the ABS uses a survey to collect this information, it is unclear if the exposed population is working for the whole period [4]. Hours worked is a better estimate of exposure for work related injuries. The total hours worked in a quarter can vary by more than 25%, while employed persons may vary by 10%, changing the average hours worked per person (Table 52).

Table 52 Employed persons ('000), hours worked ('000) and average hours worked for the Agriculture industry in NSW by quarter 1 Jul 1992 to 30 Jun 2001

Year	Quarter	Employed Total (000psns)	Hours Worked (Emp Total) (000 h)	Average Hours (hours)
	August	102.0	4,261.0	42.0
	November	113.0	5,953.0	53.0
1993	February	110.0	5,000.0	46.0
	May	93.0	3,980.0	43.0
	August	113.0	5,092.0	45.0
	November	112.0	5,248.0	47.0
1994	February	102.0	4,288.0	42.0
	May	97.0	4,535.0	47.0
	August	105.4	4,744.6	45.0
	November	105.4	4,752.7	45.1
1995	February	104.0	4,541.4	43.7
	May	90.0	3,868.1	43.0
	August	97.6	4,070.9	41.7
	November	115.8	5,545.3	47.9
1996	February	110.2	5,040.0	45.8
	May	96.9	3,716.4	38.3
	August	96.8	3,958.5	40.9
	November	100.6	4,446.5	44.2
1997	February	104.7	4,507.2	43.1
	May	99.8	4,640.4	46.5
	August	93.2	4,064.3	43.6
	November	130.5	6,517.9	49.9
1998	February	119.1	5,053.9	42.4
	May	117.5	5,506.5	46.9
	August	102.2	3,997.1	39.1
	November	105.5	5,017.7	47.6
1999	February	111.0	4,681.6	42.2
	May	111.3	5,185.9	46.6
	August	111.1	4,809.7	43.3
	November	111.4	5,541.6	49.7
2000	February	116.2	5,230.1	45.0
	May	114.9	4,888.2	42.6
	August	108.2	4,399.0	40.7
	November	111.1	5,064.2	45.6
2001	February	107.3	4,849.8	45.2
	May	115.2	5,210.3	45.2

Note: Includes all people employed in agriculture (including self-employed and own workers)

Using Workers' Compensation statistics to provide an injury rate is complex, as not all people in agriculture are covered under Workers' Compensation schemes. To address this issue, those people who are 'own account workers' or 'contributing family members' are excluded from the denominator as they are unlikely to be covered under Workers' Compensation. There are some farms who participate in the scheme voluntarily, however this number is likely to have no effect on the overall numbers.

6.1.2 Definition of agriculture

The term agricultural industry / industries used in this chapter covers the sub-divisions of the agriculture industry of the Australia and New Zealand Industry Classification (ANZIC) [2]. It refers to the industry in which people work and not necessarily the work they were undertaking or the location in which the work was being performed at the time of the injury. It does not include the industry subdivisions 'services to agriculture'; 'hunting and trapping, forestry and logging, and commercial fishing' [2].

6.2 Aims

The aims of this section are to examine NSW Workers' Compensation data to:

- Provide a rate of injury for the people injured and paid Workers' Compensation working in agriculture in NSW at the time of injury
- Describe the nature of compensated injuries by agricultural industries in NSW
- Describe the cost of compensated work related agricultural injuries per annum in NSW
- Provide direction for prevention of work-related farm injuries in NSW

6.3 Methods

Information for this section was provided by WorkCover New South Wales from the Workers' Compensation lost-time claims database.

Workers' Compensation information for the financial years 1992/93 to 2000/01 from the NSW Workers' Compensation lost-time claims database was extracted in August 2002 for accepted claims where the industry in which the person was working was agriculture. Lost-time claims are defined as claims resulting in an absence from work of 5 or more days (one working week), however the dataset provided includes all claims made [259].

WorkCover NSW only releases data where there is no confidential or commercially sensitive information and the contents of the cell in tabulation or other representation of data cannot be identified. Where the content of a single cell is five or less, the number is replaced by an asterisk (*) to ensure confidentiality.

The people covered by the Workers' Compensation scheme in NSW are those workers who sustain an 'employment injury' or 'occupational disease' and make a claim to the NSW Workers' Compensation scheme which is subsequently accepted by NSW WorkCover. It does not cover a worker in the following circumstances:

- Where a claim is not made.
- Where the period paid for total incapacity was less than 5 days and there were no other costs.
- Most self-employed people.
- Employees of the Australian Government.
- Employees suffering from diseases caused by dust inhalation (except in coal mining).
- Casual workers employed for one period only of not more than five working days and who are employed for purposes of the employer's trade or business [259]

6.3.1 Definitions

'Employee' is defined as "…a person who works for a public or private company and receives remuneration in wages, salary, a retainer fee by their employer while working on a commission basis, tips, piece rates or payment in kind, or a person who operates his or her own enterprise with or without hiring employees…" [263]

Employer is defined as "…a person who operates his or her own incorporated economic enterprise or engages independently in a profession or trade, and hires one or more employee…" [263]

Own account worker is defined as "...a person who operates his or her own unincorporated economic enterprise or engages independently in a profession or trade and hires no employees (this category was formerly entitled self employed…" [263]

Contributing family member is defined as "…a person who works without pay, in an economic enterprise operated by a relative. (This category was formerly entitled unpaid family helper)…"[263]

6.3.2 Calculation of Rates

Two sets of rates were calculated – a rate per person employed in agriculture, and a rate per number of agricultural establishments.

6.3.2.1 Agricultural establishments:

The number of agricultural establishments by industry is not available for NSW, as such an overall injury rate for agriculture is calculated by dividing the number Workers' Compensation claims by number of establishments per annum (Table 53).

Table 53 Establishments with agricultural activity, NSW

Year	Establishments with agricultural activity
1992	44,443
1993	43,227
1994	42,817
1995	42,287
1996	42,497
1997	42,758
1998	42,496
1999	43,302
2000	43,654
2001	41,951
2002	41,651

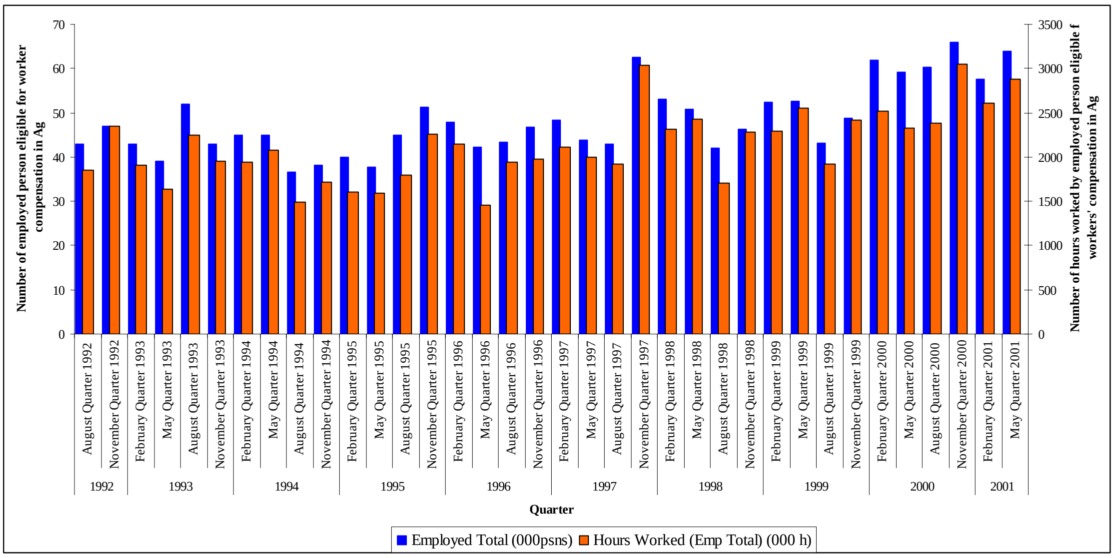
References [54 264]

6.3.2.2 Employed persons

The incidence rate of occupational injuries and diseases is the number of occurrences per 1,000 wage and salary earners[80].

Information on employed persons is provided by the Australia Bureau of Statistics via labour force statistics every quarter[265]. Unfortunately this information is not available for industry at the subdivision level by gender, age and quarter [2]. For the purposes of calculating rates, full-time employees and employers were used as the denominator and own account workers and contributing family workers were excluded (Figure 25).

Figure 25 Number of persons ('000) and hours worked ('000), employed in Agriculture eligible for Workers' Compensation [265]



Source: Australian Bureau of Statistics [263]

Annual Workers' Compensation rates of injury were calculated using the November quarter (the quarter closest to the middle of each year) as the number of people employed in agriculture for that year. However due to low or non-existent quarterly labour force statistics in the November quarter for females in the dairy, other livestock and other crops agricultural industry groups for the years (1992/93, 1993/94) and for dairy in the years (1994/95, 1999/00, and 2000/01), a different quarterly labour force statistic was used based on the following order:

- February Quarter
- August Quarter
- Next chronologically available quarter after February

It should also be noted that where the female labour force information is zero (i.e. the survey did not have any females working in that quarter) in the quarter used to calculated total rates then the male labour force information is the denominator (Table 54).

Labour force information provided from the ABS for the financial years 1992/93 and 1993/94 were provided as whole numbers. Where the labour force was reported as 0 this means there were between 0-499 people employed in the industry [265].

Table 54 Changes to denominator used to calculate annual labour force rates, number of people employed

Year	Dairy	Other Livestock	Poultry
1992/93	600 Feb 1995 Quarter	1000 Feb 1993 Quarter	1000 Feb 1993 Quarter
1993/94	600 Feb 1995 Quarter	1000 Feb 1994 Quarter	1000 Aug 1993 Quarter
1994/95	600 Feb 1995 Quarter		
1999/00	800 Feb 2000 Quarter		
2000/01	300 Feb 2001 Quarter		

6.3.2.3 Hours worked

The frequency rate of occupational injuries and disease is the number of occurrences per 1,000,000 hours worked [80]. Hours worked is calculated by the Australia Bureau of Statistics in the labour force survey [265] (Figure 25). It only refers to the number of hours worked in a week. To estimate the number of hours worked in a quarter, the number of hours worked in a week is multiplied by 13.

6.3.3 Time off work

Time off work was calculated in weeks, where the date of injury was taken as the start day and the date of returning to work was taken as the last day. If the person had not returned to work, the return to work day was arbitrarily set at 30 June 2001, the last day for which information on claims was available in this dataset. The number of days off was divided by seven to calculate the number of weeks off work.

Time off work is only calculated for those injuries where the resultant injury is temporary (21,093 claims). When this field was examined, there were some people who had time off work longer than the study period (i.e. time off work greater than 470 weeks). There were 5,882 claims where the return to work date was missing, of these 650 had a length of time off work provided in the data. There were 15,861 claims where length of time off work was known.

In the reanalysis of ‘time off work’ those claims where the return to work date was the same as the injury date were coded as ‘0.000001’ identifying them as a same day case. The claims where the return to work date was missing were coded as missing. For the reanalysis there were 15,211 claims where the length of time off work was known.

6.3.4 Coding

Information for this study was provided by the NSW WorkCover Authority from their Workers’ Compensation dataset. This information is coded using the type of occurrence classification system found in Appendix C of the NSW Statistical Bulletin [260]. For analysis the fields; *bodily location*, *agency*, *mechanism*, and *occupation* were examined at the major grouping level.

The nature field *nature of injury/disease* classification was examined at the major group level except for the category ‘injury and poisoning’ which was examined at the next level down as 92.7% of all the claims fell into this category.

6.3.5 Validation of data

No validation of the data was undertaken by the author. However, the information was checked by WorkCover NSW prior to it being made available. The provided data was checked for inconsistencies, but no incorrect codes were found (i.e. codes for which there was no classification), and the dates provided fell within the range 1 July 1992 to 30 June 2001 as expected.

6.3.6 Late Claims

There is a latency period for claims to be made to the Workers’ Compensation system compared to when the injury occurred. For this set of Workers’ Compensation information 62.2% of the claims were made in the same quarter and 77.3% in the same half year as the injury was sustained. A further 29.3% of the claims were made in the subsequent quarter and 17.9% in the subsequent half year (Table 55). On average there are 293 claims made in the half year following the occurrence of the injury.

6.3.7 Presentation of information

Where industry information is presented it is presented in the order it appear in the ANZSIC classification to enable the quick comparison of industries across tables [2].

Table 55 Half year of injury by half year in which a claim was made to the Workers' Compensation system for people employed in Agricultural industries, 1 July 1992 to 30 June 2001

Year of Claim	1992b	1993a	1993b	1994a	1994b	1995a	1995b	1996a	1996b	1997a	1997b	1998a	1998b	1999a	1999b	2000a	2000b	2001a	Total
1992b	926																		926
1993a	239	1,020																	1,259
1993b	25	258	924																1,207
1994a	13	27	286	941															1,267
1994b	8	8	30	215	931														1,192
1995a	*	*	11	20	266	947													1,249
1995b	8	*	9	12	30	214	1,042												1,316
1996a		*	*	11	9	15	274	1,134											1,452
1996b	6	*	7	*	6	9	17	247	1,073										1,373
1997a	*	*	8	6	10	7	20	23	250	1,053									1,383
1997b	*	*	14	12	14	11	18	20	30	378	1,408								1,914
1998a	*	*	*	9	*	6	9	9	16	32	352	1,471							1,917
1998b	*	*	7	*	*	*	*	14	13	12	35	347	1,492						1,942
1999a	*	*	9	*	7	*	*	10	13	13	12	31	353	1,544					2,004
1999b	*		7	*	6	8	11	*	15	7	13	15	33	358	1,457				1,941
2000a	*		*	*	*	*	*	6	*	*	17	12	31	38	333	1,585			2,044
2000b	*	*	*	*	*	*	*	*	*	7	14	17	14	12	40	315	1,175		1,620
2001a	*	*	*	*	6	*	*	*	*	*	9	8	9	13	25	19	290	1,328	1,735
Total	**1,248**	**1,348**	**1,325**	**1,250**	**1,295**	**1,233**	**1,414**	**1,474**	**1,420**	**1,509**	**1,860**	**1,901**	**1,932**	**1,965**	**1,855**	**1,919**	**1,465**	**1,328**	**27,741**

6.4 Results

An overall examination of Workers' Compensation information is presented first, followed by an examination of the 'groups' within agriculture according to ANZSIC (horticulture; grain, sheep and beef cattle farming; dairy cattle farming; poultry farming; other livestock farming; and other crop and growing) [2].

6.4.1 Overall

There were 24,332 people working in agricultural industries injured during the period 1 July 1992 to 30 June 2001, who received compensation for their injuries. Of these, 20,046 (82.4%) were males and 4,286 (17.6%) were females. Over the period there was an increase in the proportion of injuries sustained by females (Table 56).

Table 56 Gender of people compensated via Workers' Compensation and employed in Agricultural industries, 1 July 1992 to 30 June 2001

Financial Year	Female		Male		Total
	N	%	N	%	
1992/93	343	14.4	2,031	85.6	2,374
1993/94	408	17.3	1,951	82.7	2,359
1994/95	381	16.6	1,920	83.4	2,301
1995/96	437	16.8	2,166	83.2	2,603
1996/97	414	16.4	2,108	83.6	2,522
1997/98	536	17.5	2,526	82.5	3,062
1998/99	677	20.2	2,672	79.8	3,349
1999/00	648	19.5	2,676	80.5	3,324
2000/01	442	18.1	1,996	81.9	2,438
Total	**4,286**	**17.6**	**20,046**	**82.4**	**24,332**

The incidence of injury / disease in agriculture is displayed in Figure 26 and ranges from 7.2 per 1,000 workers in the May 2001 quarter (this is almost certainly an under representation by approximately 29.3%, due to late claims not being included in this quarter), to 20.3 per 1,000 workers in the November 1998 quarter. Figure 27 displays the same information, but with rates averaged for each financial year. The financial year 2000/01 had the lowest rate (37.0 per 1,000 workers) and the 1998/99 financial year had the highest (72.6 per 1,000 workers). Apart from the low rate in 2000/01, there was a reasonably steady increase in agricultural Workers' Compensation claims over the study period.

Figure 26 Incidence of injury / disease by quarter, agriculture, NSW Workers' Compensation claims, 1 July 1992 to 30 June 2001

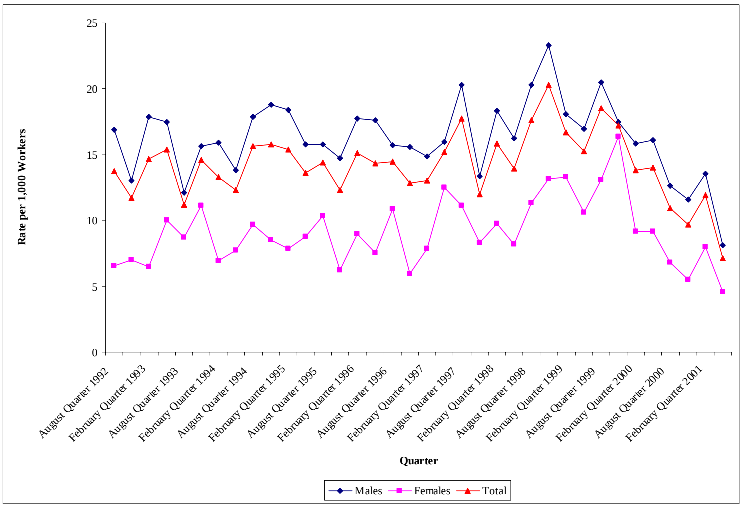
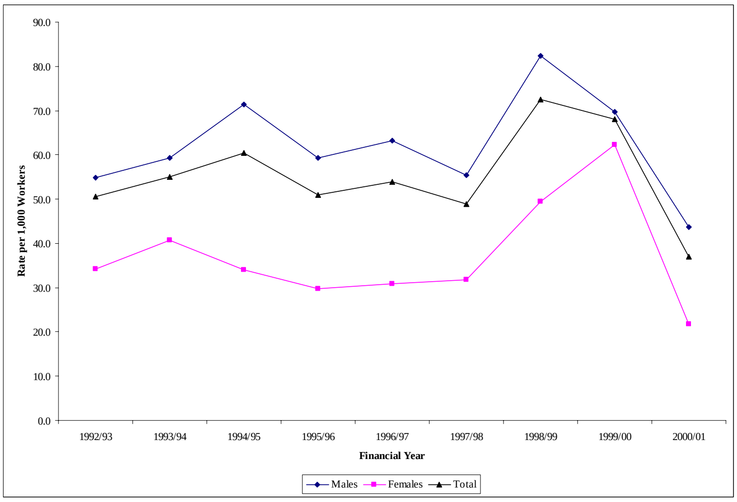
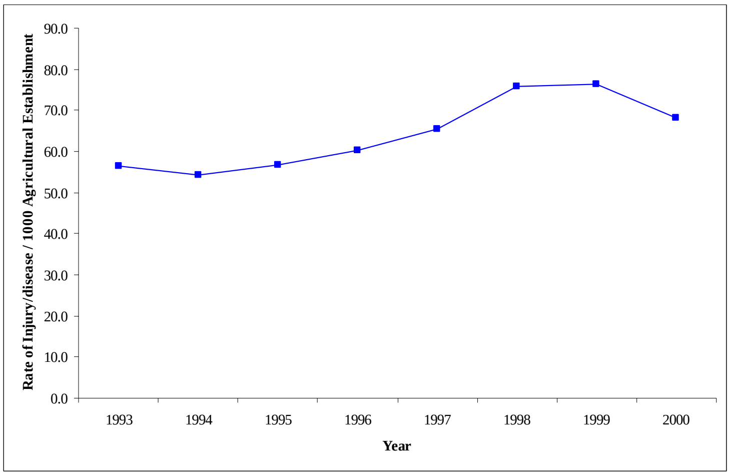


Figure 27 Incidence of injury / disease by financial year, agriculture, NSW Workers' Compensation claims, 1 July 1992 to 30 June 2001



The rate of injury / disease per 1,000 of agricultural establishments by calendar year is presented in Figure 28. The rate varies from 54.3 per 1,000 agricultural establishments in 1994 to 76.5 per 1,000 agricultural establishments in 1999.

Figure 28 Rate of injury / disease by 1,000 agricultural establishments by year, agriculture, NSW Workers' Compensation claims, 1 January 1993 to 30 December 2000



The average age of people seeking Workers' Compensation was 36.6 years (Median = 35.0 years, range 15.1 to 86.8 years). The majority (62.7%) of people employed in agriculture and seeking Workers' Compensation were aged less than 40 years (Table 57).

Table 57 Age groups of people seeking Workers' Compensation and employed in Agricultural industries, 1 July 1992 to 30 June 2001

Age group (years)	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	Total	% Total
15-19	162	160	143	161	173	232	221	200	202	1,654	6.8
20-24	410	363	380	363	356	463	518	474	353	3,680	15.1
25-29	409	359	358	347	375	417	450	478	307	3,500	14.4
30-34	323	371	298	416	368	399	415	431	299	3,320	13.6
35-39	247	283	304	338	355	382	440	466	297	3,112	12.8
40-44	248	261	230	267	253	320	366	367	274	2,586	10.6
45-49	202	228	215	254	226	277	338	301	223	2,264	9.3
50-54	157	154	176	216	177	253	274	286	233	1,926	7.9
55-59	132	100	113	140	128	182	179	173	142	1,289	5.3
60-64	65	60	59	79	80	89	109	109	74	724	3.0
65-69	17	16	15	15	20	33	23	25	23	187	0.8
70+	*	*	10	7	11	15	15	14	11	88	0.4
Unknown	-	*	-	-	-	-	*	-	-	*	0.0
Total	**2,374**	**2,359**	**2,301**	**2,603**	**2,522**	**3,062**	**3,349**	**3,324**	**2,438**	**24,332**	**100.0**

The following two tables present information on total compensation payments by industry (Table 58) and actual time lost (weeks) by industry (Table 60). The number, cost and time off work varied by industry, and is explored in greater detail within each section of the industry groupings.

The cost of claim was known in 23,724 cases, with the cost of claims ranging from $2.60 to $840,324.53. The top five industries with the highest average cost of claims were; Grain, Sheep and Beef Cattle Farming NEC ($22,531.33), Sheep Farming ($17,974.99), Grain-Sheep and Grain-Beef Cattle Farming ($15,697.93), Cut Flower and Flower Seed Growing ($14,165.53), and Vegetable Growing ($13,549.77) (Table 58).

Table 58 Total Compensation Payments by Industry for NSW Workers' Compensation claims, 1992/93 to 2000/01*

Industry	Mean	Median	Minimum	Maximum	N
Plant Nurseries	$13,085.30	$821.29	$14.75	$730,770.41	838
Cut Flower and Flower Seed Growing	$14, 165.53	$1,598.76	$121.50	$313,513.23	44
Vegetable Growing	$13,549.77	$1,023.25	$27.00	$248,990.24	662
Grape Growing	$9,617.13	$711.93	$13.65	$417,005.04	729
Apple and Pear Growing	$9,599.20	$1,031.14	$39.50	$165,666.38	181
Stone Fruit Growing	$5,573.24	$617.50	$24.90	$155,585.67	159
Fruit Growing NEC.	$9,634.55	$816.00	$16.97	$310,277.53	1,237
Grain, Sheep and Beef Cattle Farming NEC	$22,531.49	$2,315.28	$93.00	$238,491.54	30
Grain Growing	$11,231.33	$1, 171.29	$29.50	$377,457.34	580
Grain-Sheep and Grain-Beef Cattle Farming	$15,697.93	$1,554.00	$10.70	$840,324.53	3,043
Sheep-Beef Cattle Farming	$13, 155.03	$1,537.20	$14.00	$421,721.17	1,668
Sheep Farming	$17,974.99	$1,802.41	$7.14	$434, 131.95	2,396
Beef Cattle Farming	$12, 166.93	$1,342.23	$11.95	$449, 164.55	1,588
Dairy Cattle Farming	$7,596.40	$653.67	$13.87	$359,408.64	1,825
Poultry Farming (Meat)	$6,399.71	$472.25	$9.70	$362,025.24	3,659
Poultry Farming (Eggs)	$7, 192.21	$456.42	$10.27	$321, 193.99	1,038
Pig Farming	$4,079.53	$306.30	$2.60	$276,951.72	1,159
Horse Farming	$6,460.15	$637.93	$28.60	$212,398.01	520
Livestock Farming NEC	$9,992.34	$1,035.90	$16.00	$496,001.92	641
Sugar Cane Growing	$10,970.16	$893.91	$45.00	$103,821.25	82
Cotton Growing	$9,384.10	$527.66	$10.57	$379,836.93	1,191
Crop and Plant Growing NEC	$11,758.54	$1,088.90	$18.20	$258,093.88	440
Total	**$10,879.53**	**$858.28**	**$2.60**	**$840,324.53**	**23,724**

* Industries with five or less claims have been removed (Kiwi Fruit Growing, Deer Farming, Crop and Plant Growing NEC)

Of the 24,332 people working in agricultural industries who received Workers' Compensation, 81 of these were for injuries which resulted in death, three for a permanent total disability, 3,158 for permanent partial disability and 21,093 for temporary disabilities (Table 59). The deaths are examined in greater detail later in the chapter (6.4.8 Workers' Compensation reported deaths). The average ages for each injury outcome was: death (39.1 years; median 38.4 years), permanent disability (41.1 years; median 40.5 years) and temporary disability (35.9 years; medium 34.1 years).

Table 59 Outcome of injury for workers employed in Agricultural industries, 1 July 1992 to 30 June 2001

Injury Outcome	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	Total
Death	7	7	9	10	14	13	9	6	6	81
Permanent disability *	314	343	334	404	340	353	392	387	291	3,158
Temporary disability	2,053	2,009	1,958	2,189	2,168	2,696	2,948	2,931	2,141	21,093
Total	**2,374**	**2,359**	**2,301**	**2,603**	**2,522**	**3,062**	**3,349**	**3,324**	**2,438**	**24,332**

* Permanent total disability and permanent partial disability have been added together

Information on the length of time off work for temporary disability claims was provided by NSW WorkCover for 15,861 cases with the average length of time off work being 9.2 weeks ranging from zero weeks to 2,052.3 weeks (Table 60). There were, however a number of problems identified with the data in this area. Firstly, a number of claims were missing a return to work date. Secondly the time period examined has a maximum of 468 weeks, less than the number of weeks currently reported for some cases. Therefore a second analysis was undertaken excluding all cases where there was no return to work date. This reanalysis found for the 15,211 claims an average length of time off work of 8.9 weeks ranging from zero to 462.4.

The occupation of the injured worker grouped at the subdivision level (where there were more than 45 people in the subdivision), is displayed in Table 61. The 24,332 people who claimed Workers' Compensation worked 183 different occupations. The three most common occupation groupings were 'labourers and related workers' (of whom two-thirds were 'farm hands and assistants'), managers and administrators (of whom 91.3% were 'farmers and farm managers') and tradespersons (of whom 55.5% were 'shearers'). For farmers and farm managers 7.5% were females and for farmhands and assistants 17.3% were females.

Table 60 Actual time lost (Weeks) due to a compensated injury by industry, NSW Workers' Compensation, 1992/93-2000/01

Industry	Time lost (Calender weeks) WorkCover Provided					Recalculated Time Lost (Calender weeks)				
	Mean	**Median**	**Min**	**Max**	**N**	**Mean**	**Median**	**Min**	**Max**	**N**
Plant Nurseries	12.8	1.6	0.1	1,023.1	567	11.4	2.0	0.0	282.9	539
Cut Flower and Flower Seed Growing	40.2	2.6	0.1	1,037.4	35	10.6	2.7	0.4	160.4	29
Vegetable Growing	11.3	2.1	0.1	712.0	423	11.1	2.6	0.0	268.7	407
Grape Growing	8.2	1.3	0.1	623.1	517	6.2	1.7	0.0	242.9	499
Apple and Pear Growing	19.7	1.7	0.1	1,466.6	134	10.2	1.9	0.0	394.3	128
Stone Fruit Growing	6.3	1.6	0.1	112.9	105	5.7	1.8	0.1	135.1	96
Fruit Growing NEC	11.5	1.7	0.0	2,052.3	933	8.0	2.0	0.0	296.0	897
Horticulture	**11.7**	**1.7**	**0.0**	**2,052.3**	**2,717**	**8.9**	**2.0**	**0.0**	**394.3**	**2,598**
Grain, Sheep and Beef Cattle Farming NEC	3.8	2.7	0.1	13.1	19	4.0	2.9	0.1	13.4	19
Grain Growing	10.8	2.2	0.1	1,413.0	400	8.8	2.7	0.0	357.6	385
Grain-Sheep and Grain-Beef Cattle Farming	8.2	2.4	0.1	1,106.6	2,132	8.6	2.7	0.0	240.7	2,062
Sheep-Beef Cattle Farming	11.1	2.6	0.0	1,357.3	1,167	8.0	2.9	0.0	391.9	1,105
Sheep Farming	8.7	2.4	0.0	530.7	1,637	9.2	2.9	0.0	372.7	1,573
Beef Cattle Farming	10.9	2.3	0.1	975.9	1,113	8.6	2.7	0.0	329.0	1,067
Grain, Sheep and Beef Cattle Farming	**9.5**	**2.4**	**0.0**	**1,413.0**	**6,468**	**8.6**	**2.7**	**0.0**	**391.9**	**6,211**
Dairy Cattle Farming	**7.1**	**1.4**	**0.0**	**1,107.9**	**1,279**	**9.6**	**1.7**	**0.0**	**462.4**	**1,254**
Poultry Farming (Meat)	7.3	0.9	0.0	633.1	2,116	10.2	1.3	0.0	410.6	2,001
Poultry Farming (Eggs)	7.8	1.0	0.0	402.6	712	9.5	1.3	0.0	276.9	688
Poultry	**7.4**	**0.9**	**0.0**	**633.1**	**2,828**	**10.0**	**1.3**	**0.0**	**410.6**	**2,689**
Pig Farming	8.1	0.9	0.1	1,344.9	676	5.8	1.1	0.0	167.1	668
Horse Farming	9.3	1.1	0.0	638.0	342	7.8	1.7	0.0	179.3	310
Livestock Farming NEC	6.5	2.0	0.1	212.9	415	6.9	2.4	0.0	108.7	395
Other Livestock Farming	**7.9**	**1.1**	**0.0**	**1,344.9**	**1,436**	**6.6**	**1.6**	**0.0**	**179.3**	**1,376**
Sugar Cane Growing	5.1	1.3	0.1	61.4	53	6.3	1.7	0.1	67.6	52
Cotton Growing	7.6	1.1	0.1	522.9	795	8.2	1.6	0.0	318.3	770
Crop and Plant Growing NEC	17.5	2.1	0.1	1,007.9	285	11.8	2.6	0.0	208.3	261
Other Crop Farming	**10.0**	**1.4**	**0.1**	**1,007.9**	**1133**	**9.0**	**1.7**	**0.0**	**318.3**	**1,083**
Total	**9.2**	**1.7**	**0.0**	**2,052.3**	**15,861**	**8.9**	**2.0**	**0.0**	**462.4**	**15,211**

Note industries with 5 or less claims have been removed (Kiwi Fruit Growing, Deer Farming.)

Table 61 Occupations at subdivision level* of people who claimed Workers' Compensation in Agricultural industries, NSW Workers' compensation, 1992/93-2000/01

Grouped Occupation	Occupation	Number Injured	%
Managers and Administrators		**3,557**	**14.6**
	General Managers	69	0.3
	General Managers	72	0.3
	Farmers and farm managers	3,249	13.4
	Managing supervisors (other business)	55	0.2
Professionals		**132**	**0.5**
	Life Scientists	52	0.2
Para-Professionals		**162**	**0.7**
	Other Para-professional	58	0.2
Tradespersons		**3,481**	**14.3**
	Metal fitters and machinists	306	1.3
	Structural steel, boiler making and welding tradespersons	191	0.8
	Electrical mechanics	52	0.2
	Carpenters and joiners	45	0.2
	Vehicle mechanics	221	0.9
	Meat tradespersons	97	0.4
	Nurserymen/women	131	0.5
	Gardeners	166	0.7
	Sheep shearers	1,932	7.9
	Animal trainers	89	0.4
Clerks		**140**	**0.6**
Salespersons and Personal Service Workers		**174**	**0.7**
	Sales assistants	72	0.3
Plant and Machine Operators, and Drivers		**1,565**	**6.4**
	Truck drivers	559	2.3
	Excavating and earthmoving plant operators	75	0.3
	Forklift and related drivers	85	0.3
	Agricultural plant operator	273	1.1
	Yarn production machine operators	172	0.7
	Food processing machine operators	190	0.8
Labourers and Related Workers		**15,121**	**62.1**
	Trade assistants	45	0.2
	Assemblers	229	0.9
	Hand Packers	272	1.1
	Other trades assistants and factory hands	2,854	11.7
	Farm hands and assistants	10,051	41.3
	Nursery and garden labourers and related workers	280	1.2
	Cleaners	169	0.7
	Other construction and mining labourers	65	0.3
	Storemen/women	204	0.8
	Other labourers and related workers	693	2.8
Total		**24,332**	**100.0**

* Where there were more than 45 claims

The three most common grouped body locations were ‘upper limbs’, ‘trunk’ and ‘lower limbs’. These accounted for 81.3% of all of the Workers’ Compensation claims in agricultural industries. The four most common nature of injury/disease categories were ‘sprains and strains of joints and adjacent muscles’, ‘open wound not involving traumatic amputation’, ‘contusion with intact skin surface and crushing injury excluding those with fractures’, and ‘fractures’. These accounted for 79.8% of the Workers’ Compensation claims in agricultural industries. (Table 62)

The three most common mechanisms of injury were being hit by moving object (28.0%), body stressing (27.6%) and falls, trips and slips of a person (18.6%). The three most common grouped agencies were non-powered hand tools, appliances and equipment (19.7%), animal, human and biological agencies (19.5%) and environmental agencies (14.4%) (Table 63).

Table 62 Grouped nature of injury/disease by grouped bodily location, NSW Workers' Compensation claims, 1992/93-2000/01

Nature of Injury/Disease	Head	Neck	Trunk	Upper Limbs	Lower Limbs	Multiple Locations	Systemic locations	Non-physical locations	Unspecified Locations	Total	%
Fractures	103	1	316	1,057	777	75	0	0	0	2,329	9.6
Fracture of vertebral column	0	7	71	0	0	3	0	0	0	81	0.3
Dislocation	0	0	9	136	55	0	0	0	0	200	0.8
Sprains and strains of joints and adjacent muscles	2	371	4,468	2,427	2,483	451	0	0	0	10,202	41.9
Intracranial injury, including concussion	134	0	0	0	0	1	0	0	0	135	0.6
Internal injury of chest, abdomen and pelvis	0	0	34	0	0	0	0	0	0	34	0.1
Traumatic amputation, including enucleation of eye	4	0	0	115	4	0	0	0	0	123	0.5
Open wound not involving traumatic amputation	694	7	49	2,518	764	74	0	0	0	4,106	16.9
Superficial injury	139	2	19	228	127	30	0	0	0	545	2.2
Contusion with intact skin surface and crushing injury excluding those with fractures	164	10	421	1032	954	192	0	0	0	2,773	11.4
Foreign body on external eye, in ear or nose or in respiratory, digestive or reproductive systems	886	1	2	1	1	0	1	0	0	892	3.7
Burns	145	2	18	126	103	63	0	0	0	457	1.9
Injuries to nerves and spinal cord without evidence of spinal bone injury	0	0	5	1	1	0	0	0	0	7	0.0
Poisoning and toxic effects of substances	43	5	25	104	58	30	44	0	0	309	1.3
Effects of weather, exposure, air pressure and other external cause NEC	10	0	0	9	0	7	11	0	2	39	0.2
Multiple injuries	5	0	6	4	1	117	0	0	10	143	0.6
Damage to artificial aid(s)	1	0	0	0	1	0	0	0	47	49	0.2
Other and unspecified injuries	30	0	16	30	30	16	1	2	15	140	0.6
Diseases of the nervous system and sense organs	277	2	6	77	2	2	1	0	0	367	1.5
Diseases of the musculoskeletal system and connective tissue	0	9	106	437	36	25	0	0	0	613	2.5
Diseases of skin and subcutaneous tissue	5	2	13	116	36	32	0	0	0	204	0.8
Diseases of the digestive system	0	0	256	0	0	0	1	0	0	257	1.1
Infectious and parasitic diseases	2	0	4	16	2	7	95	0	0	126	0.5
Diseases of the respiratory system	3	1	18	0	0	0	43	0	0	65	0.3
Disease of the circulatory system	1	0	22	0	4	0	5	0	0	32	0.1
Neoplasms	6	1	0	2	0	0	0	0	0	9	0.0
Mental disorders	0	0	0	0	0	0	0	65	0	65	0.3
Other diseases	9	1	2	3	2	6	5	0	1	29	0.1
Total	**2,663**	**422**	**5,886**	**8,439**	**5,441**	**1,131**	**207**	**67**	**75**	**24,331**	**100.0**

Table 63 Grouped mechanism of injury/disease by grouped agency, NSW Workers' Compensation claims, 1992/93-2000/01

Mechanism	Machinery and (Mainly) Fixed Plant	Mobile Plant and Transport	Powered equipment, tools and appliances	Non-Powered Hand tools, appliances and equipment	Chemicals and Chemical Product	Materials and substances	Environmental agencies	Animal, human and biological agencies	Other and unspecified agencies	Total	%
Fall, trips and slips of a person	113	715	17	625	3	214	2,179	495	161	4,522	18.6
Hitting objects with a part of the body	427	259	157	1,144	3	502	340	128	93	3,053	12.5
Being hit by moving objects	762	764	274	1,158	39	1,255	393	2,081	97	6,823	28.0
Sound and pressure	39	20	4	1	0	0	103	0	1	168	0.7
Body stressing	527	466	135	1,829	38	687	362	1,552	1,114	6,710	27.6
Heat, radiation and electricity	67	19	112	1	4	154	25	0	5	387	1.6
Chemical and other substances	3	1	9	3	378	46	9	235	6	690	2.8
Biological factors	0	0	0	2	1	8	4	163	4	182	0.7
Mental Stress	0	1	0	0	0	0	0	7	59	67	0.3
Other and unspecified mechanisms of injury	21	1,156	6	22	22	15	83	76	329	1,730	7.1
Total	**1,959**	**3,401**	**714**	**4,785**	**488**	**2,881**	**3,498**	**4,737**	**1,869**	**24,332**	**100.0**
%	**8.1**	**14.0**	**2.9**	**19.7**	**2.0**	**11.8**	**14.4**	**19.5**	**7.7**	**100.0**	

There were over 250 individual agents identified as being involved in Workers' Compensation claims in Agricultural industries. The ten most common agents were sheep, goats (5.3%), ferrous and non-ferrous metals (5.0%), crates, cartons, boxes, etc (4.5%), horses, donkeys, mules (3.5%), cows, steers, cattle, bulls, buffalo (3.5%) sheep shearing plant (2.5%), vegetation (2.5%), cars, station wagons, vans utilities (2.3%), motorcycles and sidecars, scooters, trail bikes (3.2%) knives and cutlery (2.1%), and tractors, agricultural or otherwise (2.1%). (Table 64)

Table 64 Grouped agencies by agent of injury*, NSW Workers' Compensation claims, 1992/93-2000/01

Agent	N	%
Forklift trucks	114	0.5
Other conveyors and lifting plant	129	0.5
Sheep shearing plant	610	2.5
Other and unspecified production line type of plant or stand	189	0.8
Total machinery and (mainly) fixed plant	**1,959**	8.1
Tractors, agricultural or otherwise	499	2.1
Trolleys, handcarts	295	1.2
Trailers, caravans	157	0.6
Trucks, semi-trailers, lorries	399	1.6
Cars, station wagons, vans, utilities	559	2.3
Motorcycles and sidecars, scooters, trail bikes	790	3.2
Total mobile plant and transport	**3,401**	14.0
Abrasive, planing, cutting powered tools	145	0.6
Total powered equipment, tools and appliances	**714**	2.9
Knives and cutlery	512	2.1
Scissors	208	0.9
Hammers, mallets	136	0.6
Manual lifting equipment	121	0.5
Wire, wire rope, metal strapping	194	0.8
Crates, cartons, boxes, cases, drums, kegs, barrels	1,100	4.5
Pallets	191	0.8
Bags, bundles and bales	297	1.2
Doors and windows	152	0.6
Ladders, mobile ramps and stairways	435	1.8
Vehicle wheels and tyres	106	0.4
Other equipment	206	0.8
Total non-Powered Hand tools, appliances and equipment	**4,785**	19.7
Other basic and unspecified chemicals	139	0.6
Total chemicals and Chemical Product	**488**	2.0
Rocks, stones, boulders	135	0.6
Bricks and tiles and concrete, cement and clay products, NEC	100	0.4
Dust, not elsewhere classified	182	0.7
Sawn or dressed timber	373	1.5
Ferrous and non-ferrous metal	1,206	5.0
Fragments	174	0.7
Other materials and objects	169	0.7
Food and beverages	128	0.5
Total materials and substances	**2,881**	11.8

Agent	N	%
Holes in the ground	254	1.0
Wet, oily or icy traffic and ground surfaces	293	1.2
Traffic and ground surfaces with hazardous objects	268	1.1
Traffic and ground surfaces other	440	1.8
Fencing	492	2.0
Vegetation	607	2.5
Steps and stairways	182	0.7
Wet, oily or icy other internal traffic and ground areas	259	1.1
Other internal traffic and ground areas	121	0.5
Internal conditions	111	0.5
Total environmental agencies	**3,498**	14.4
Horses, donkeys, mules	858	3.5
Cows, steers, cattle, bulls, buffalo	855	3.5
Sheep, goats	1,294	5.3
Pigs	293	1.2
Insects	125	0.5
Poultry	495	2.0
Carcass	131	0.5
Other animal part or product	154	0.6
Total animal, human and biological agencies	**4,737**	19.5
Non-physical agencies	123	0.5
Other agencies, not elsewhere classified	237	1.0
Agency not apparent	1,089	4.5
Agency not known	420	1.7
Total other and unspecified agencies	**1,869**	7.7
Total	**24,332**	**100.0**

* Where there were more than 100 claims

The number of claims still awaiting closure increased as the date of injury came closer to the final date of information available for claims (30 June 2001). The average cost of a claim was higher for those claims not closed ($55,367.59) than the average cost of closed claims ($7,612.93). (Table 65)

Table 65 Status of claim (closed or not) by financial year, by number of claims and mean cost of claims, NSW Workers' Compensation, 1992/93-2000/01

Financial Year	No			Yes			Total	
	N	%	Aver cost of claim	N	%	Aver cost of claim	N	Mean
1992/93	37	1.6	$131,665.19	2,273	98.4	$10,215.28	2,310	$12,160.59
1993/94	56	2.4	$110,354.36	2,232	97.6	$9,696.85	2,288	$12,160.50
1994/95	57	2.5	$136,708.22	2,180	97.5	$10,875.65	2,237	$14,081.94
1995/96	94	3.7	$116,158.07	2,426	96.3	$11,258.16	2,520	$15,171.09
1996/97	106	4.3	$83,146.57	2,345	95.7	$9,232.33	2,451	$12,428.94
1997/98	158	5.3	$63,075.20	2,826	94.7	$7,692.34	2,984	$10,624.82
1998/99	294	9.0	$51,803.50	2,979	91.0	$5,072.76	3,273	$9,270.39
1999/00	384	11.8	$42,129.75	2,867	88.2	$3,249.74	3,251	$7,842.15
2000/01	437	18.3	$22,680.63	1,957	81.7	$2,263.88	2,394	$5,990.75
Total	**1,623**	**6.8**	**$55,367.59**	**22,085**	**93.2**	**$7,612.93**	**23,708**	**$10,882.11**

The rate per 1,000 workers per quarter by gender and full-time/part-time is displayed in Figure 29. Part-time males had the highest incidence rate of injury/disease. The injury/disease rate difference for part-time males was even greater when examined by number of hours worked (Figure 30).

Figure 29 Incidence of injury / disease by 1,000 workers by quarter by gender and employed full-time/part-time, agriculture, NSW Workers' Compensation claims, 1 July 1992 to 30 June 2001

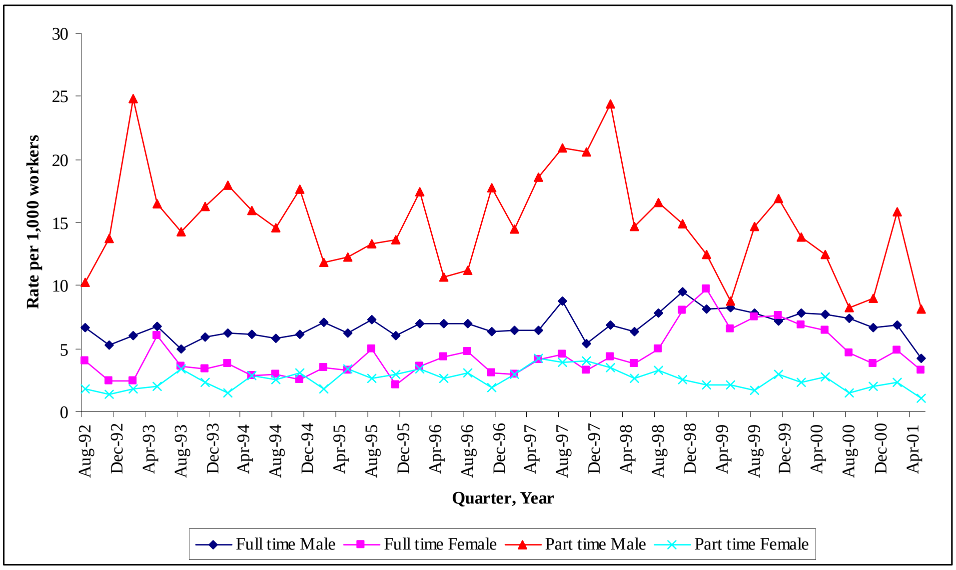
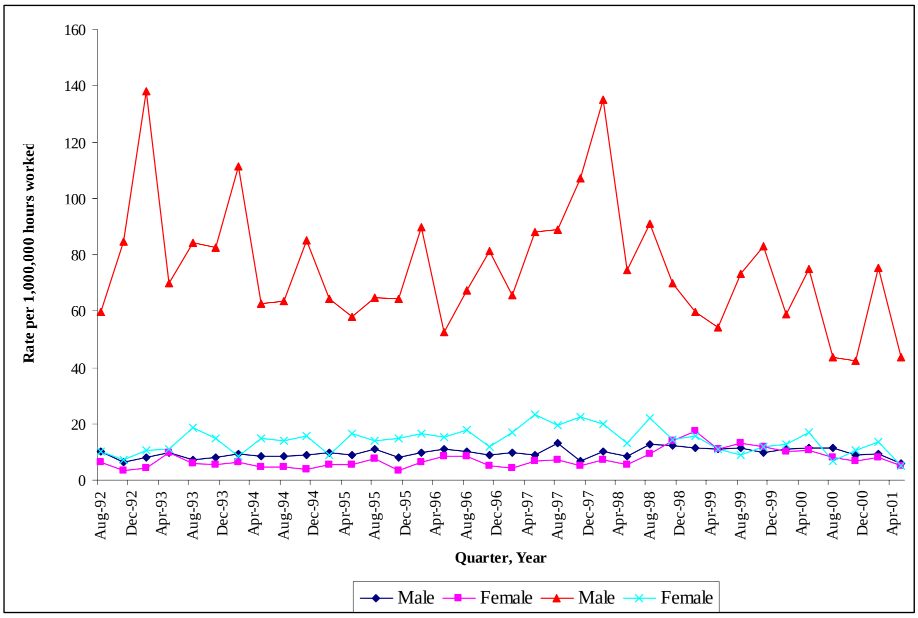


Figure 30 Frequency of injury / disease per 1,000,000 hours worked by quarter by gender and employed full-time/part-time, agriculture, NSW Workers' Compensation claims, 1 July 1992 to 30 June 2001



6.4.2 Horticulture

There were 3,947 Workers' Compensation claims in horticultural industries in NSW over the period 1 July 1992 to 30 June 2001, averaging 439 compensation claims per annum. The industries in this grouping include plant nurseries, cut flowers and flower seed growing, vegetable growing, grape growing, apple and pear growing, stone fruit growing, kiwi fruit growing and fruit growing NEC. The average compensation claim for horticulture was $10,946, ranging from $5,573 for stone fruit growing to $14,166 for cut flowers and flower seed growing (Table 58). The average amount of time-off work in weeks was 11.7 (median 1.7) for WorkCover information and 8.9 (Median 2.0) from the recalculated time lost information (Table 60).

The average age of people seeking Workers' Compensation in horticulture industries was 36.3 years (Median = 35.3 years, range 15.2 to 86.8 years). More than half (51.1%) of the injuries occurred to people aged 25-44 yrs. The three most common age groups in horticulture industries were 25-34 yrs (26.4%), 35-44 yrs (24.7%) and 45-54 yrs (17.8%). The majority (74.9%) of people claiming Workers' Compensation in horticulture industries were males.

The numbers of compensated claims by month of injury event varied from eight to 80 per month. March (9.5%), February (9.4%) and November (9.1%) were the months with the highest number of people injured. April had the lowest number of people injured (Table 66).

The incidence of injury / disease in horticultural industries is displayed in Figure 31 and ranges from 4.4 per 1,000 workers in the November 1992 quarter, to 22.5 per 1,000 workers in the August 1997 quarter. Figure 32 displays the annual incidence of injury / disease in horticultural industries. The financial year 1992/93 had the lowest rate (22.1 per 1,000 workers) and the 1997/98 financial year had the highest rate (71.0 per 1,000 workers). The large rates in the February 1994 quarter are due to the low number of estimated female workers in the industry.

Table 66 Month by financial year, NSW Workers' Compensation claims, Horticulture Industries, 1 July 1992 to 30 June 2001

Month of injury	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	Total	%
July	18	19	18	26	34	65	45	52	50	327	8.3
August	25	30	19	39	33	39	39	44	36	304	7.7
September	14	20	29	29	39	49	44	43	43	310	7.9
October	16	51	18	35	41	30	47	55	40	333	8.4
November	19	28	31	30	42	51	56	65	37	359	9.1
December	18	24	15	24	33	63	63	43	37	320	8.1
January	23	24	25	39	41	50	54	44	49	349	8.8
February	21	22	19	51	28	64	50	68	47	370	9.4
March	28	23	38	34	36	80	53	42	42	376	9.5
April	25	28	14	37	27	37	32	45	28	273	6.9
May	31	40	23	26	38	44	44	45	34	325	8.2
June	27	16	32	24	53	51	47	43	8	301	7.6
Total	**265**	**325**	**281**	**394**	**445**	**623**	**574**	**589**	**451**	**3,947**	**100.0**

Figure 31 Incidence of injury / disease by quarter, horticulture, NSW Workers' Compensation claims, 1 July 1992 to 30 June 2001

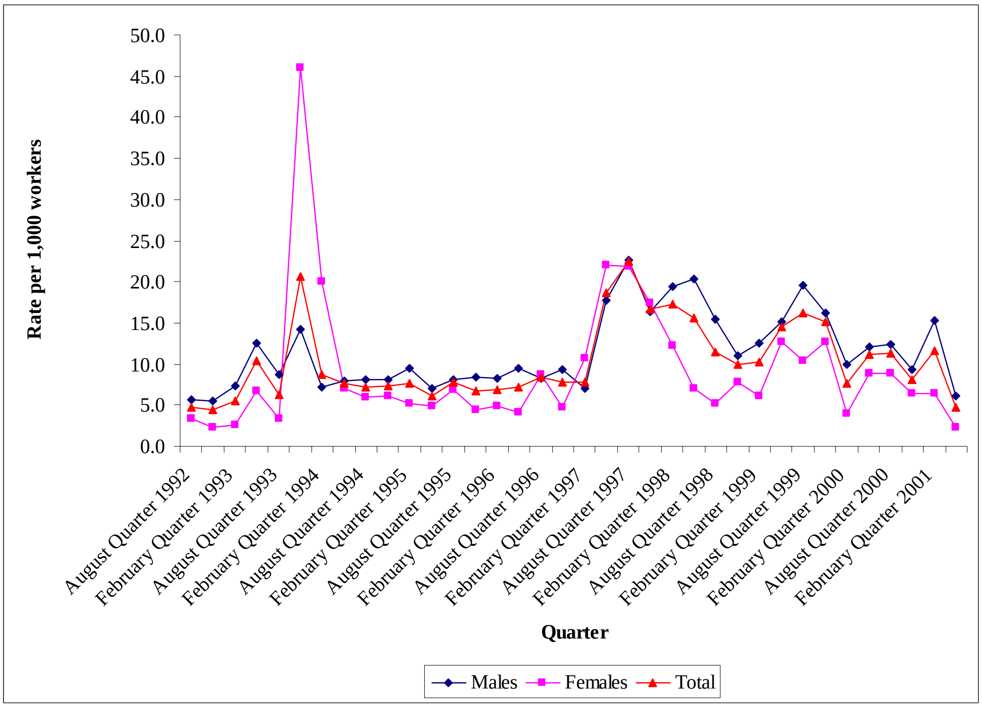
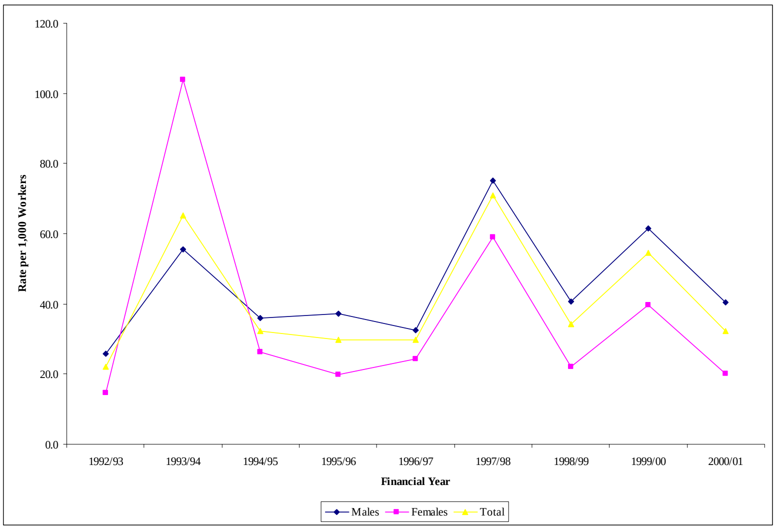


Figure 32 Incidence of injury / disease by financial year, horticultural industries, NSW Workers' Compensation claims, 1 July 1992 to 30 June 2001



In horticulture industries, the largest numbers of claims were made due to injuries from non-powered hand tools, appliances and equipment (27.5%), environmental agencies (22.0%), mobile plant and transport (13.6%), and materials and substances (12.2%) (Table 67).

Table 67 Agency of Injury by financial year, NSW Workers' Compensation claims, Horticulture Industries, 1 July 1992 to 30 June 2001

Agency	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	Total	%
Machinery and (Mainly) Fixed Plant	17	11	9	25	24	37	31	40	26	220	5.6
Mobile Plant and Transport	36	39	33	58	81	88	80	59	63	537	13.6
Powered equipment, tools and appliances	13	11	10	5	13	16	12	22	11	113	2.9
Non-Powered Hand tools, appliances and equipment	85	110	78	102	113	155	141	166	132	1,082	27.4
Chemicals and Chemical Product	3	25	9	10	12	17	11	10	7	104	2.6
Materials and substances	27	32	37	54	46	80	77	71	59	483	12.2
Environmental agencies	68	77	76	91	91	149	121	117	78	868	22.0
Animal, human and biological agencies	4	5	10	21	18	31	40	26	20	175	4.4
Other and unspecified agencies	12	15	19	28	47	50	61	78	55	365	9.2
Total	**265**	**325**	**281**	**394**	**445**	**623**	**574**	**589**	**451**	**3,947**	**100.0**

The most common mechanisms of injury in horticulture industries were body stressing (29.3%), falls, trips and slips (23.1%), being hit by moving objects (21.6%), and hitting objects with a part of the body (13.9%) (Table 68).

Table 68 Mechanism of Injury by financial year, NSW Workers' Compensation claims, Horticulture Industries, 1 July 1992 to 30 June 2001

Mechanism	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	Total	%
Falls, trips and slips of a person	70	77	57	84	82	164	135	139	104	912	23.1
Hitting objects with a part of the body	45	39	38	44	51	80	73	93	85	548	13.9
Being hit by moving objects	56	66	57	95	113	134	122	116	92	851	21.6
Sound and pressure	0	3	0	3	4	4	0	1	0	15	0.4
Body Stressing	68	94	97	115	147	158	172	187	119	1,157	29.3
Heat, radiation and electricity	4	3	4	6	3	6	5	4	1	36	0.9
Chemicals and other substances	6	25	12	20	18	35	37	20	11	184	4.7
Biological factors	0	0	2	2	0	0	1	0	2	7	0.2
Mental stress	0	0	0	0	4	2	3	7	1	17	0.4
Other and unspecified mechanism	16	18	14	25	23	41	26	22	36	221	5.6
Total	**265**	**325**	**281**	**394**	**445**	**623**	**574**	**589**	**451**	**3,947**	**100.0**

6.4.3 Grain, Sheep and Beef Cattle Farming

In the grain, sheep and beef cattle farming industries in NSW there were 9,619 Workers' Compensation claims over the period 1 July 1992 to 30 June 2001, averaging 1,069 claims per annum. The industries in this grouping include grain growing, combined grain growing-sheep farming-beef cattle farming, sheep-beef cattle farming, sheep farming, beef cattle farming and beef cattle feedlots. The average compensation claim was $14,977, ranging from $11,213 for grain growing to $22,531 for grain, sheep and beef cattle farming NEC (Table 58). The average amount of time off work in weeks was 9.5 (median 2.4) for WorkCover information and 8.6 (Median 2.7) from the recalculated time-lost information (Table 60).

The average age of people seeking Workers' Compensation in grain, sheep and beef cattle farming was 38.2 years (Median = 36.6 years, range 15.2 to 81.3 years). These people were most commonly aged 25-34 yrs (26.4%), 35-44 yrs (22.9%), and 45-54 yrs (18.2%). In grain, sheep and beef cattle farming industries, the vast majority of the claims (94.4%) were from males.

The number of Workers' Compensation claims by month of injury varied from 25 to 119 per month in the grain, sheep and beef cattle farming industries. October (9.6%), March (9.3%), November (9.2%), and January (9.1%) were the months when the largest numbers of injuries were sustained, whereas June (6.9%) had the smallest number (Table 69).

The incidence of injury / disease in Grain, Sheep and Beef Cattle Farming Industries is displayed in Figure 33 and ranged from 5.9 per 1,000 workers in the May 2001 quarter (this is probably an under representation due to late claims not being included in this quarter), to 16.2 per 1,000 workers in the November 1998 quarter. Figure 34 displays the annual incidence of injury / disease in Grain, Sheep and Beef Cattle Farming Industries. The financial year 1997/98 had the lowest rate (25.6 per 1,000 workers) and the 1998/99 financial years had the highest rate (53.8 per 1,000 workers).

Table 69 Month of Injury by financial year, NSW Workers' Compensation claims in Grain, Sheep and Beef Cattle Farming Industries, 1 July 1992 to 30 June 2001

Month of Injury	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	Total	%
July	80	67	107	102	75	92	90	92	68	773	8.0
August	114	97	88	102	67	88	77	85	93	811	8.4
September	119	70	75	81	86	76	85	79	80	751	7.8
October	97	95	97	98	85	90	128	114	118	922	9.6
November	97	113	115	97	89	85	112	101	73	882	9.2
December	81	113	93	82	68	68	103	85	71	764	7.9
January	110	124	88	85	84	82	86	99	116	874	9.1
February	107	87	109	110	86	73	72	99	90	833	8.7
March	108	92	97	103	87	111	117	95	85	895	9.3
April	75	92	83	62	79	67	88	84	82	712	7.4
May	78	90	72	99	69	59	96	97	81	741	7.7
June	83	73	81	72	75	92	83	77	25	661	6.9
Total	**1,149**	**1,113**	**1,105**	**1093**	**950**	**983**	**1,137**	**1,107**	**982**	**9,619**	**100.0**

Figure 33 Incidence of injury / disease by quarter, Grain, Sheep and Beef Cattle Farming Industries, NSW Workers' Compensation claims, 1 July 1992 to 30 June 2001

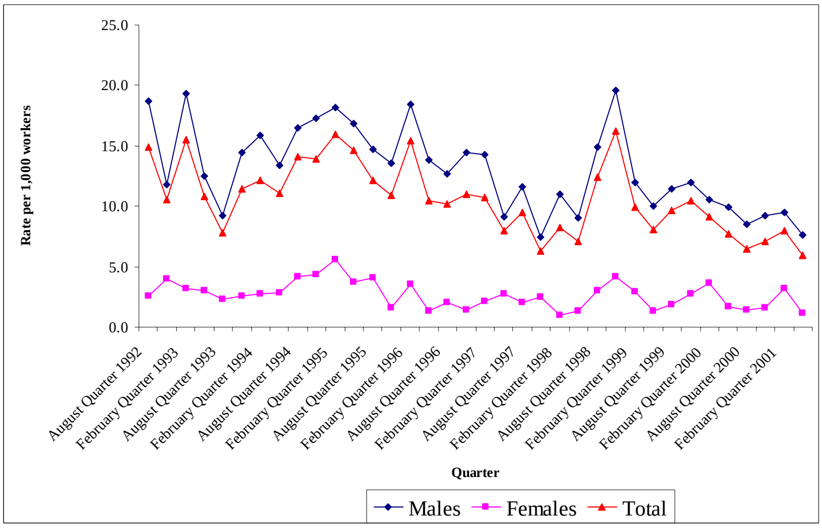
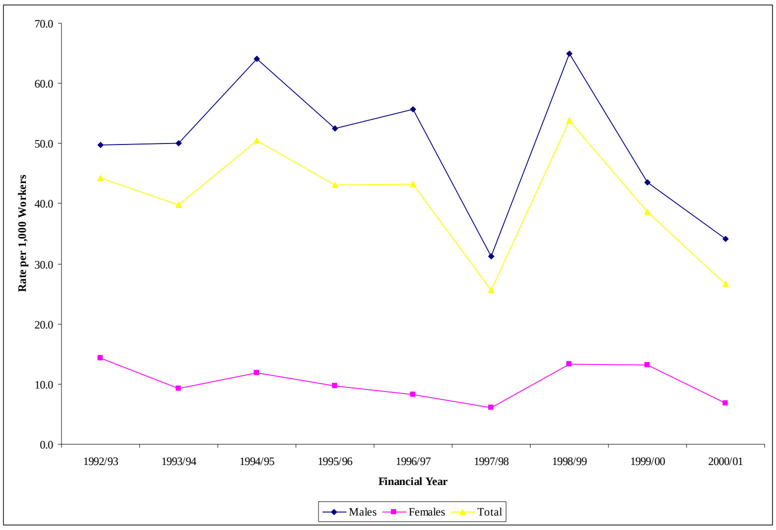


Figure 34 Incidence of injury / disease by financial year, Grain, Sheep and Beef Cattle Farming Industries, NSW Workers' Compensation claims, 1 July 1992 to 30 June 2001



In the grain, sheep and beef cattle farming industry, animal, human and biological agencies (26.0%) was the most common agency group followed by mobile plant and transport (16.2%), and environmental agencies (12.9%) (Table 70).

Table 70 Agency of Injury by financial year, NSW Workers' Compensation claims in Grain, Sheep and Beef Cattle Farming Industries, 1 July 1992 to 30 June 2001

Agency	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	Total	%
Machinery and (Mainly) Fixed Plant	132	161	125	117	103	83	110	97	84	1,012	10.5
Mobile Plant and Transport	168	169	189	165	171	179	185	195	141	1,562	16.2
Powered equipment, tools and appliances	30	29	42	32	28	27	36	26	28	278	2.9
Non-Powered Hand tools, appliances and equipment	159	141	128	128	120	116	146	145	139	1,222	12.7
Chemicals and Chemical Product	13	11	11	13	9	11	22	11	13	114	1.2
Materials and substances	115	106	112	117	99	100	129	98	126	1,002	10.4
Environmental agencies	130	146	167	154	123	129	135	135	120	1,239	12.9
Animal, human and biological agencies	334	297	248	296	245	257	279	293	252	2,501	26.0
Other and unspecified agencies	68	53	83	71	52	81	95	107	79	689	7.2
Total	**1,149**	**1,113**	**1,105**	**1,093**	**950**	**983**	**1,137**	**1,107**	**982**	**9,619**	**100.0**

Being hit by moving objects (30.3%) and *body stressing* (24.6%) were the most common mechanisms of injury for people claiming Workers' Compensation in the grain, sheep and beef cattle farming industries (Table 71).

Table 71 Mechanism of Injury by financial year, NSW Workers' Compensation claims in Grain, Sheep and Beef Cattle Farming Industries, 1 July 1992 to 30 June 2001

Mechanism	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	Total	%
Falls, trips and slips of a person	191	196	202	179	164	175	194	199	194	1,694	17.6
Hitting objects with a part of the body	141	127	127	134	128	130	141	148	138	1,214	12.6
Being hit by moving objects	357	335	310	328	295	286	362	336	304	2,913	30.3
Sound and pressure	6	10	3	17	6	9	8	8	5	72	0.7
Body Stressing	291	286	297	287	228	246	260	265	206	2,366	24.6
Heat, radiation and electricity	18	21	18	16	6	12	21	12	18	142	1.5
Chemicals and other substances	19	16	18	16	16	12	12	24	16	149	1.5
Biological factors	23	28	20	11	10	9	10	4	6	121	1.3
Mental stress	0	0	4	1	1	2	3	4	2	17	0.2
Other and unspecified mechanism	103	94	106	104	96	102	126	107	93	931	9.7
Total	**1,149**	**1,113**	**1,105**	**1,093**	**950**	**983**	**1,137**	**1,107**	**982**	**9,619**	**100.0**

6.4.4 Dairy Cattle

In the dairy cattle farming industry in NSW there were 1,853 Workers' Compensation claims over the period 1 July 1992 to 30 June 2001, averaging 206 compensation claims per annum. The average compensation claim was $7,596 (Table 58) and the average amount of time off work in weeks was 7.1 (median 1.4) for WorkCover information and 9.6 (Median 1.7) from the recalculated time-lost information (Table 60).

The average age of people seeking Workers' Compensation in the dairy cattle farming industry was 36.4 years (Median = 34.6 years, range 15.2 to 76.2 years). Over one quarter (28.5%) of Workers' Compensation injury claims were from the 25-34 yrs age group. Other age groups commonly claiming Workers' Compensation were 35-44 yr (23.7%) and 45-54 yrs (16.5%) in the dairy cattle industry. More than half (52.2%) of the Workers' Compensation claims in the dairy industry were from people aged 25-44 yrs (52.2%). Only 8.9% of Workers' Compensation injury claims in the dairy industry were made by people aged over 55 years. Of the 1,853 Workers' Compensation claims made in the dairy cattle industry 86.1% were males.

The number of Workers' Compensation injury claims by month of injury incident in the dairy industry varied from four to 33 per month. The months with the highest numbers of people injured were March (9.6%), September (9.1%) and February (9.1%) and the month with the lowest number was April (6.6%) (Table 72).

The incidence of injury / disease in dairy is displayed in Figure 35 and ranges from 6.4 per 1,000 workers in the May 1999 quarter, to 86.0 per 1,000 workers in the November 1994 quarter (it should be noted that due to small number of females being employed in the dairy industry there are a number of quarters where the ABS employment figures registered zero employees thus less than 50 females were employed and as such a rate could not be calculated). Figure 36 displays the annual incidence of injury / disease in dairy. The financial year 1998/99 has the lowest rate (36.0 per 1,000 workers) and the 1994/95 financial years had the highest rate (244.0 per 1,000 workers).

Table 72 Month of Injury by financial year, NSW Workers' Compensation claims in Dairy Cattle Farming Industries, 1 July 1992 to 30 June 2001

Month of injury	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	Total	%
July	17	22	23	9	17	12	10	6	12	128	6.9
August	26	17	23	14	20	14	10	17	16	157	8.5
September	22	28	21	23	28	8	12	16	11	169	9.1
October	24	19	28	22	20	11	10	11	6	151	8.1
November	24	22	27	20	15	12	12	16	9	157	8.5
December	23	32	31	23	23	7	10	9	5	163	8.8
January	22	15	25	29	21	11	10	10	13	156	8.4
February	27	30	23	27	14	8	16	14	10	169	9.1
March	25	27	32	28	24	14	11	11	6	178	9.6
April	19	16	14	17	16	14	6	9	12	123	6.6
May	20	26	19	33	17	12	10	14	12	163	8.8
June	22	16	22	26	15	13	9	12	4	139	7.5
Total	**271**	**270**	**288**	**271**	**230**	**136**	**126**	**145**	**116**	**1,853**	**100.0**

Figure 35 Incidence of injury / disease by quarter, dairy, NSW Workers' Compensation claims, 1 July 1992 to 30 June 2001

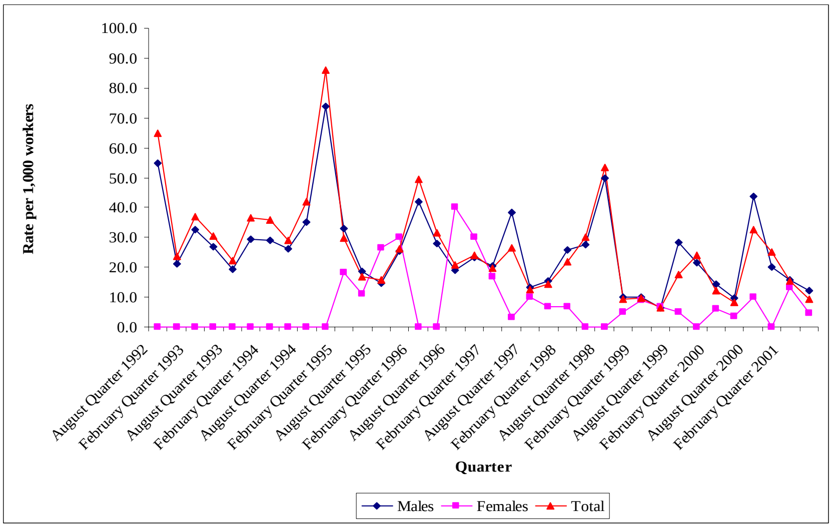
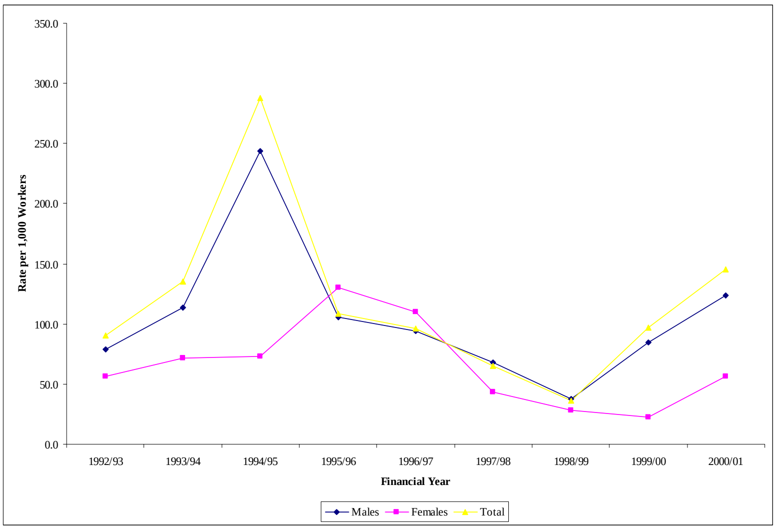


Figure 36 Incidence of injury / disease by financial year, dairy, NSW Workers' Compensation claims, 1 July 1992 to 30 June 2001



In the dairy cattle industry, the largest number of Workers' Compensation claims were from incidents involving non-powered hand tools, appliances and equipment (22.3%), followed by animal, human and biological agencies (17.7%), materials and substances (15.5%), environmental agencies (13.6%) and mobile plant and transport (13.1%) (Table 73).

Table 73 Agency of Injury by financial year, NSW Workers' Compensation claims in Dairy Cattle Farming Industries, 1 July 1992 to 30 June 2001

Agency	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	Total	%
Machinery and (Mainly) Fixed Plant	27	28	20	14	18	5	3	5	5	125	6.7
Mobile Plant and Transport	33	34	28	21	33	23	18	26	26	242	13.1
Powered equipment, tools and appliances	8	4	11	11	4	2	3	4	2	49	2.6
Non-Powered Hand tools, appliances and equipment	64	67	87	76	60	21	14	16	8	413	22.3
Chemicals and Chemical Product	13	12	15	10	7	3	1	2	4	67	3.6
Materials and substances	49	51	45	42	43	16	21	11	10	288	15.5
Environmental agencies	36	33	38	42	32	18	18	24	11	252	13.6
Animal, human and biological agencies	35	35	32	45	22	36	40	47	36	328	17.7
Other and unspecified agencies	6	6	12	10	11	12	8	10	14	89	4.8
Total	**271**	**270**	**288**	**271**	**230**	**136**	**126**	**145**	**116**	**1,853**	**100.0**

For Workers' Compensation claims in the dairy cattle industry the common mechanisms of injury were being hit by moving objects (31.9%), body stressing (24.9%), and falls, trips and slips (18.0%) (Table 74).

Table 74 Mechanism of Injury by financial year, NSW Workers' Compensation claims in Dairy Cattle Farming Industries, 1 July 1992 to 30 June 2001

Mechanism	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	Total	%
Falls, trips and slips of a person	64	48	48	49	43	21	20	21	19	333	18.0
Hitting objects with a part of the body	13	18	24	27	23	12	15	11	9	152	8.2
Being hit by moving objects	77	93	83	84	64	51	46	54	40	592	31.9
Sound and pressure	3	2	4	1	4	1	0	0	1	16	0.9
Body Stressing	70	66	83	78	55	26	28	33	23	462	24.9
Heat, radiation and electricity	12	9	8	8	8	3	4	3	1	56	3.0
Chemicals and other substances	14	14	16	13	7	3	1	1	5	74	4.0
Biological factors	3	1	2	1	0	2	2	2	1	14	0.8
Mental stress	1	2	2	0	1	0	0	1	1	8	0.4
Other and unspecified mechanism	14	17	18	10	25	17	10	19	16	146	7.9
Total	**271**	**270**	**288**	**271**	**230**	**136**	**126**	**145**	**116**	**1,853**	**100.0**

6.4.5 Poultry Farming

In the poultry farming industries in NSW, there were 4,795 Workers' Compensation claims over the period 1 July 1992 to 30 June 2001, averaging 533 compensation claims per annum. The industries in this grouping include poultry farming (meat) and poultry farming (eggs). The average compensation claims were $6,400 for poultry farming (meat) and $7,192.21 for poultry farming (eggs) (Table 58). The average amount of time off work in weeks was 7.4 (median 0.9) for WorkCover information and 10.0 (Median 1.3) from the recalculated time-lost information (Table 60).

The average age of people seeking Workers' Compensation in poultry farming was 34.8 years (Median = 33.2 years, range 15.7 to 70.4 years). The Workers' Compensation injury claims were the largest in 20-24 (17.4%), and 25-29 (17.0%) years accounting for one third (34.3%) of the total injury in poultry farming industries. More than half (55.3%) of these industries injury occurred to 25-44 yrs persons. In the poultry farming industries of NSW, 61.7% of Workers' Compensation claims were made by male workers and 38.3% of claims were made by female workers.

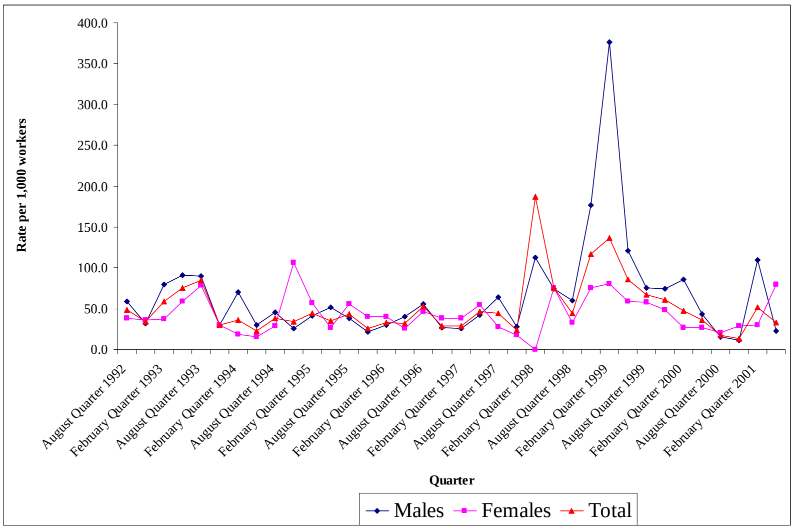
The number of Workers' Compensation claims by month of injury in the poultry farming industries of NSW varied from 17 to 83 per month. On average more people were injured in the month of July (10.2%) and the lowest numbers were in the month of April (7.3%) (Table 75).

Table 75 Month of Injury by financial year, NSW Workers' Compensation claims in Poultry Farming Industries, 1 July 1992 to 30 June 2001

Month of injury	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	Total	%
July	38	72	51	40	47	50	79	69	41	487	10.2
August	24	57	37	41	51	50	69	63	35	427	8.9
September	35	40	38	45	38	55	57	62	17	387	8.1
October	33	34	38	35	44	43	65	52	20	364	7.6
November	29	33	24	40	37	45	69	67	24	368	7.7
December	39	23	39	37	30	43	65	69	18	363	7.6
January	32	33	35	47	37	54	71	57	23	389	8.1
February	40	37	34	38	33	50	83	67	22	404	8.4
March	45	37	43	46	41	46	64	67	32	421	8.8
April	50	29	36	25	43	43	51	52	22	351	7.3
May	50	21	38	45	29	48	64	83	35	413	8.6
June	50	40	29	47	49	44	82	62	18	421	8.8
Total	**465**	**456**	**442**	**486**	**479**	**571**	**819**	**770**	**307**	**4,795**	**100.0**

The incidence of injury / disease in poultry industries is displayed in Figure 37 and ranges from 17.1 per 1,000 workers in the August 2000 quarter, to 187.5 per 1,000 workers in the February 1998 quarter (it should be noted that due to small number of females employed in poultry industries for the February quarter of 1998, the ABS employment figures registered zero employees thus less than 50 females were employed and as such a rate could not be calculated). Figure 38 displays the annual incidence of injury / disease in poultry industries. The financial year 2000/01 has the lowest rate (68.4 per 1,000 workers) and the 1998/99 financial years has the highest rate (481.8 per 1,000 workers).

Figure 37 Incidence of injury / disease by quarter, poultry, NSW Workers' Compensation claims, 1 July 1992 to 30 June 2001



The largest number of Workers' Compensation claims in the poultry farming industries of NSW was from contact with non-powered hand tools, appliances and equipment (28.3%). The other common agencies were animal, human and biological agencies (17.7%), environmental agencies (12.1%), materials and substances (10.9%) and mobile plant and transport (9.8%) (Table 76).

Figure 38 Incidence of injury / disease by financial year, poultry, NSW Workers' Compensation claims, 1 July 1992 to 30 June 2001

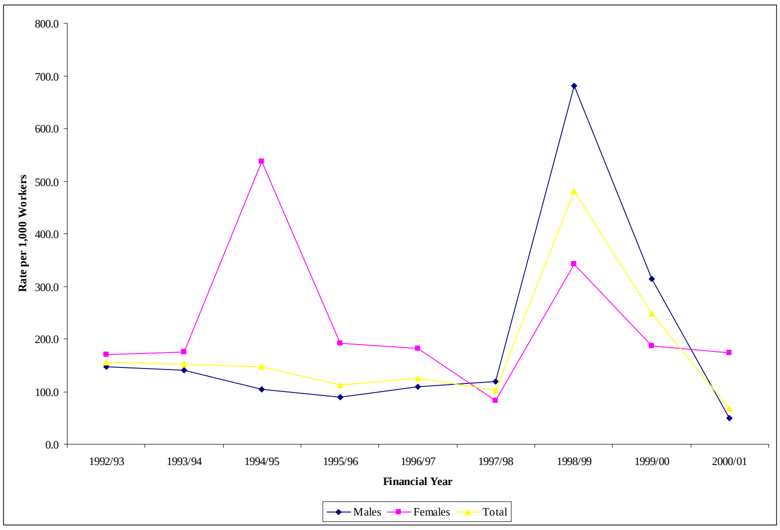


Table 76 Agency of Injury by financial year, NSW Workers' Compensation claims in Poultry Farming Industries, 1 July 1992 to 30 June 2001

Agency	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	Total	%
Machinery and (Mainly) Fixed Plant	28	36	32	26	43	54	79	65	20	383	8.0
Mobile Plant and Transport	40	50	46	42	60	49	82	77	21	467	9.8
Powered equipment, tools and appliances	10	9	11	13	5	14	19	15	10	106	2.2
Non-Powered Hand tools, appliances and equipment	147	117	127	131	123	183	221	213	93	1,355	28.3
Chemicals and Chemical Product	11	12	12	18	16	19	25	20	6	139	2.9
Materials and substances	74	59	44	65	50	50	66	78	39	525	10.9
Environmental agencies	64	65	62	60	50	60	94	90	37	582	12.1
Animal, human and biological agencies	80	75	83	103	83	98	138	137	53	850	17.7
Other and unspecified agencies	11	33	25	28	49	44	95	75	28	388	8.1
Total	**465**	**456**	**442**	**486**	**479**	**571**	**819**	**770**	**307**	**4,795**	**100.0**

Body stressing (37.6%) was the most common mechanism of injury for Workers' Compensation claims in the poultry farming industries of NSW. Other common mechanism of injury include being hit by moving objects (22.6%), falls, trips and slips (17.2%) and hitting objects with a part of the body (12.6%) (Table 77).

Table 77 Mechanism of Injury by financial year, NSW Workers' Compensation claims in Poultry Farming Industries, 1 July 1992 to 30 June 2001

Mechanism	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	Total	%
Falls, trips and slips of a person	81	75	87	81	75	95	132	137	63	826	17.2
Hitting objects with a part of the body	63	72	46	51	46	70	111	103	42	604	12.6
Being hit by moving objects	121	120	99	116	121	140	146	164	54	1,081	22.6
Sound and pressure	3	5	7	4	2	0	2	6	2	31	0.6
Body Stressing	161	147	155	183	193	215	334	299	115	1,802	37.6
Heat, radiation and electricity	5	2	4	4	3	11	14	7	8	58	1.2
Chemicals and other substances	13	21	20	31	19	21	32	23	10	190	4.0
Biological factors	3	2	6	2	4	3	5	1	0	26	0.5
Mental stress	1	0	1	2	3	2	6	3	1	19	0.4
Other and unspecified mechanism	14	12	17	12	13	14	37	27	12	158	3.3
Total	**465**	**456**	**442**	**486**	**479**	**571**	**819**	**770**	**307**	**4,795**	**100.0**

6.4.6 Other Livestock Farming

In the other livestock farming industry in NSW there were 2,364 Workers' Compensation claims over the period 1 July 1992 to 30 June 2001, averaging 263 compensation claims per annum. The industries included in this grouping are: pig farming; horse farming; deer farming; and other livestock farming NEC. The average compensation claim ranged from $4,080 for pig farming to $9,992 for livestock farming NEC (Table 58). The average amount of time off work in weeks was 7.9 (median 1.1) for WorkCover information and 6.6 (Median 1.6) from the recalculated time-lost information (Table 60).

The average age of people seeking Workers' Compensation in other livestock farming was 35.2 years (Median = 33.4 years, range 15.6 to 73.4 years). Nearly one-fifth of other livestock farming injuries occurred to 20-24 year olds (18.9%). Half (50.2%) of the total injury in this industry occurred to 25-44 yrs age group. Of claims made to the NSW Workers' Compensation scheme, males (84.2%) claimed largest number in the other livestock farming industries.

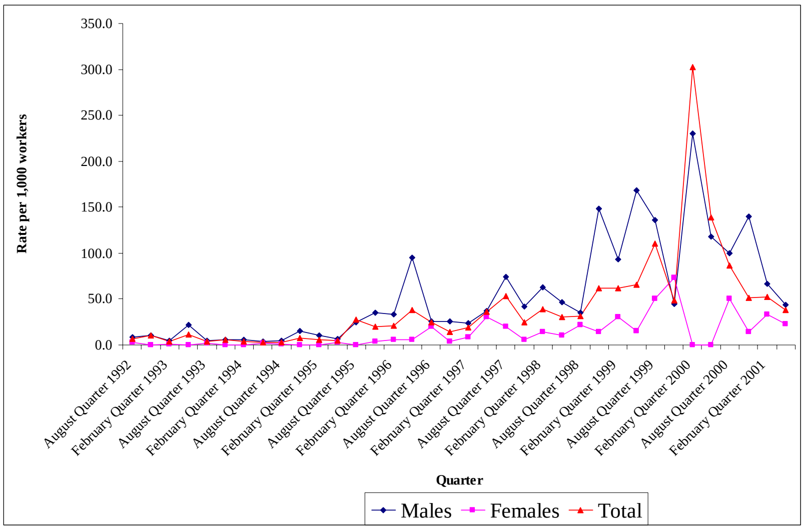
The number of people injured per month in other livestock farming industries varied from one to 58 per month. The largest number of people injured were in February (9.6%) and October (9.5%) and smallest number were in June and July (7.1% each) (Table 78).

Table 78 Month of Injury by financial year, NSW Workers' Compensation claims in Other Livestock Farming Industries, 1 July 1992 to 30 June 2001

Month of injury	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	Total	%
July	6	4	6	19	12	35	20	33	34	169	7.1
August	7	6	2	36	19	31	25	36	31	193	8.2
September	8	6	3	17	11	30	31	41	30	177	7.5
October	9	3	7	24	11	51	33	40	46	224	9.5
November	7	2	6	25	8	41	58	32	37	216	9.1
December	5	6	7	20	14	44	32	30	40	198	8.4
January	1	5	8	22	17	35	32	48	28	196	8.3
February	5	6	7	17	19	52	39	40	42	227	9.6
March	4	4	10	21	13	44	40	33	30	199	8.4
April	6	3	3	14	17	35	38	46	29	191	8.1
May	6	4	5	15	28	39	35	50	24	206	8.7
June	10	6	8	13	27	31	26	43	4	168	7.1
Total	74	55	72	243	196	468	409	472	375	2,364	100.0

The incidence of injury / disease in Other Livestock Farming Industries ranges from 3.2 per 1,000 workers in the August 1994 quarter, to 302.5 per 1,000 workers in the February 2000 quarter (Figure 39). It should be noted that due to small number of females being employed in Other Livestock Farming Industries there are some quarters where the ABS employment figures registered zero employees thus less than 50 females were employed and as such a rate could not be calculated. The financial year 1993/94 has the lowest rate (28.0 per 1,000 workers) and the 1999/00 financial years had the highest rate (224.8 per 1,000 workers) (Figure 40).

Figure 39 Incidence of injury / disease by quarter, Other Livestock Farming Industries, NSW Workers' Compensation claims, 1 July 1992 to 30 June 2001



One-third (33.4%) of the Workers' Compensation claims in the other livestock farming industries were due to animal, human and biological agencies. The other common agencies which resulted in Workers' Compensation claims in the other livestock farming industries were non-powered hand tools, and appliances (15.2%), environmental agencies (13.1%), materials and substances (11.7%), and mobile plant and transport (10.7%) (Table 79).

Figure 40 Incidence of injury / disease by financial year, Other Livestock Farming Industries, NSW Workers' Compensation claims, 1 July 1992 to 30 June 2001

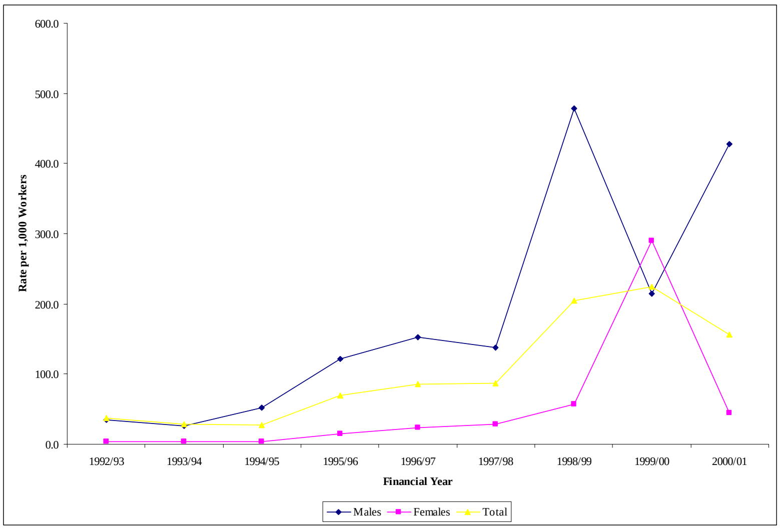


Table 79 Agency of Injury by financial year, NSW Workers' Compensation claims in Other Livestock Farming Industries, 1 July 1992 to 30 June 2001

Agency	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	Total	%
Machinery and (Mainly) Fixed Plant	3	4	3	12	8	14	15	21	11	91	3.8
Mobile Plant and Transport	11	12	10	13	13	44	52	53	45	253	10.7
Powered equipment, tools and appliances	5	2	5	5	7	12	17	12	4	69	2.9
Non-Powered Hand tools, appliances and equipment	8	6	8	54	28	81	55	72	48	360	15.2
Chemicals and Chemical Product	0	1	0	6	3	4	4	9	1	28	1.2
Materials and substances	11	7	19	20	30	49	48	47	45	276	11.7
Environmental agencies	10	8	10	41	27	63	34	56	59	308	13.1
Animal, human and biological agencies	21	15	14	62	65	157	147	178	131	790	33.4
Other and unspecified agencies	5	0	3	30	15	44	37	24	31	189	8.0
Total	**74**	**55**	**72**	**243**	**196**	**468**	**409**	**472**	**375**	**2,364**	**100.0**

Being hit by moving objects (38.0%) was the most common mechanism of injury resulting in a Workers' Compensation claim in the other livestock farming industries, followed by body stressing (22.2%), falls, trips and slips (16.2%) and hitting objects with a part of the body (12.3%) (Table 80).

Table 80 Mechanism of Injury by financial year, NSW Workers' Compensation claims in Other Livestock Farming Industries, 1 July 1992 to 30 June 2001

Mechanism	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	Total	%
Falls, trips and slips of a person	15	9	9	31	22	85	49	87	75	382	16.2
Hitting objects with a part of the body	6	5	8	37	32	52	46	61	44	291	12.3
Being hit by moving objects	33	21	31	62	77	191	154	183	146	898	38.0
Sound and pressure	1	1	1	13	1	3	1	0	1	22	0.9
Body Stressing	15	10	11	76	45	94	103	97	72	523	22.2
Heat, radiation and electricity	2	2	3	3	5	5	12	8	3	43	1.8
Chemicals and other substances	2	1	2	8	3	8	8	10	4	46	1.9
Biological factors	0	0	0	0	1	1	0	1	1	4	0.2
Mental stress	0	0	0	0	1	2	1	0	2	6	0.3
Other and unspecified mechanism	0	6	7	13	9	27	35	25	27	149	6.3
Total	**74**	**55**	**72**	**243**	**196**	**468**	**409**	**472**	**375**	**2,364**	**100.0**

6.4.7 Other Crop Farming

In the other crop farming industries in NSW there were 1,754 Workers' Compensation claims over the period 1 July 1992 to 30 June 2001, averaging 195 compensation claims per annum. The industries included in this grouping are: sugar cane growing; cotton growing; and other crop and plant growing NEC. Average compensation claims ranged from $9,384 for cotton growing to $11,759 for crop and plant growing NEC (Table 58). The average amount of time off work in weeks was 10.0 (median 1.4) for WorkCover information and 8.9 (Median 2.0) from the recalculated time-lost information (Table 60).

The average age of people seeking Workers' Compensation in other crop farming was 35.3 years (Median = 33.0 years, range 15.8 to 71.0 years). Of Workers' Compensation claims in the other crop farming industries, nearly one-third (31.5%) of the claims were from farmers in the age group 25-34 yrs. In other crop farming industry most of the Workers' Compensation claims were from males (83.5%).

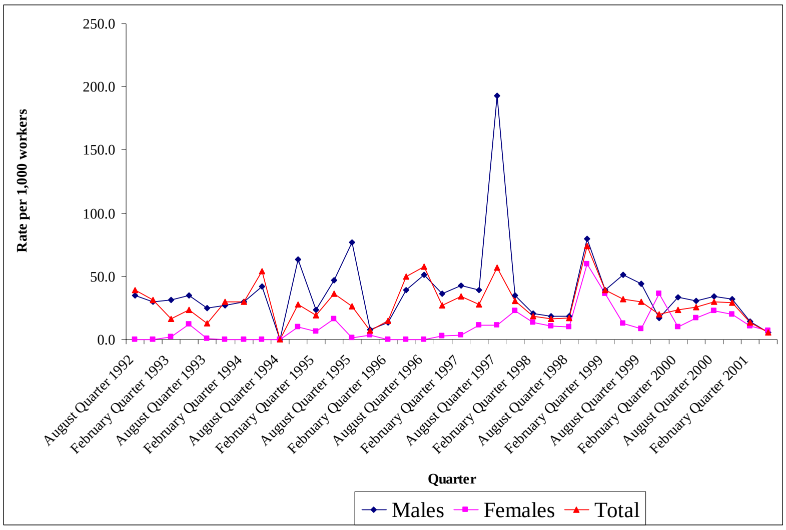
The number of Workers' Compensation claims by month of injury event in other crop farming industries varied from one to 42 per month. The largest number of people injured in other crop farming industries occurred in May (12.4%) and the smallest numbers in October and November (7.0% each) (Table 81).

Table 81 Month of Injury by financial year, NSW Workers' Compensation claims in Other Crop Farming Industries, 1 July 1992 to 30 June 2001

Month of injury	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	Total	%
July	9	8	12	8	16	30	14	13	18	128	7.3
August	19	9	11	9	12	16	21	27	21	145	8.3
September	11	9	9	7	24	22	12	20	21	135	7.7
October	15	10	10	4	13	18	22	12	19	123	7.0
November	9	13	9	5	9	16	30	18	13	122	7.0
December	7	7	6	8	19	31	21	21	26	146	8.3
January	9	6	10	7	27	28	27	20	13	147	8.4
February	8	13	7	9	15	11	27	19	20	129	7.4
March	16	11	6	9	6	27	20	22	16	133	7.6
April	13	14	8	11	25	31	23	23	18	166	9.5
May	21	25	8	22	33	27	42	19	21	218	12.4
June	13	15	17	17	23	24	25	27	1	162	9.2
Total	**150**	**140**	**113**	**116**	**222**	**281**	**284**	**241**	**207**	**1,754**	**100.0**

The incidence of injury / disease in other crop farming industries ranged from 6.8 per 1,000 workers in the May 2001 quarter (this is probably an under representation due to late claims not being included in this quarter), to 74.0 per 1,000 workers in the November 1998 quarter (Figure 41). It should be noted that due to small number of females being employed in other crop farming industries there are a number of quarters where the ABS employment figures registered zero employees thus less than 50 females were employed and as such a rate could not be calculated, this also occurs for males in the August 1994 quarter. The financial year 1995/96 had the lowest rate (46.4 per 1,000 workers) and the 1999/00 financial year had the highest rate (285.0 per 1,000 workers) (Figure 42).

Figure 41 Incidence of injury / disease by quarter, agriculture, NSW Workers' Compensation claims, 1 July 1992 to 30 June 2001



In other crop farming industries, non-powered hand tools, appliances and equipment (20.1%), mobile plant and transport (19.4%), materials and substances (17.5%), and environmental agencies (14.2%) were the common agencies which contributed to Workers' Compensation claims in NSW (Table 82).

Figure 42 Incidence of injury / disease by financial year, agriculture, NSW Workers' Compensation claims, 1 July 1992 to 30 June 2001

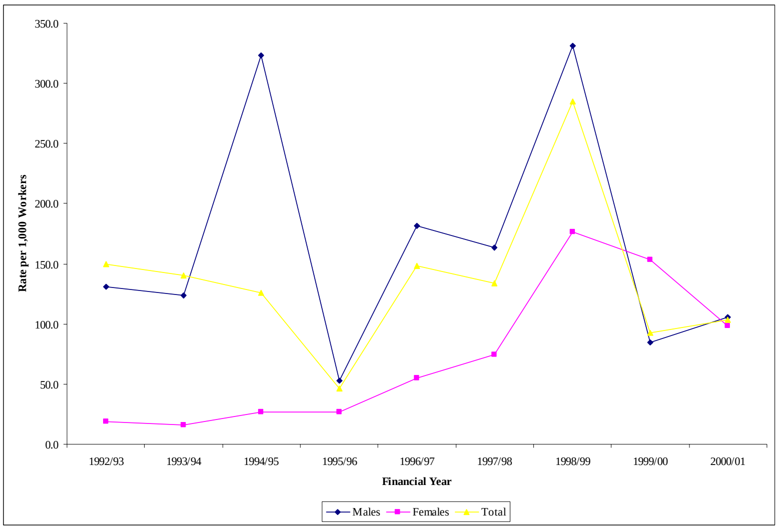


Table 82 Agency of Injury by financial year, NSW Workers' Compensation claims in Other Crop Farming Industries, 1 July 1992 to 30 June 2001

Agency	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	Total	%
Machinery and (Mainly) Fixed Plant	15	6	6	8	20	21	19	19	14	128	7.3
Mobile Plant and Transport	29	28	16	22	41	54	48	61	41	340	19.4
Powered equipment, tools and appliances	15	12	11	5	14	15	15	5	7	99	5.6
Non-Powered Hand tools, appliances and equipment	35	29	33	24	47	52	49	42	42	353	20.1
Chemicals and Chemical Product	2	5	1	4	3	5	6	6	4	36	2.1
Materials and substances	26	19	15	28	39	55	45	48	32	307	17.5
Environmental agencies	16	30	19	14	35	33	43	23	36	249	14.2
Animal, human and biological agencies	3	5	5	5	8	20	25	10	12	93	5.3
Other and unspecified agencies	9	6	7	6	15	26	34	27	19	149	8.5
Total	**150**	**140**	**113**	**116**	**222**	**281**	**284**	**241**	**207**	**1,754**	**100.0**

Being hit by moving objects (27.9%), body stressing (22.8%), falls, trips and slips (21.4%) and hitting objects with a part of the body (13.9%) were the common mechanism of Workers' Compensation claims in other crop farming industries (Table 83).

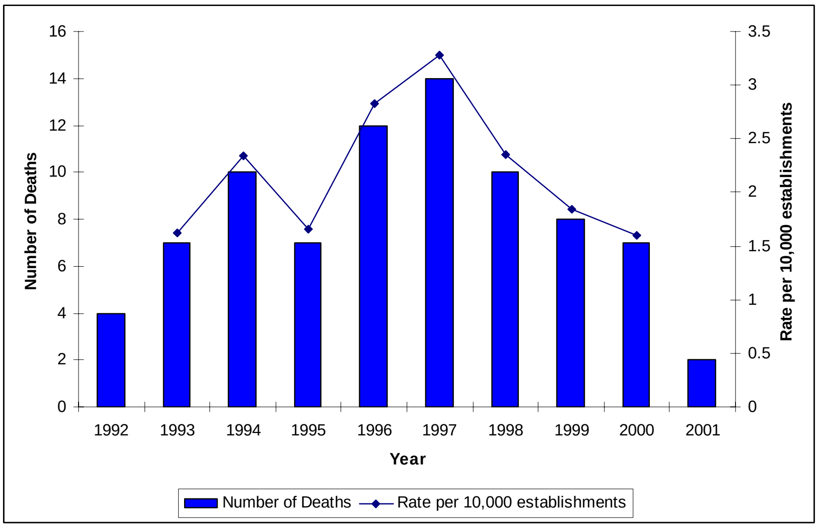
Table 83 Mechanism of Injury by financial year, NSW Workers' Compensation claims in Other Crop Farming Industries, 1 July 1992 to 30 June 2001

Mechanism	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	Total	%
Falls, trips and slips of a person	30	31	21	19	45	58	61	61	50	376	21.4
Hitting objects with a part of the body	18	16	22	14	41	38	44	30	21	244	13.9
Being hit by moving objects	64	39	32	40	62	73	64	60	54	488	27.9
Sound and pressure	1	0	0	1	3	3	2	0	2	12	0.7
Body Stressing	29	27	21	27	44	73	74	55	50	400	22.8
Heat, radiation and electricity	2	7	6	2	4	12	10	4	5	52	3.0
Chemicals and other substances	2	6	3	6	8	6	6	4	6	47	2.7
Biological factors	2	2	0	0	3	0	0	2	1	10	0.6
Other and unspecified mechanism	2	12	8	7	12	18	23	25	18	125	7.1
Total	**150**	**140**	**113**	**116**	**222**	**281**	**284**	**241**	**207**	**1,754**	**100.0**

6.4.8 Workers' Compensation reported deaths

There were 81 deaths (average 9 deaths per annum) recorded in the Workers' Compensation claims data bases over the period 1 July 1992 to 30 June 2001. Of the 81 deaths, 79 (97.5%) were males. The rate per annum per 10,000 agricultural establishments ranged from 1.6 in 1993 to 3.3 in 1997 (Figure 43). Compensation payments were recorded in 63 (77.8%) of the cases with an average payout of $108,831 per claim (median was $25,000), and a range of $786 to $385,204.

Figure 43 Number of deaths and rate per 10,000 agricultural establishments, NSW Workers' Compensation claims agricultural industries, 1 July 1992 to 30 June 2001

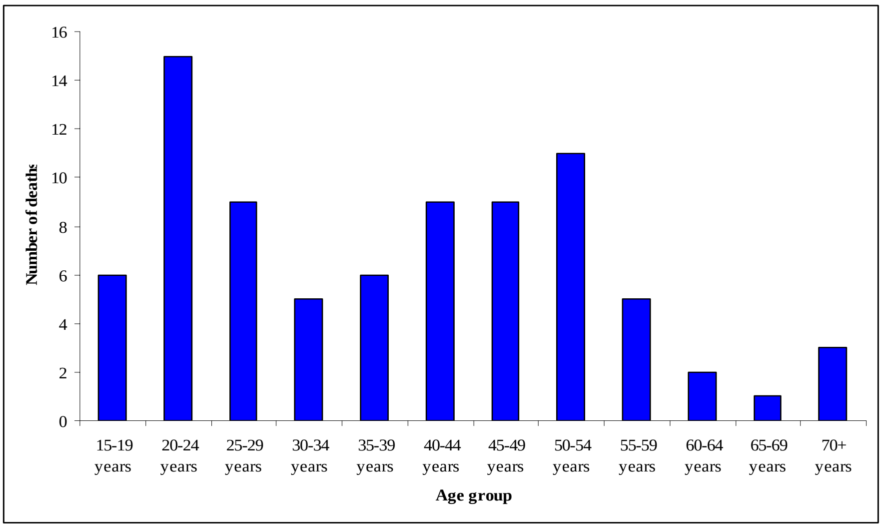


The average age of people killed while working in agricultural industries and registered in the Workers' Compensation system was 39.1 years (Median = 38.4 years, range 16.0 to 74.4 years) (Table 84). The 20-24 years age group had the highest number (18.5%) of deaths followed by the 50-54 years age group (13.6%). Half of the people who died were aged less than 40 years (Figure 44).

Table 84 Average age of people killed while working in agricultural industries NSW Workers' Compensation claims agricultural industries, 1 July 1992 to 30 June 2001

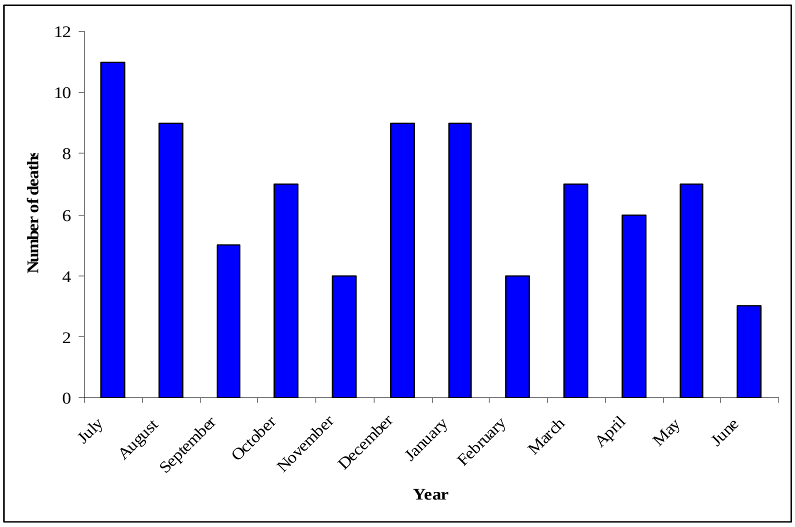
Industry Grouped	Mean	Median	N	Std. Deviation	Minimum	Maximum
Horticulture	37.7	42.1	9	13.6	19.8	57.0
Grains, sheep and beef cattle	43.0	44.9	41	14.9	18.9	74.0
Dairy	40.2	30.5	7	19.6	22.4	74.4
Poultry	31.3	28.8	7	8.6	21.4	44.7
Other livestock farming	26.7	19.9	6	15.0	16.0	54.9
Other crop farming	36.6	35.2	11	13.7	19.4	62.5
Total	**39.1**	**38.4**	**81**	**15.1**	**16.0**	**74.4**

Figure 44 Number of deaths by age group, NSW Workers' Compensation claims agricultural industries, 1 July 1992 to 30 June 2001



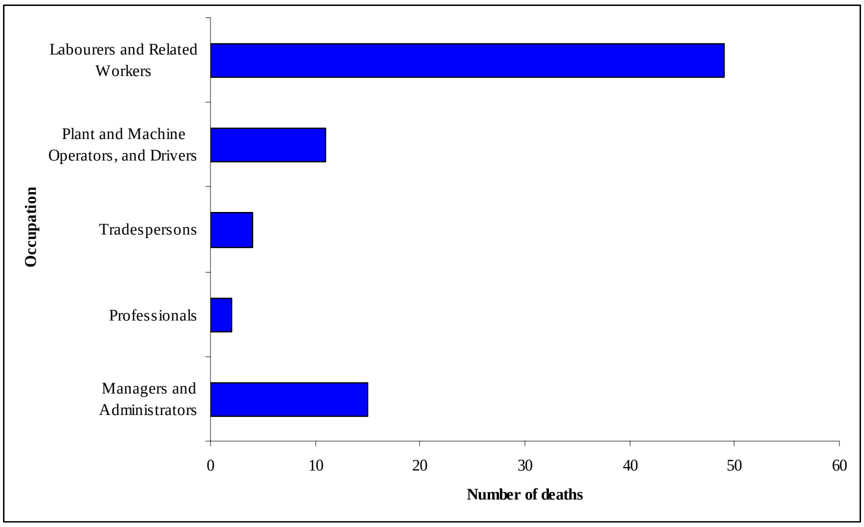
The months with the highest number of deaths were July (13.6%), August, December and January (11.1% each) (Figure 45).

Figure 45 Number of deaths by month of death, NSW Workers' Compensation claims agricultural industries, 1 July 1992 to 30 June 2001



Labourers and related workers comprised 60.5% of all the deaths. Of the 49 deaths of labourers and related workers, 39 were of farm hands. Of the 15 managers, 14 were farmers and farm managers, and of the 11 deaths of plant and machinery operators and drivers, seven were truck drivers and two were excavating and earth moving plant operators. (Figure 46)

Figure 46 Number of deaths by occupation group, NSW Workers' Compensation claims agricultural industries, 1 July 1992 to 30 June 2001



The agency group with the most deaths was mobile plant and transports (59.3%). Of these, two-thirds involved cars, station wagons, vans, utilities; and trucks, semi-trailers, lorries. (Table 85)

Table 85 Number of deaths by agent, NSW Workers' Compensation claims agricultural industries, 1 July 1992 to 30 June 2001

Agent	Number of Deaths	%
Machinery and (Mainly) Fixed Plant		
Conveyor belts and escalators	1	1.2
Distribution lines: high tension	1	1.2
Other and unspecified production line type of plant or stand	1	1.2
Total	**3**	**3.7**
Mobile Plant and Transport		
Self-propelled harvesters	2	2.5
Graders, dozers, snowploughs, other scraping plant	2	2.5
Excavators, backhoes, other digging plant	1	1.2
Other self-propelled plant	1	1.2
Tractors, agricultural or otherwise	5	6.2
Ploughs, harrows, cultivators	1	1.2
Oil, gas and water drilling rigs	1	1.2
Trucks, semi-trailers, lorries	10	12.3
Cars, station wagons, vans, utilities	21	25.9
Motorcycles and sidecars, scooters, trail bikes	1	1.2
Other road transport	1	1.2
Trains	1	1.2
Passenger aircraft	1	1.2
Total	**48**	**59.3**
Powered equipment, tools and appliances		
Weapons	1	1.2
Other powered equipment tools and appliances, not elsewhere	1	1.2
Total	**2**	**2.5**
Non-Powered Hand tools, appliances and equipment		
Hand drills, brace and bit, augers	1	1.2
Vehicle wheels and tyres	2	2.5
Total	**3**	**3.7**
Chemicals and Chemical Product		0.0
Industrial gases, fumes	3	3.7
Plant treatment chemicals	1	1.2
Total	**4**	**4.9**
Materials and substances		
Ferrous and non-ferrous metal	1	1.2
Stock feed	1	1.2
Total	**2**	**2.5**
Environmental agencies		
Weather and water	2	2.5
Holes in the ground	1	1.2
Buildings and other structures	1	1.2
Total	**4**	**4.9**
Animal, human and biological agencies		
Horses, donkeys, mules	1	1.2
Sheep, goats	1	1.2
Condition of affected person	4	4.9
Total	**6**	**7.4**

Agent	Number of Deaths	%
Other and unspecified agencies		
Non-physical agencies	2	2.5
Agency not apparent	5	6.2
Agency not known	2	2.5
Total	**9**	**11.1**
Total	**81**	**100.0**

Vehicle accidents (51.9%) were the most common mechanism of injury causing deaths, usually (88.1%) with mobile plant and transport as the agency. For one tenth (11.1%) of the deaths the mechanism was recorded as being unknown. (Table 86)

The most common nature of injury / disease was multiple injuries (51.9%), then disease of the circulatory system (13.6%). The most common bodily location was multiple locations (46.9%), head (18.5%) and trunk (46.9%) (Table 87).

Table 86 Number of deaths by agency and mechanism, NSW Workers' Compensation claims agricultural industries, 1 July 1992 to 30 June 2001

Mechanism	Machinery and (Mainly) Fixed Plant	Mobile Plant and Transport	Powered equipment, tools and appliances	Non-Powered Hand tools, appliances and equipment	Chemicals and Chemical Product	Materials and substances	Environmental agencies	Animal, human and biological agencies	Other and unspecified agencies	Total	%
Falls from a height	0	0	1	0	0	0	0	1	0	2	2.5
Being hit by falling objects	1	3	0	1	0	1	1	0	0	7	8.6
Being trapped by moving machinery or equipment	1	3	0	0	0	0	0	0	0	4	4.9
Being trapped between stationary and moving objects	0	1	0	0	0	0	0	0	0	1	1.2
Being hit by moving objects	0	4	1	1	0	0	0	0	0	6	7.4
Muscular stress while lifting, carrying, or putting down object	0	0	0	0	0	0	0	1	0	1	1.2
Exposure to environmental cold	0	0	0	0	0	0	1	0	0	1	1.2
Contact with electricity	1	0	0	0	0	0	0	0	0	1	1.2
Single contact with chemical or substances	0	0	0	0	4	0	0	0	0	4	4.9
Long term contact with chemicals or substances	0	0	0	0	0	1	0	0	0	1	1.2
Vehicle accident	0	37	0	1	0	0	2	0	2	42	51.9
Other and multiple mechanisms of injury	0	0	0	0	0	0	0	1	1	2	2.5
Unspecified mechanisms of injury	0	0	0	0	0	0	0	3	6	9	11.1
Total	**3**	**48**	**2**	**3**	**4**	**2**	**4**	**6**	**9**	**81**	**100.0**

Table 87 Number of deaths by bodily location and nature of injury, NSW Workers' Compensation claims agricultural industries, 1 July 1992 to 30 June 2001

Nature of Injury / Disease	Head	Neck	Trunk	Multiple Locations	Systemic locations	Unspecified Locations	Total	%
Fractures	5	0	0	1	0	0	6	7.4
Fracture of vertebral column	0	1	0	1	0	0	2	2.5
Intracranial injury, including concussion	7	0	0	0	0	0	7	8.6
Internal injury of chest, abdomen and pelvis	0	0	1	0	0	0	1	1.2
Burns	0	0	0	1	0	0	1	1.2
Poisoning and toxic effects of substances	0	0	0	0	1	0	1	1.2
Effects of weather, exposure, air pressure and other external cause NEC	0	0	0	0	4	0	4	4.9
Multiple injuries	1	0	0	34	0	7	42	51.9
Other and unspecified injuries	0	0	0	1	0	0	1	1.2
Diseases of the respiratory system	0	0	1	0	3	0	4	4.9
Disease of the circulatory system	1	0	9	0	1	0	11	13.6
Other diseases	1	0	0	0	0	0	1	1.2
Total	**15**	**1**	**11**	**38**	**9**	**7**	**81**	**100.0**
%	18.5	1.2	13.6	46.9	11.1	8.6	100.0	

6.5 Discussion

The New South Wales Workers' Compensation insurance scheme has been operating since 1987 for the purposes of making payments to people who are employees and injured while working. The information has also been used on an annual basis for the last 16 years to provide a picture of trends in workplace health and safety in New South Wales. [257]

Beside the regular reporting by work health authorities across Australia and the Office of the Australia Safety and Compensation Council (OASCC), the collection of Workers' Compensation information attracts very little attention in Australia [159]. Very few published studies from Australia have examined Workers' Compensation in detail, and only one study has examined agricultural Workers' Compensation at a national level and one at a NSW state level [80 266-269].

This study describes the rate of injury for the people injured and paid Workers' Compensation who were working in agriculture in NSW at the time of injury. It describes the nature of compensated injuries by agricultural industries in NSW, and it describes the cost of compensated work related agricultural injuries per annum in NSW. The discussion provides a comparison between this study and other similar studies, a ranking of the burden, costs associated with compensated claims in agricultural industries and subsequent areas for prevention.

6.5.1 Comparison with other Australian studies

The study by Cole and Foley examining Workers' Compensation claims in agricultural industries provides a snapshot of the extent, size and cost of compensated injuries [80]. Cole and Foley identified five important occupational health and safety issues for agricultural industries: plant; hand tools, appliances and equipment; manual handling practices; work environment; and livestock. Cole and Foley found mobile plant and equipment were involved in 14.7% of claims: this study found it to be involved in 14.0% of claims, and both studies found motorcycle/trail bikes were involved in approximately one quarter of the claims. Cole and Foley found fixed plant represented 9.4% of claims whereas this study found they represented 8.1%. Both found sheep shearing plant to be a large contributor to fixed plant injuries (over half in Cole and Foley [80] and one-third in this study). [80]

Hand-tools, appliances and equipment were the biggest contributor to Workers' Compensation claims in both the Cole ad Foley (17%) and this study (19.7%). Body stressing (manual handling) in both Cole and Foley and this study contributed over one-quarter of all claims in Agricultural industries. Over half (62.3%) of the environmental agency claims in this study were due to falls, slips and trips, whereas in Cole and Foley this category accounted for almost one-quarter. Livestock in both studies accounted for approximately one-fifth of all claims, with horses/mules, sheep/goats and cattle being the three most common animals. [80]

De Silva and co-workers examined Workers' Compensation claims for agriculture in NSW, for the financial year 1991/92. The study was based on number of injuries and median gross incurred cost and identified cereal grains, sheep, cattle and pigs industry and other agriculture industries (sugar cane, tobacco, cotton and nurseries) as the two highest risk agricultural industries. The occupations with the highest risk were farmers and farm managers, sheep shearers and farm hands and assistants, similar to this study. De Silva and co-workers then explored the two identified industries in greater detail. [267]

De Silva and co-workers developed a formula to rank the industries who had the highest risk, using a ranked total number of injuries and diseases and median gross incurred cost, then summed the ranks and gave an overall ranking based on the lowest sum of rank [267]. While De Silva and co-workers have called the assembled information a ranking of risk, this is not the case, as it does not necessarily reflect actual risk. In this study it has been called a ranking of burden.

Using the information from the current study the burden of people being injured in agriculture by industry (both at the agricultural industries group level and industry level) was calculated using number of injuries / diseases, average cost and average time lost (the average rank of both time lost was used). Thus the industry with the highest ranking (1 being the highest and 22 being the lowest) is the industry with the highest burden. The five highest ranked industries are sheep farming, grain-sheep and grain-beef cattle farming, plant nurseries, sheep-beef cattle farming and vegetable growing (Table 88). The three highest ranked agricultural industry groups were: grain, sheep and beef cattle farming; horticulture and poultry (Table 88).

Table 88 Ranking of burden by agricultural industry, 1 July 1992 to 30 June 2001

Industry	Number of Injury / Disease	Rank	Average Cost	Rank	Average Time Lost (Weeks)	Rank	Re-Calculated Average Time Lost Weeks	Rank	Calculated Rank	Over all Ranking
Plant Nurseries	874	11	$13,085.30	7	12.8	4	11.4	2	21	3
Cut Flower and Flower Seed Growing	45	21	$14,165.53	4	40.2	1	10.6	4	27.5	7
Vegetable Growing	676	13	$13,549.77	5	11.3	6	11.1	3	22.5	5
Grape Growing	744	12	$9,617.13	14	8.2	12	6.2	19	41.5	16
Apple and Pear Growing	186	18	$9,599.20	15	19.7	2	10.2	5	36.5	13
Stone Fruit Growing	163	19	$5,573.24	21	6.3	20	5.7	21	60.5	22
Fruit Growing NEC.	1254	7	$9,634.55	13	11.5	5	8	14	29.5	9
Horticulture	**3,947**	**3**	**$10,945.88**	**2**	**11.7**	**1**	**8.9**	**4**	**7.5**	**2**
Grain, Sheep and Beef Cattle Farming NEC	30	22	$22,531.49	1	3.8	22	4	22	45	18
Grain Growing	596	15	$11,231.33	10	10.8	9	8.8	10	34.5	12
Grain-Sheep and Grain-Beef Cattle Farming	3,140	2	$15,697.93	3	8.2	12	8.6	11	16.5	2
Sheep-Beef Cattle Farming	1,738	5	$13,155.03	6	11.1	7	8	14	21.5	4
Sheep Farming	2,485	3	$17,974.99	2	8.7	11	9.2	9	15	1
Beef Cattle Farming	1,630	6	$12,166.93	8	10.9	8	8.6	11	23.5	6
Grain, Sheep and Beef Cattle Farming	**9,619**	**1**	**$14,977.02**	**1**	**9.5**	**3**	**8.6**	**5**	**6**	**1**
Dairy Cattle Farming	1,853	4	$7,596.40	17	7.1	18	9.6	7	33.5	11
Dairy Cattle Farming	**1,853**	**5**	**$7,596.40**	**4**	**7.1**	**6**	**9.6**	**2**	**13**	**5**
Poultry Farming (Meat)	3,741	1	$6,399.71	20	7.3	17	10.2	5	32	10
Poultry Farming (Eggs)	1,054	10	$7,192.21	18	7.8	15	9.5	8	39.5	15
Poultry	**4,795**	**2**	**$6,576.20**	**5**	**7.4**	**5**	**10**	**1**	**10**	**3**
Pig Farming	1,171	9	$4,079.53	22	8.1	14	5.8	20	48	19
Horse Farming	525	16	$6,460.15	19	9.3	10	7.8	16	48	19
Livestock Farming NEC	663	14	$9,992.34	12	6.5	19	6.9	17	44	17
Other Livestock Farming	**2,364**	**4**	**$6,255.77**	**6**	**7.9**	**4**	**6.6**	**6**	**15**	**6**
Sugar Cane Growing	81	20	$10,970.16	11	5.1	21	6.3	18	50.5	21
Cotton Growing	1,213	8	$9,384.10	16	7.6	16	8.2	13	38.5	14
Crop and Plant Growing NEC	455	17	$11,758.54	9	17.5	3	11.8	1	28	8
Other Crop Farming	**1,754**	**6**	**$10,104.56**	**3**	**10.0**	**2**	**9**	**3**	**11.5**	**4**
Total	**24,332**		**$10,879.53**		**9.2**		**8.9**			

6.5.2 Ranking of burden by agricultural industry

The use of a ranking to determine the industries which should be targeted for prevention activities is appropriate. Usually such targeting is based on incidence or frequency rates. However, it is difficult to get appropriate denominator information for rates to be calculated. For example, rates for this study could only be calculated at the level of the agricultural industry groups.

To determine the difference between the agricultural industry burden rank (Table 88) and the incidence rate, the average incidence rate over the nine years was calculated (i.e. the annual rate added together and divided by nine). The rank order of the agricultural industry groups based on average incidence rate was:

1. Poultry (177.1 / 1,000 workers)
2. Other crops (136.1 / 1,000 workers)
3. Dairy (117.8 / 1,000 workers)
4. Other livestock (102.1 / 1,000 workers)
5. Horticulture (41.3 / 1,000 workers)
6. Grain, sheep and beef cattle farming (40.6 / 1,000 workers).

The different rank order compared to the one in Table 88 is due to the number of people employed in the grain, sheep and beef cattle farming and horticulture industries. They went from a ranking of 1 and 2 to 7 and 6 respectively, and the rest were in the same rank order.

While neither method is perfect the one based on average incidence is far preferable for determining which industries should be a higher priority. This does highlight the difficulty faced by people planning prevention strategies with limited resources who are trying to decide where those resources should be allocated.

6.5.3 Costs

Workers' Compensation data is a powerful source of information about injuries occurring to people in agricultural industries and are used in one of the indicators in the Farmsafe Australia goals and targets (goal 2 – reduction of compensable injury by 30%) [76]. This study did not find any indication to show there had been a reduction (it actually showed an increase). Using compensable injuries is probably not the best measure to see if there has been any change over time. There is however a consistent decrease in the incidence of injury / disease by quarter from mid August 1998 to the end of the study, a measure which also takes into account the number of people employed (i.e. exposed to risk).

The cost of the injury/disease has often been used to justify funding for prevention. Cole and Foley in their study found Workers' Compensation claims in the agricultural sector cost $36.3 million and estimated the total cost of injuries to people in the agricultural sector of Australia to be between $0.52 billion and $1.29 billion [80]. The current examination of NSW Workers' Compensation Data found an average of 2,704 people compensated each year, with an average cost of $10,880 per claim and a total cost of compensation for the study period of $257,993, 093 or on average $28.7 million per annum (this will probably increase as claims are finalised).

While there are some differences between the WorkCover time lost figures and those calculated in this study (either an average 9.2 weeks or 8.9 weeks per claim) the cost of compensation and the length off time off work indicates that injuries to workers on farms are an important issue for NSW agriculture. This study of Workers' Compensation information only represents a small proportion of all injuries to people working on farms as it excludes those people where the amount of time off work is less than five days (i.e. where the injury/disease is not defined as a lost time injury / disease) and those who are not employees.

6.5.4 Analysis of the information

Workers' Compensation information can be stratified in a large number of variations which can produce a large number of tables and figures. However, to be able to make sense of the information, much of it needs to be grouped. The aim of the analysis was to provide a description of the nature of compensated injuries by agricultural industries, rates and cost of injuries. The fourth aim was to provide direction for the prevention of work-related farm injuries in NSW.

The National Farm Injury Data Centre on behalf of Farmsafe Australia has taken the step of examining information stratified by agricultural industry or group of industries with similar work patterns. To this end they have produced a number of reports exploring what work is undertaken by a particular industry and the risk of undertaking the activity [22 23 26 168].

For a number of years in Australia there has been a growing movement in the agricultural health and safety industry to stop treating agriculture as one industry, to examine it by sub industries and use this information to plan prevention activities in a more directed manner [270]. The sheep industry was the first industry in which this approach was used [168]. Unfortunately, as this is a reasonably new approach, there is a lack of information available to properly inform the development of the risk profiles. Fortunately this is changing as a result of new publications containing information about specific industries [14 17 73 77 176].

6.5.5 Targeting prevention

An intervention (i.e. something attempted to improve safety) can occur at different levels [271]. Farmsafe Australia uses the Hierarchy of Control based on the Haddon's ten countermeasures to reduce energy damage [60 122]. The Hierarchy of Control is a five level guide to the effectiveness of an intervention. The order is as follows:

1. Eliminate the hazard (risk)
2. Substitute for a lesser hazard (risk)
3. Engineer out the hazard (risk)
4. Design safer work procedures (management)
5. Use personal protective equipment

In order to develop an intervention, the target of an invention is required to be known. Based on the information in this study, there are a number of high priority industries, occupations, and agents that could be targeted by Farmsafe Australia. Farmsafe Australia has identified 10 industries (sheep and wool; grains; dairy; horticulture; sugar; beef cattle; viticulture; piggeries; and poultry), seven specific hazards (farm machinery – post hole diggers, tractors, grain augers and PTO shaft guards; farm workshop – design, electricity, welding and cutting, grinding, power hoists, power and hand tools, battery charging, tyre changing; All-terrain vehicles; noise injury; mental health; zoonoses; and farm chemicals) and children as their target areas.

Information form this study supports the targeting in NSW of eight of the ten industries identified by Farmsafe Australia (sheep and wool; grains; dairy; horticulture; beef cattle; dairy; and poultry). Horticulture in this study included viticulture (grapes) which would not be in the top ten. Grain growing on its own is unlikely to be in the top ten but because it is associated with other industries (i.e. grain-sheep and grain-beef cattle farming) it is appropriate to be included. While plant nurseries are not included as a separate industry in the Farmsafe Australia list (they are included as part of horticulture), it would be worthwhile developing a strategy for this industry in NSW due to the high number of injuries.

Farmsafe Australia, while identifying children as a specific target group has not developed specific strategies for particular occupations. They have instead targeted specific hazards involved in events where people are injured on farms. Farmsafe Australia has however developed the Managing Farm Safety course to help farm managers and owners better understand and prevent farm injuries (level three on the Hierarchy of Control). Further work needs to be undertaken to understand the different hazards and exposure for the different occupations on farms, as this should provide a better understanding of how to prevent injuries in agriculture.

One of the strengths of the Farmsafe Australia list of targeted hazards is that it not only looks at agents but also the location of the injury event (e.g. workshop). For example injuries due to ferrous and non-ferrous metal are likely to occur in the workshop from grinding, but information is not available.

From the information provided in this analysis there are two areas where Farmsafe Australia should consider developing strategies. The first is for manual handling; there were a large number of injuries from body stressing and preventions in this area could be expected to significantly reduce the number of injuries suffered. The second area is transport related injuries, as there were a large number of truck, car, station wagons, van and utilities involved in injuries in Agriculture.

Age is considered a risk factor (i.e., a measurable characteristic associated with a higher probability of occurring) in injury prevention, as there are some injuries which occur more often to a particular population group (e.g. drowning in children) [6 38]. Farmsafe Australia has identified children as one of their target areas. In this analysis (which excludes children) people aged less than 30 years made up more than one-third of all the claims (36.3%). Other studies from overseas have also found younger workers to be at higher risk than older workers when examining Workers' Compensation records [88 272 273]. Further work needs to be undertaken to properly understand the risk faced by younger workers in the workplace.

The proportion of female workers in agriculture has been static over the last decade. Females represent about 20% of the total agricultural workforce, and their injury profile has not been examined in detail [274]. Further work is needed to better understand the risk of injury to women in agricultural industries.

6.5.6 Agricultural Industries

Targeting specific agricultural industries is part of Farmsafe Australia's strategy to improve health and safety in agriculture [275]. The reason for targeting specific agricultural industries has been to align risk management procedures more closely to the industries in which the accidents occur [168]. To this end, this study examined agricultural industries at the group level (horticulture; grain, sheep and beef cattle; dairy cattle; poultry farming; other livestock farming; other crop farming).

The incidence of injury/disease in agricultural industries varied from 37 to 72.6 per 1,000 workers, similar to New Zealand, which had a rate of 53 per 1,000 workers [130]. There were also large variations in the incidence at agricultural industry level ranging from an average over the nine years of 40.6 per 1,000 workers for grain, sheep and beef cattle farming to an average of 177.1 per 1,000 workers in poultry.

6.5.6.1 Gender and age

Overall 82.4% of people working in agricultural industries who received Workers' Compensation between 1 July 1992 and 30 June 2001 were males. However, this proportion varied by industry group, with poultry having the lowest proportion (61.7%) and grain, sheep and beef cattle farming having the highest proportion (94.4%). As previously mentioned, gender differences in injury occurrences has not been well explored. Development and design of prevention activities targeting females may yield good results, particularly in poultry and horticulture, which have a higher proportion of females being injured than other agricultural industries.

The average age of people being injured while working in agricultural industries was 36.6 years, with a slight variation (34.8 years poultry to 38.2 years grain, sheep and beef cattle) between the industries. As Workers' Compensation data only includes employees, those who are self employed are not included. As self employed people tend to be older than employees, it would be expected there would be a greater proportion of younger people in Workers' Compensation statistics than when compared to the whole agricultural workforce.

6.5.6.2 Cost

The total cost of Workers' Compensation claims was $174 million or $19.4 million per annum. Grains, sheep and beef cattle farming industries costs were on average $8.9 million per annum and while 39.5% of the claims were from this industry, 45.7% of the costs were incurred by the industry. The annual average Workers' Compensation costs for the other industries were $3.6 million horticulture, $1.2 million dairy, $2.7 million poultry, $1.2 million other livestock farming, and $1.7 million other crop farming.

6.5.6.3 Time of year

While injuries occurred all year round there was an increase over the November to March period for most of the industries except for poultry and other crop farming, where there were increases in the middle of the year. There was variability across quarters and years when examining the incidence of injury / disease in the horticultural industries. Activities undertaken at a particular time of the year, and changing employment conditions (such as sort term part-time employment due to harvesting) contribute to the variability and as such warrant further examination from the perspective of planning prevention activities.

6.5.6.4 Occupation

Occupation is a tricky variable to examine as many people in agriculture undertake multiple occupational roles on the farm, making it difficult to accurately describe one's occupation. The proportion of injuries to particular occupation groups varies by agricultural industries.

Whilst more than half of the injuries in all agricultural industries occurred to labourers and related workers, horticulture (70.7%) and poultry (77.5%) had the highest proportions of injuries occurring to this occupation group. In the grain, sheep, and beef cattle farming (19.8%), dairy (16.9%), and other livestock farming (16.4%) industries approximately one-fifth of the people injured were employed as managers and administrators. In the grain, sheep, and beef cattle farming industry, a large proportion (22.7%) of people injured were tradespersons. In dairy (10.4%), poultry (8.4%) and other crop farming (20.6%), plant and machine operators were a large occupation group in terms of injury.

6.5.6.5 Agency and mechanism

Each agricultural industry has a different proportion of injuries due to particular agencies. However, non-powered hand tools, appliances and equipment were common and are being addressed as part of the Farmsafe Australia workshop strategy. The two most common mechanisms in all industries except for horticultural industries involved in Workers' Compensation claims were 'body stressing' and 'being hit by moving object'. In horticulture, the most common mechanisms were 'body stressing' and 'falls, trips and slips'. Further work needs to be undertaken to investigate specific hazards and the mechanisms of injury associated with them.

The most common agencies in horticultural industries were non-powered hand tools, appliances and equipment (27.4%) and environmental agencies (22.0%). For grain, sheep and beef cattle farming the most common agencies were animal, human biological (26.0%) and mobile plant and transport (16.2%). In dairy (22.3%) and poultry (28.3%) industries, the most common agencies were non-powered hand tools, appliance and equipment, and followed equally by animal, human and biological (17.7% each). For other livestock farming industries, the most common agencies were non-powered hand tools, appliances and equipment (15.2%), and environment agencies (13.1%). For other crop farming industries the most common agencies were non-powered hand tools, appliances and equipment (19.4%), and mobile plant and transport (19.4%).

6.5.6.6 Bodily location and nature

Examination of bodily location by industry yielded very little useful information and would be used more appropriately when examining the specific hazards. In all industries the top three bodily locations injured were upper limbs, trunk and lower limbs, with some minor variations in the order. The most common nature of injury was sprains and strains. Further examination of bodily location and nature for specific hazards will provide information likely to be useful for prevention. For example, if eye injuries are associated with the use of grinders, then goggles, face shields and guards should reduce the injuries [276].

6.5.7 Deaths

Deaths have been the primary focusof agricultural health and safety statistics and been used extensively to explore health and safety issues [50 68 93 94 141 277-279]. Workers' Compensation as a complete source of information about agricultural fatalities has been found to be flawed, with only one-third (28.2%) of agricultural fatalities being recorded in the system [14]. This does, however, vary by age, jurisdiction, industry, agent, and work arrangement[14].

For NSW, 28.2% of deaths of people working in agriculture were recorded in the Workers' Compensation information for the years 1989-1992 [14]. In the analysis of Workers' Compensation information for the period 1 July 1992 to 30 June 2001 there were 81 deaths. If the same level of underreport was present for other years, during this period there may have been as many as 287 (81 x 1,000/282) agricultural deaths.

There was an increase in the number of deaths from the start of the study to 1997, when there were 14 deaths in the year. From this time the number of deaths declined to two in the first six months of 2001. The average age of the deceased person was slightly higher than for persons with temporary disability but lower than with permanent disability. Labourers and related workers were the most common occupation group killed, accounting for nearly two-thirds (60.5%) of all deaths.

There were over 30 agents identified as being involved in the deaths. However, only two groups (trucks, semi trailers, lorries; and cars, station wagons, vans utilities) were involved in more than three deaths. Cars, truck and utilities have previously been found to be common agents of deaths in agriculture across Australia [14]. What was unexpected was the lack of deaths from tractors identified in the study as tractors have been found to be a major source of death in agriculture both in Australia and overseas[14 47 91 93 94 141 143 145 148 203 280-284].

Death was predominantly caused by multiple injuries to multiple locations, and injuries to the head (either intracranial or fractures) or to the trunk.

6.5.8 Errors and limitations of the data

The reliability of the information presented in this study is highly dependant on the quality of the information provided by NSW WorkCover. Since there was no way to validate the information provided, it is taken as being accurate except in the case of time lost. NSW WorkCover do have an internal data checking system which monitors and corrects errors in the system [259].

'Time lost' is problematic as a measure, because the final date or return to work date is entered into the system after the case is closed and the person has returned to work, which in some cases may be years after the incident. This reduces the reliability of this item. As differences were found in the time lost information from WorkCover compared to the calculated time lost information both the WorkCover information and the re-calculated time lost information were used in this study. Also the use of five or more days as a measure for lost-time claims while reducing the burden of the Workers' Compensation (this period of time-off is covered by the employer), underestimates the effect of injuries on agricultural industries. This may be of a greater burden to agricultural industries depending on time of year (shearing time, planting crops, etc) or for those industries which have ongoing tasks such as milking and feeding that can not wait till the next day.

The cost of compensation should be used with caution when measuring the cost of workplace injury and disease (Cole and Foley). Cost data is also prone to be an underestimation of the total costs, because this information also needs to be updated as the case progresses [259].

A limitation of this study is the course categories used for some items, as some of the detail of the injury and injury circumstances is lost in the grouping. This effect was more of a problem for some items (agents and bodily location) than for others (occupation and mechanism). Unfortunately, with the large amount of information available, if the more detailed categories were used, many of the tables would have been very difficult to interpret.

Another limitation is the lack of long-term illnesses (such as hearing loss and pesticide poisoning), and the lack of disease such as farmers lung, organic dust toxic syndrome, respiratory illness from grain dust, and other farm-related problems involving inhalation of toxic dusts and moulds. These conditions have been found to have a significant impact of the farmers work capacity as well as the costs involved in treating these problems [285]. While Workers' Compensation data represents younger farmers, collection of this information would help in early identification and prevention.

6.5.8.1 Calculation of Rates

While providing a better method of comparing risk, the calculation of rates is limited by the availability of appropriate denominator data. Initially, it was planned for rates to be calculated for each individual agricultural industry. Unfortunately, the denominator data (labour force information[265]) were only available at the level of grouped agricultural industries. It was also planned that age-adjusted rates be calculated, because there are differences in the age distribution between industries and occupations. This would be particularly helpful when comparing Workers' Compensation information with other sources. Unfortunately this information was not available for NSW at the agricultural grouped level.

As seen in some of the rates there are some large variation in the rates from quarter to quarter and years to year, while the number of people claiming Workers' Compensation has remained reasonably consistent over the same period. This is due to fluctuations in the denominator used, there is no explanation why the denominator fluctuated so widely. The fluctuations are seen in those industries with smaller number of employees and may be a result of the survey technique used by the ABS.

6.6 Conclusion

Workers' compensation data is a valuable source of information about the circumstances surrounding injuries to people while working in agriculture. In NSW approximately half of all people working in agriculture are covered by the Workers' Compensation scheme. The cost per year to the scheme for injuries to people in agriculture is on average $19.4 million per annum. Information collected as part of the Workers' Compensation scheme allows for the development and monitoring of programs targeted at preventing people on farms form being injured.

6.7 Summary – NSW Workers' Compensation reported injury in Agricultural industries

1. An extensive examination of accepted Workers' Compensation claims for agricultural industries in NSW has been undertaken. This study examines claims accepted by NSW WorkCover between 1 July 1992 and 30 June 2001 for persons who suffered an injury or disease while working in an agricultural industry.
2. The information provided was taken to be accurate as NSW WorkCover, however it was checked for inconsistencies. There were no cases where the coding was not consistent with the coding framework 'Type of occurrence'. NSW WorkCover undertakes a system of data management to ensure the data provided is as accurate as possible [259].
3. There were 24,332 Workers' Compensation claims between 1 July 1992 and 30 June 2001 in agricultural industries in New South Wales (average of 2,704 per annum). Of these the majority of people injured were males (82.4%).
4. The incidence of injury / disease in Agriculture per quarter varied from 7.2 per 1,000 workers to 20.3 per 1,000 workers. The incidence of injury / disease in Agriculture per annum varied from 37.0 per 1,000 workers to 72.6 per 1,000 workers.
5. The rate per 1,000 agricultural establishments varied from 54.3 to 76.5.
6. The majority of people seeking Workers' Compensation claims were aged less than 40 years. The three most common age groups seeking Workers' Compensation were:
   a. 20-24 years (15.1%)
   b. 25-29 years (14.4%)
   c. 30-34 years (13.6%)
7. The total cost of claims over the study period was $258 million, an average of $28.7 million per annum. The average cost of claims was $10,880 ranging from $2.60 to $840,324.53. The top five agricultural industries with the highest average claims were:
   a. Grain, sheep and beef cattle ($22,531)
   b. Sheep farming ($17,975)
   c. Grain-sheep and grain-beef cattle farming ($15,698)
   d. Cut flower and flower seed growing ($14,166)
   e. Vegetable growing ($13,550)
8. The average time lost per claim was 9.2 weeks for the WorkCover reported information and 8.9 weeks for the recalculated time lost. The top five industries with the highest average recalculated time lost were:

    a. Crop and plant growing NEC (11.8 weeks)
    b. Plant nurseries (11.4 weeks)
    c. Vegetable growing (11.1 weeks)
    d. Poultry farm (meat) (10.2 weeks)
    e. Dairy cattle farming (9.6 weeks)
9. There were 81 deaths over the study period, 3,158 permanent disability claims and 21,093 temporary disability claims.
10. There were 183 different occupations classified by the Australia Standard Classification of Occupations (ASCO). The top four occupations making Workers' Compensation claims from Agricultural industries were:
    a. Farm hands and assistants (41.3%)
    b. Farmers and farm managers (13.4%)
    c. Other trade assistants and factory hands (11.7%)
    d. Sheep shearers (7.9%)
11. The three most common bodily locations were upper limbs (34.7%), trunk (24.2%) and lower limbs (22.4%). The three most common nature of injury/disease were sprains and strains (41.9%), open wound not involving amputation (16.9%) and contusion and crushing (16.9%). The rank of top 5 nature of injury/disease by bodily location were:
    a. Sprains and strain of the trunk (18.4%)
    b. Open wound of upper limbs (10.3%)
    c. Sprains and strains of the lower limbs (10.2%)
    d. Sprain and strains of the upper limbs (10.0%)
    e. Fracture of the upper limbs (4.3%)
12. The three most common mechanisms of injury were being hit by a moving object (28.0%), body stressing (27.6%) and falls, trips and slips of a person (18.6%). The three most common grouped agencies were non-powered hand tools, appliances and equipment (19.7%). The rank top five mechanism by grouped agencies were:
    a. Fall, trips and slips of a person by environmental agencies (9.0%)
    b. Being hit by moving object by animals, human and biological agencies (8.6%)
    c. Body stressing by non-powered hand tools, appliances and equipment (7.5%)
    d. Body stressing by animals, human and biological agencies (6.4%)
    e. Being hit by moving objects by material and substances (5.2%)
13. The rank top five agents were:
    a. Sheep, goats (5.3%)

b. Ferrous and non-ferrous metals (5.0%)
c. Crates, cartons, boxes, etc (4.5%)
d. Horses, donkeys, mules (3.5%)
e. Cows, steers, cattle, bulls, buffalo (3.5%)

14. The number of claims still pending per annum increased the closer they came to the final date from which information was available.
15. Workers' Compensation data provides information about those cases where employees working in agricultural are injured and some information about the circumstances immediately prior to being injured. Information that is provided includes the agent involved, the general activity, industry in which they are employed, occupation, injury sustained, cost and time off work. Information over time is reasonable robust and can be used to establish rates. The accuracy of the information is unknown; however WorkCover does have a quality assurance system in place to check the data.
16. The information is only relevant for those people employed in agricultural industries (approximately 50% of the workforce), it is however reasonably robust for the surveillance of people injured while working in agricultural industries over time.

Chapter 7 Deaths of Male 'Farmers and Farm Managers' and 'Agricultural Labourers and related Workers' due to injury: A 10 year population Study

> The grand aim of all science is to cover the greatest number of empirical facts by logical deduction from the smallest number of hypotheses or axioms. - Albert Einstein

7.1 Introduction

Studies about agricultural injuries in Australia and overseas have predominantly used information about fatalities to explore the issues. This has primarily been due to the availability of detailed information about deaths, the relative ease of access to this information, and almost complete case ascertainment [66].

In Australia there are several organisations which collect information about deaths. The Australia Bureau of Statistics (ABS) collects all deaths (both natural and non-natural) as part of their regular reporting of deaths in Australia [286]. Work Health Authorities in Australia also collect work-related deaths, although there has been some contention as to the completeness of this information [14 159]. The National Coroners Information System (NCIS) collects all deaths and subsequent information from Coroners, but has only been in existence since 2000 [287]. There are also a number of other authorities and organisations who collect information about specific types of death, such as state and territory electricity commissions for deaths due to electrocution and the Royal Life Saving Society Australia for drowning deaths [288].

The most comprehensive examination of agricultural fatalities undertaken to date in Australia was by Franklin et al who examined all fatalities that occurred on Australian farms or were associated with agricultural commodities production between 1989 and 1992 from coronial records kept by each State and Territory Coroner [14]. The collection of coronial information is time consuming, and until the development of the NCIS was difficult to access. The NCIS has improved the access to coronial records since its inception in NSW in July 2000 [287]. There are still a number of issues that need to be addressed in the NCIS system:

- delay in the information being available (i.e. full information about a case is not available until the coronial investigation is complete);

- completeness of the information that can be accessed (i.e. currently only police, coroners and some autopsy reports are on-line); and
- information over long time frames (although this will improve as more cases are entered over time).

This Thesis uses information from the Australian Bureau of Statistics to examine unintentional deaths of ‘farmers and farm managers’ and ‘agricultural labourers and related workers’, that were registered in Australia between 1 January 1991 and 31 December 2000.

7.2 Aims

1. To critically examine the utility of the ABS Deaths Data for the surveillance of unintentional injury fatalities of farmers and farm workers.
2. To describe frequency of unintentional fatalities of farmers and farm workers using ABS Deaths Data.
3. To define priority areas for farm injury prevention based on the analysis of unintentional fatalities of farmers and farm workers using ABS Deaths Data.

7.3 Methods

Information about a deceased person is collected by the Australian Bureau of Statistics (ABS) via the Medical Certificate of Cause of Death and the Death Information form, or its equivalent in each State and Territory. The Medical Certificate of Death is completed by the attending medical practitioner and/or the coroner and the Death Information form is usually completed by the undertaker. The forms are then passed to the Registrar of Births, Deaths and Marriages in the State or Territory where the death occurred. This information is then passed onto the ABS, usually in an electronic format. [286]

There were 1,254,613 deaths registered by the ABS for Australia between 1 January 1991 and 31 December 2000 of which 442,326 (35.3%) were registered in NSW. Of the deaths registered in NSW, those where the occupation of the person was ‘Farmers and Farm Manager’ (Code = 1400 or 1410 – retired) or ‘Agricultural Labourers and Related Workers’ (Code = 8200 or 8210 – retired), were selected. Of these 18,454 deaths, 15,273 were ‘farmers and farm managers’, 550 were ‘retired farmers and farm managers’, 2,453 were ‘agricultural labourers and related workers’ and 178 were ‘retired agricultural labourers and related workers’ (Table 89).

Those 1,021 cases classified as ‘injury’ in Table 89 (i.e. where the cause of death was defined as an external cause of death) were selected for further investigation in this Chapter.

Occupation is collected on the Death Information form and is automatically coded to the Australian Standard Classification of Occupation (ASCO) [3]. Additional supplementary codes are used to cover children, students and other persons not in the labour force [289]. There have been a number of issues identified that impact on the quality of occupation information:

- the familiarity of the person completing the information with the deceased person;
- the familiarity of the person completing the form with the deceased persons’ working life;
- the wording of the questions; and
- the layout of the forms used. [289].

Table 89 Distribution of causes of death by year of registration for 'farmers and farm managers' and 'agricultural labourers and related workers'

Cause of Death Grouped	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total	%
Infectious and Parasitic Disease	13	8	13	11	14	16	15	13	20	13	136	0.7
Neoplasms	428	461	461	471	479	498	475	492	537	481	4,783	25.9
Endocrine, nutritional, metabolic diseases and immunity disorders	51	44	39	52	49	39	47	53	43	48	465	2.5
Disease of the blood and blood-forming organs	9	9	8	4	5	7	5	3	10	8	68	0.4
Mental and behavioural disorders	14	27	25	44	41	33	32	36	38	36	326	1.8
Diseases of the nervous and sense organs	22	35	45	33	51	45	33	38	51	47	400	2.2
Diseases of the circulatory system	853	843	873	898	866	889	850	832	820	782	8,506	46.1
Diseases of the respiratory system	157	185	147	162	153	179	229	191	133	163	1,699	9.2
Diseases of the digestive system	53	53	59	57	41	53	59	57	51	47	530	2.9
Disease of the Genitourinary system	25	36	35	37	31	39	38	31	37	32	341	1.8
Disease of the skin and subcutaneous tissue	1	3	2	4	2	2	2	1	4	2	23	0.1
Disease of the musculoskeletal system and connective tissue	5	9	12	9	12	12	9	13	9	12	102	0.6
Congenital abnormalities	1	2	0	1	1	1	1	3	2	1	13	0.1
Symptoms, signs and ill-defined conditions	3	2	6	8	5	3	4	4	5	1	41	0.2
Injury	94	100	122	104	93	87	118	98	106	99	1,021	5.5
Total	**1,729**	**1,817**	**1,847**	**1,895**	**1,843**	**1,903**	**1,917**	**1,865**	**1,866**	**1,772**	**18,454**	**100.0**

The quality of occupational information for females has been found to be poor and as such only male deaths will be considered [289].

As this Thesis is an examination of those injuries that occur on farms or while employed (either for pay or in-kind) in an agricultural business, those people whose occupation was recorded as retired were excluded. This included nine 'farmers and farm managers' and six 'agricultural labourers and related workers', leaving 952 deaths over the study period.

ABS information is collected by year of registration; however, not all deaths that occur in a particular year are registered in the same year, which is an issue for those deaths occurring towards the end of the year.

7.3.1 Information available in the data

Information collected in the ABS deaths information and used in this study includes: age; alcohol flag (1994-1998); cause of death; state of residence; date of death; date of registration; gender; state of usual residence; drugs flag (1994-1998); and marital status.

Information about alcohol and other drugs is only available for the registration years 1994-1998.

7.3.2 Calculations

Information about the number of 'farmers and farm managers' and the number of 'agricultural labourers and related workers' in Australia is not readily available, therefore the number employed in agriculture is used as a proxy.

The incidence rate of occupational injuries and diseases is the number of occurrences per 1,000 wage and salary earners [80].

Employed persons information is provided by the ABS via their labour force statistics by quarter, however only the August quarter was used to calculate rates [265]. Information is not available for industry at the subdivision level by gender and age [2]. For the purposes of calculating rates, employees were used as the denominator for 'agricultural labourers and related workers' and employers and own account workers were used as the dominator for 'farmers and farm managers', while contributing family members were excluded (Table 90). A separate rate for all males was calculated.

The frequency rate of occupational injuries and diseases is the number of occurrences per 1,000,000 hours worked [80]. Hours worked is calculated by the ABS of Statistics in the labour force survey (Table 91) [265]. It refers to the number of hours worked in a week; this number is then multiplied by 13 to obtain the approximate number of hours worked per quarter.

Calculation of confidence intervals (CI) was undertaken using the standard error of the mean. Comparisons of the means were undertaken using ANOVA.

Table 90 Number of Male Employed persons ('000) in Agriculture by employment status [265]

Year	Employee	Employer	Own account worker	Contributing family worker	Total
1991	30	9	36	3	78
1992	23	7	38	3	71
1993	26	12	36	5	79
1994	21.7	5	38.7	5.8	71.2
1995	25.1	8.6	28.1	4.5	66.3
1996	24.1	8.6	27.9	6.5	67.1
1997	23.3	7.9	28.4	3.1	62.7
1998	22.1	7.4	37.8	1.6	68.9
1999	24.2	7.5	42.5	2.3	76.5
2000	31	11.8	25	4.5	72.3

Table 91 Number of hours worked ('000) per annum by people working in Agriculture [265]

Year	Employee	Employer	Own account worker	Contributing family worker
1991	69,641	27,664	94,497	4,836
1992	61,516	24,583	106,405	4,472
1993	52,975	28,860	102,908	9,490
1994	52,793	20,928.7	97,377.8	9,509.5
1995	52,500.5	20,883.2	96,388.5	7,944.3
1996	52,393.9	23,995.4	90,496.9	7,325.5
1997	72,372.3	23,979.8	94,848	5,800.6
1998	64,366.9	25,083.5	103,810.2	48,63.3
1999	71,834.1	26,163.8	106,667.6	5,265
2000	73,853	29,805.1	85,637.5	55,34.1

An overall rate of fatalities per annum by agricultural establishments was also calculated. Table 92 shows the denominator data for each year of study.

Table 92 Establishments with agricultural activity, NSW

Year	Establishments with agricultural activity
1991	36,821
1992	44,443
1993	43,227
1994	42,817
1995	42,287
1996	42,497
1997	42,758
1998	42,496
1999	43,302
2000	43,654

Note: 1991 is based on Estimated Value of Agricultural Output (EVAO) of $20,000, all other years are based on $5,000. References [54 264]

7.3.3 Coding

Farmsafe Australia (FSA) has developed a method to categorise External Cause Codes (E-Codes) to examine trends over time [76]. The FSA Codes were used in this chapter. However as they exclude some E-codes, the additional missing E-codes were included but provided separately from the FSA codes [77]. The FSA selection of E-codes appears in the top section of the tables and the other E-Codes appear in the bottom section.

Table 93 Farmsafe Australia e-code groups with additional codes

ICD9 E-code	Description	ICD10 E-codes
Farmsafe Australia E-codes		
E820-829	Motor vehicle non traffic accident and other road vehicle accidents	
	Motorcycle	V20-29-.0,.1,.2
	Other vehicles	V01-09-.0 V10-19-.1,.2 V30-39-.0,.1,.2,.3 V40-49-.0,.1,.2,.3 V50-59-.0,.1,.2,.3 V60-69-.0,.1,.2,.3 V70-79-.0,.1,.2,.3
	Animal Ridden	V80
E862	Poisoning by petroleum products	X46, Y16
E863	Poisoning by Agricultural Chemicals	X48, Y18
E864	Accidental poisoning by corrosives and caustics, not elsewhere classified	X49
E866-869	Poisoning by other solids, gases and liquids	X40-45, X47, Y10-Y15, Y17, Y19
E891-899*	Fire and flames	X00-09, Y26
E905	Venomous animal and plants	W60, X20-29
E906.0	Dog bites	W54
E906.8	Injury by other animal	W53, W55-59
E919.0	Agricultural machinery	W30
E919.1-.9	Accidents cause by machinery excluding agricultural	W31
E920	Accidents cause by cutting and piercing instruments or objects	W25, W26, W27, W28, Y28
E922	Firearms	W32, W34, Y22, Y24
Additional E-code Groups		
E810-819	Motor vehicle accidents	V01-09- .1,.9 V10-19-.3,.4,.5,.9 V20-29-.3,.4,.5,.9 V30-39-.4,.5,.6,.7,.9 V40-49-.4,.5,.6,.7,.9 V50-59-.4,.5,.6,.7,.9 V60-69-,.4,.5,.6,.7,.9 V70-79-.4,.5,.6,.7,.9 V81-89, Y32, Y85
E850-865**	Poisoning	
E880-E888	Falls	W00-W19, Y30
E900-909[#]	Natural & Environmental Factors	W85-99, X30-39
E910	Drowning	V90, V92, W65-74, Y21
E870-879 & E930-949[a]	Complication of medical and surgical care	Y40-84, Y88
E950-959 [a]	Suicide	X60-84, Y87
E960-E969 [a]	Homicide	X85-Y09
	Other E-code[##]	V91, V93, V94 V95-97 W20, W21, W22, W23, W24, W29, W35-49 W50-52, W64, W74-84 X10-19 X50-59, Y20, Y25, Y27, Y29, Y31, Y33-34, Y35-36, Y86, Y89

*Excluding E893.0, E895.0-9 and E898.0 (if included are in other e-codes). ** Excludes E863.0-9, E864.0-9
[#] E905.0-9, E906.0 & E906.8. [##] Includes all E-codes not elsewhere represented. [a] These codes have been added to the Farmsafe Australia Codes to identify intentional incidents or complications due to medical care.

7.4 Results

There were 952 males whose occupation was either ‘farmer and farm manager’ or ‘agricultural labourer and related worker’ who were not retired and whose death due to injury was registered between January 1991 and December 2000. There were 81 (8.5%) deaths which were registered in the year following death (Table 94). The number of deaths not registered in the year they died has been decreasing over time, with an average of 8.1 deaths (95% CI: 6.1-10.1) for the 10 years of study. There were 10.2 deaths per annum on average for the first five years and six deaths per annum for the last six years. There were on average 95 deaths per annum during the study period.

Table 94 Year of death by year of registration, ‘farmer and farm manager’ and ‘agricultural labourers and related workers’.

Year of Deaths	Year of Registration											
	1991	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**Total**	**%**
1990	8										8	0.8
1991	81	14									95	10.0
1992		77	12								89	9.3
1993			99	7							106	11.1
1994				90	10						100	10.5
1995					79	7					86	9.0
1996						74	8				82	8.6
1997							106	2			108	11.3
1998								91	8		99	10.4
1999									89	5	94	9.9
2000										85	85	8.9
Total	**89**	**91**	**111**	**97**	**89**	**81**	**114**	**93**	**97**	**90**	**952**	**100.0**

Of the 952 deaths, ‘farmers and farm managers’ comprised nearly three quarters (72.8%) of the fatalities (Table 95). The number of deaths per annum of ‘farmers and farm managers’ ranged from 64 in 2000 (this is likely to be an underestimation due to year of registration issue), to 76 in 1993 with an average of 69 deaths per annum. The number of deaths of ‘agricultural labourers and related workers’ ranged from 16 in 1996 to 34 in 1998 with an average of 26 deaths per annum. (Table 95)

Table 95 Number of fatalities for 'farmers and farm managers' and 'agricultural labourers and related workers' by year (year of registration 1991-2000)

Year of death	Farmers and Farm Managers	Agricultural labourers and Related Workers	Total
	N	N	N
1990	5	3	8
1991	69	26	95
1992	66	23	89
1993	76	30	106
1994	73	27	100
1995	68	18	86
1996	66	16	82
1997	75	33	108
1998	65	34	99
1999	66	28	94
2000	64	21	85
Total	**693**	**259**	**952**

The rate of deaths per 1,000 establishments was calculated for all 'farmers and farm managers' and 'agricultural labourers and related workers' deaths. The rate ranged from 1.95 per 1,000 establishments in 2000 (this will be a slight under estimation due to year of registration issue) to 2.58 per 1,000 in 1991 (Table 96, Figure 47).

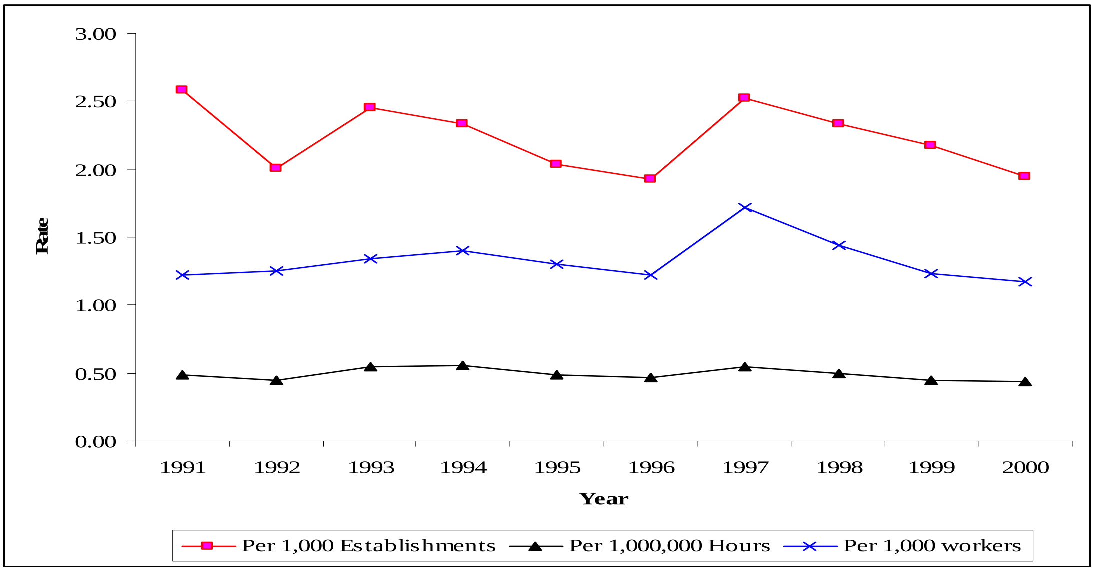
The rate of deaths per 1,000,000 hours worked and per 1,000 workers was calculated for 'farmers and farm managers', 'agricultural labourers and related workers' and both combined. 'Agricultural labourers and related workers' had a lower rate than that of 'farmers and farm managers'. Overall the rate per 1,000,000 hours worked ranged from 0.44 in 2000 to 0.55 in 1994 and the rate per 1,000 workers ranged from 1.18 in 2000 to 1.72 in 1997. (Table 96, Figure 47)

Table 96 Rate of death for 'farmers and farm managers' and 'agricultural labourers and related workers' by agricultural establishments, hours worked and number employed (year of registration 1991-2000)

Year	Per 1,000 Establish-ments	Per 1,000,000 Hours			Per 1,000 workers		
		Farmers and Farm Managers	Agricultural labourers and Related Workers	Total	Farmers and Farm Managers	Agricultural labourers and Related Workers	Total
1991	2.58	0.56	0.37	0.48	1.53	0.87	1.22
1992	2.00	0.50	0.37	0.45	1.47	1.00	1.25
1993	2.45	0.58	0.57	0.55	1.58	1.15	1.34
1994	2.34	0.62	0.51	0.55	1.67	1.24	1.40
1995	2.03	0.58	0.34	0.48	1.85	0.72	1.30
1996	1.93	0.58	0.31	0.47	1.81	0.66	1.22
1997	2.53	0.63	0.46	0.55	2.07	1.42	1.72
1998	2.33	0.50	0.53	0.50	1.44	1.54	1.44
1999	2.17	0.50	0.39	0.45	1.32	1.16	1.23
2000	1.95	0.55	0.28	0.44	1.74	0.68	1.18

Overall there has been very little change in the number or rate of fatalities per annum (Figure 47).

Figure 47 Rate of death for 'farmers and farm managers' and 'agricultural labourers and related workers' by agricultural establishments, hours worked and number employed (year of registration 1991-2000)



The three most common external cause groups were ‘motor vehicle accidents’ (22.0%), ‘suicides’ (27.7%) and falls (12.9%) (Table 97).

Table 97 External cause groups by year of death for ‘farmers and farm managers’ and ‘agricultural labourers and related workers’ (year of registration 1991-2000)

E-code	Description	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total	%
E820-829	Motorcycle	0	1	1	1	1	0	0	4	1	2	0	11	1.2
	Other vehicles	1	0	5	2	1	0	3	1	4	8	5	30	3.2
	Animal Ridden	1	0	0	0	2	1	0	1	0	0	0	5	0.5
E863	Poisoning by Agricultural Chemicals	0	0	0	0	0	0	0	0	0	1	0	1	0.1
E866-869	Poisoning by other solids, gases and liquids	0	0	0	0	2	0	1	0	0	0	0	3	0.3
E891-899*	Fire and flames	1	2	2	0	3	0	0	2	1	3	1	15	1.6
E905	Venomous animal and plants	0	1	0	1	0	1	0	1	0	1	0	5	0.5
E906.8	Injury by other animal	0	0	0	0	1	1	1	0	0	0	0	3	0.3
E919.0	Agricultural machinery	0	9	7	3	5	4	2	3	1	2	2	38	4.0
E919.1-.9	Accidents caused by machinery excluding agricultural	0	1	2	1	0	0	2	0	3	1	0	10	1.1
E922	Firearms	0	3	2	0	0	1	0	1	0	1	2	10	1.1
FSA Total		**3**	**17**	**19**	**8**	**15**	**8**	**9**	**13**	**10**	**19**	**10**	**131**	**13.8**
E810-819	Motor vehicle accidents	1	28	18	22	26	16	15	24	27	13	19	209	22.0
E850-865**	Poisoning	0	1	0	0	0	2	1	1	3	1	1	10	1.1
E880-E888	Falls	1	10	7	12	21	16	14	15	14	8	5	123	12.9
E900-909[#]	Natural & Environmental Factors	0	0	0	0	1	1	0	0	0	0	0	2	0.2
E910	Drowning	0	2	2	5	2	0	2	4	5	4	2	28	2.9
E870-879 & E930-949[a]	Complication of medical and surgical care	0	2	2	0	1	0	1	1	1	1	1	10	1.1
E950-959 [a]	Suicide	2	18	29	34	17	31	22	26	25	31	29	264	27.7
E960-E969 [a]	Homicide	0	0	2	3	3	2	2	0	2	4	1	19	2.0
	Other E-code[##]	1	17	10	22	14	10	16	24	12	13	17	156	16.4
Total		**8**	**95**	**89**	**106**	**100**	**86**	**82**	**108**	**99**	**94**	**85**	**952**	**100.0**

*Excluding E893.0, E895.0-9 and E898.0 (if included are in other e-codes). ** Excludes E863.0-9, E864.0-9
[#] E905.0-9, E906.0 & E906.8. [##] Includes all E-codes not elsewhere represented. [a] These codes have been added to the Farmsafe Australia Codes to identify intentional incidents or complications due to medical care.

7.4.1 Unintentional Fatalities

Unintentional fatalities are those deaths where there was no intent (i.e. not suicide or homicide) and were not caused by complications of medical care. There were 659 unintentional fatalities registered in NSW where the occupation was ‘farmers and farm managers’ and ‘agricultural labourers and related workers’ between 1 January 1991 and 31 December 2000, an average of 65 deaths per annum. ‘Farmers and farm managers’ comprised three quarters (74.7%) of the unintentional fatalities.

Table 98 Number of unintentional fatalities for ‘farmers and farm managers’ and ‘agricultural labourers and related workers’ by year (year of registration 1991-2000)

Year of death	Farmers and Farm Managers	Agricultural Labourers and Related Workers	Total
	N	N	N
1990	5	1	6
1991	57	18	75
1992	40	16	56
1993	47	22	69
1994	60	19	79
1995	45	8	53
1996	47	10	57
1997	62	19	81
1998	47	24	71
1999	42	16	58
2000	40	14	54
Total	**492**	**167**	**659**

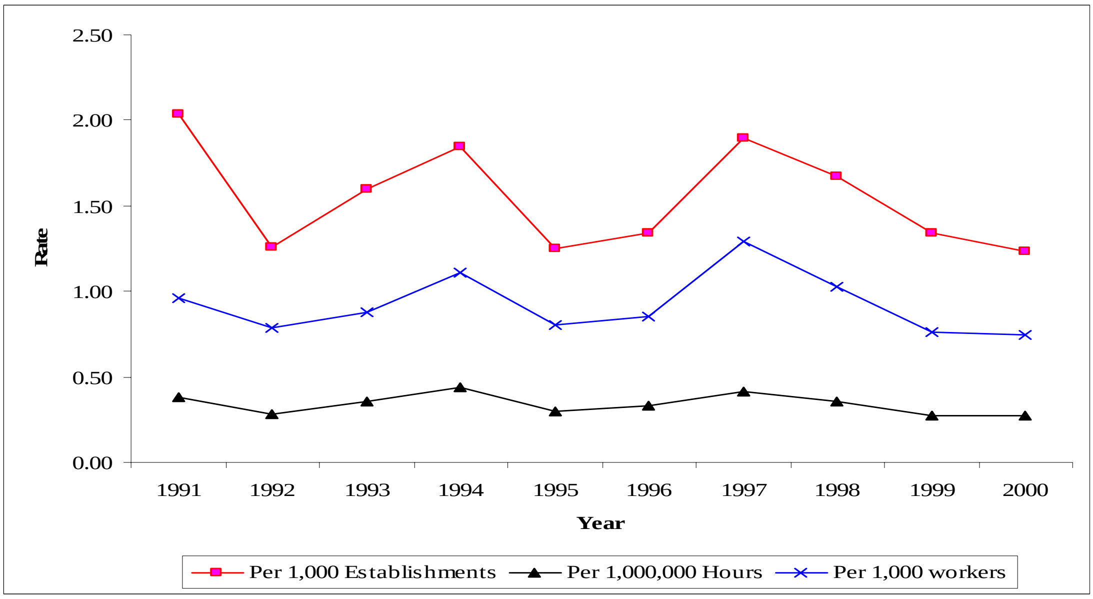
The rate of deaths per 1,000 establishments was calculated for unintentional ‘farmers and farm managers’ and ‘agricultural labourers and related workers’ deaths. The rate ranged from 1.24 per 1,000 establishments in 2000 (this will be an under estimation due to year of registration issue) to 2.04 per 1,000 in 1991. There are three years (1991, 1994 and 1997) where there is a spike in the number of deaths (Table 99, Figure 48).

The rate of unintentional deaths per 1,000,000 hours worked and per 1,000 workers was calculated for ‘farmers and farm managers’, ‘agricultural labourers and related workers’ and both combined. ‘Agricultural labourers and related workers’ had a lower rate than ‘farmers and farm managers’. Overall the rate per 1,000,000 hours worked ranged from 0.28 in 1999 to 0.44 in 1994 and the rate per 1,000 workers ranged from 0.75 in 2000 to 1.29 in 1997. (Table 99)

Table 99 Unintentional rate of death for 'farmers and farm managers' and 'agricultural labourers and related workers' by agricultural establishments, hours worked and number employed (year of registration 1991-2000)

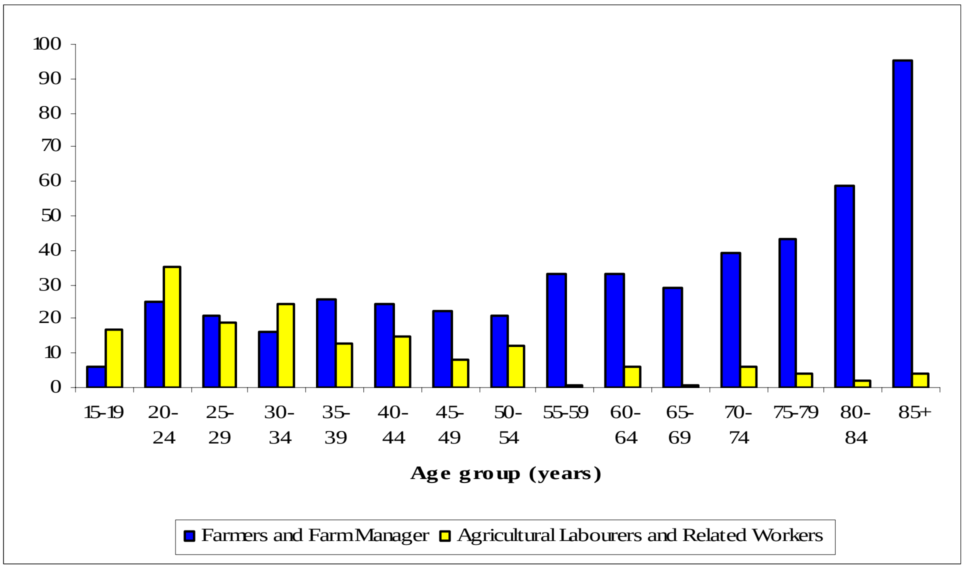
Year	Per 1,000 Establish-ments	Per 1,000,000 Hours			Per 1,000 workers		
		Farmers and Farm Managers	Agricultural labourers and Related Workers	Total	Farmers and Farm Managers	Agricultural labourers and Related Workers	Total
1991	2.04	0.47	0.26	0.38	1.27	0.60	0.96
1992	1.26	0.31	0.26	0.28	0.89	0.70	0.79
1993	1.60	0.36	0.42	0.36	0.98	0.85	0.87
1994	1.85	0.51	0.36	0.44	1.37	0.88	1.11
1995	1.25	0.38	0.15	0.30	1.23	0.32	0.80
1996	1.34	0.41	0.19	0.33	1.29	0.41	0.85
1997	1.89	0.52	0.26	0.41	1.71	0.82	1.29
1998	1.67	0.36	0.37	0.36	1.04	1.09	1.03
1999	1.34	0.32	0.22	0.28	0.84	0.66	0.76
2000	1.24	0.35	0.19	0.28	1.09	0.45	0.75

Figure 48 Unintentional rate of death for 'farmers and farm managers' and 'agricultural labourers and related workers' by agricultural establishments, hours worked and number employed (year of registration 1991-2000)



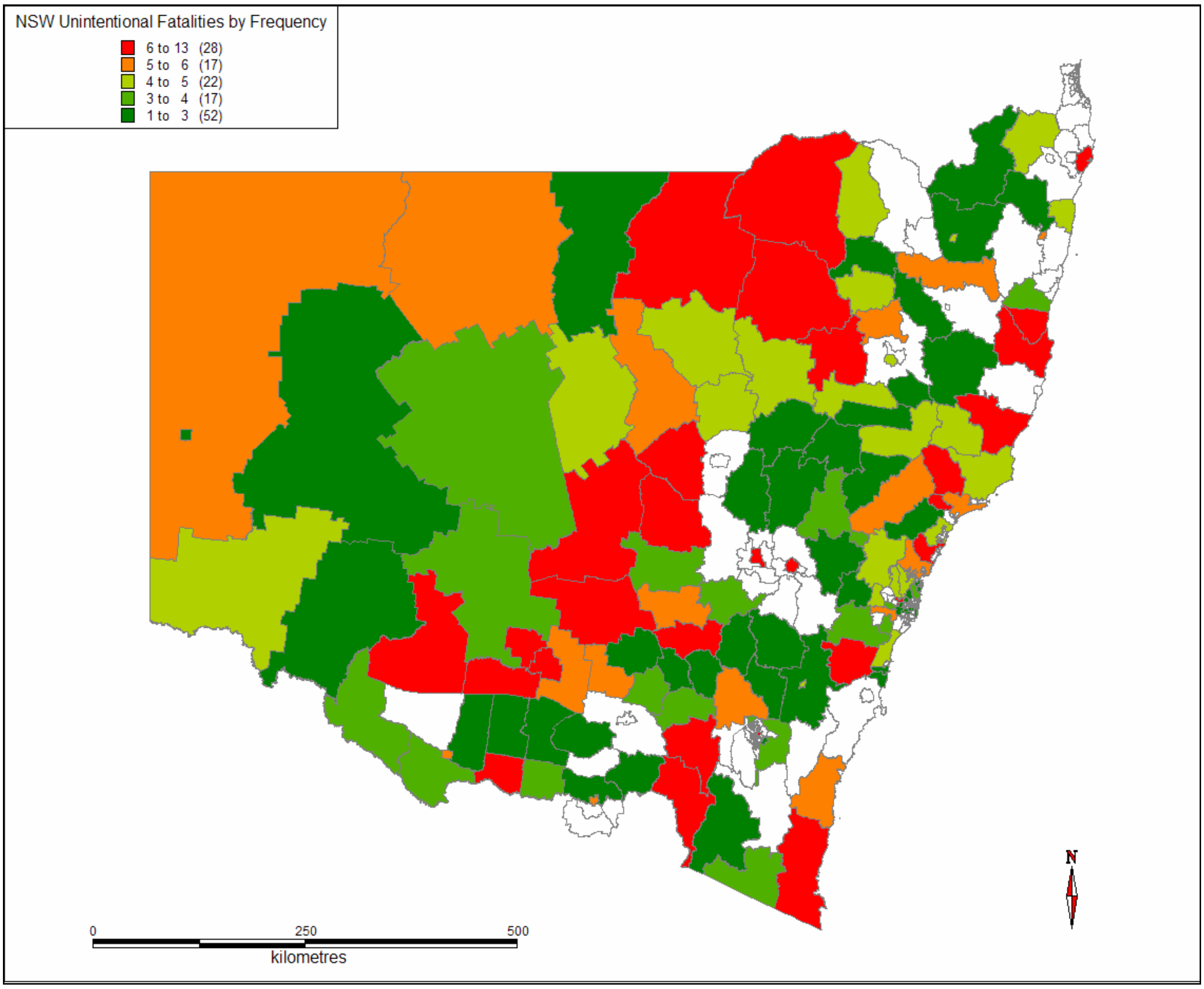
The mean age overall was 56.8 years (SD=24.0), however for 'farmers and farm managers' mean age was 63.5 years (SD=22.1)) which was significantly higher (P<0.0001) than 'agricultural labourers and related workers' (mean age = 37.2 years; SD18.0). The number of unintentional fatalities by age group for ‘farmers and farm managers’ increased as age increased, whereas the number of unintentional fatalities by age group for ‘agricultural labourers and related workers’ decreased as age increased. Approximately one quarter (25.5%) of deaths was among people aged over 75 years (Figure 49). These finding are for the raw numbers and due to there being no information of number of ‘farmers and farm managers’ and ‘agricultural labourers and related workers’ employed by age group for NSW it is not possible to provide age specific rates.

Figure 49 Age by occupation status for ‘farmers and farm managers’ and ‘agricultural labourers and related workers’, unintentional fatalities (year of registration 1991-2001) (N=952)



There were 29 unintentional fatalities of ‘farmers and farm managers’ and ‘agricultural labourers and related workers’ who did not live in NSW. The fatalities that occurred in NSW were distributed across NSW, however due to changes in coding (i.e. some Statistical Local Areas (SLA) no longer exist), there appears to be areas with no fatalities (Figure 50).

Figure 50 Usual area of residence for NSW 'farmers and farm managers' and 'agricultural labourers and related workers' unintentionally fatally injured (year of registration 1991-2000)



There were some minor differences in the external cause groups between 'farmers and farm managers' and 'agricultural labourers and related workers'. These were:

- agricultural machinery, firearms, and falls (P<0.0001) were more common in 'farmers and farm managers'
- fire and flames, accidents caused by machinery excluding agricultural, motor vehicle accidents, poisoning, and drowning (P<0.01) were more common in 'agricultural labourers and related workers'. (Table 100)

Falls were statistically more common in 'farmers and farm manager' (P<0.0001) and drowning was statistically more common in 'agricultural labourers and related workers' (P<0.01). The rest were not statistically different.

Table 100 External cause groups by occupation for 'farmers and farm managers' and 'agricultural labourers and related workers', unintentional fatalities (year of registration 1991-2000)

E-code	Description	Farmers and Farm Managers		Agricultural Labourers and Related Workers		Total	
		N	%	N	%	N	%
E820-829	Motorcycle	8	1.6	3	1.8	11	1.7
	Other vehicles	23	4.7	7	4.2	30	4.6
	Animal Ridden	5	1.0	0	0.0	5	0.8
E863	Poisoning by Agricultural Chemicals	1	0.2	0	0.0	1	0.2
E866-869	Poisoning by other solids, gases and liquids	2	0.4	1	0.6	3	0.5
E891-899*	Fire and flames	6	1.2	9	5.4	15	2.3
E905	Venomous animal and plants	4	0.8	1	0.6	5	0.8
E906.8	Injury by other animal	3	0.6	0	0.0	3	0.5
E919.0	Agricultural machinery	32	6.5	6	3.6	38	5.8
E919.1-.9	Accidents cause by machinery excluding agricultural	5	1.0	5	3.0	10	1.5
E922	Firearms	9	1.8	1	0.6	10	1.5
FSA Total		***98***	***19.9***	***33***	***19.8***	***131***	***19.9***
E810-819	Motor vehicle accidents	146	29.7	63	37.7	209	31.7
E850-865**	Poisoning	4	0.8	6	3.6	10	1.5
E880-E888	Falls	111	22.6	12	7.2	123	18.7
E900-909#	Natural & Environmental Factors	2	0.4	0	0.0	2	0.3
E910	Drowning	15	3.0	13	7.8	28	4.2
	Other E-code##	116	23.6	40	24.0	156	23.7
Total		**492**	**100.0**	**167**	**100.0**	**659**	**100.0**

Information about alcohol was known for 339 unintentional fatalities. Alcohol was identified as a factor in the deaths of the 8.6% of cases. There was no difference between the proportion of 'farmers and farm managers' and 'agricultural labourers and related workers' identified as having alcohol in their system (Table 101). The average age of those where alcohol was present was 36.3 years (SD=14.2) which was significantly lower (P<0.0001) than those who did not (average age = 59.9 years, SD=23.8).

Table 101 Alcohol by 'farmers and farm managers' and 'agricultural labourers and related workers', unintentional fatalities (year of registration 1991-2000)

Alcohol-related deaths	Farmers and Farm Managers		Agricultural Labourers and Related Workers		Total	
	N	%	N	%	N	%
No	241	93.1	69	86.3	310	91.4
Yes	18	6.9	11	13.8	29	8.6
Total	**259**	**100.0**	**80**	**100.0**	**339**	**100.0**

Information about other drugs was known for 339 unintentional fatalities, of these 4.7% of people had drugs (other than alcohol) in their system. 'Agricultural labourers and related workers' were slightly more likely to have other drugs in their system than 'farmers and farm managers', although this was not significant (P=0.011) (Table 102). The average age of those who had other drugs in their system was 41.5 years (SD=18.1), significantly lower (P<0.01) than those who did not (average age = 58.7 years, SD=24.1).

Table 102 Other drugs by 'farmers and farm managers' and 'agricultural labourers and related workers', unintentional fatalities (year of registration 1991-2000)

Other drugs	Farmers and Farm Managers		Agricultural Labourers and Related Workers		Total	
	N	%	N	%	N	%
No	251	96.9	72	90.0	323	95.3
Yes	8	3.1	8	10.0	16	4.7
Total	**259**	**100.0**	**80**	**100.0**	**339**	**100.0**

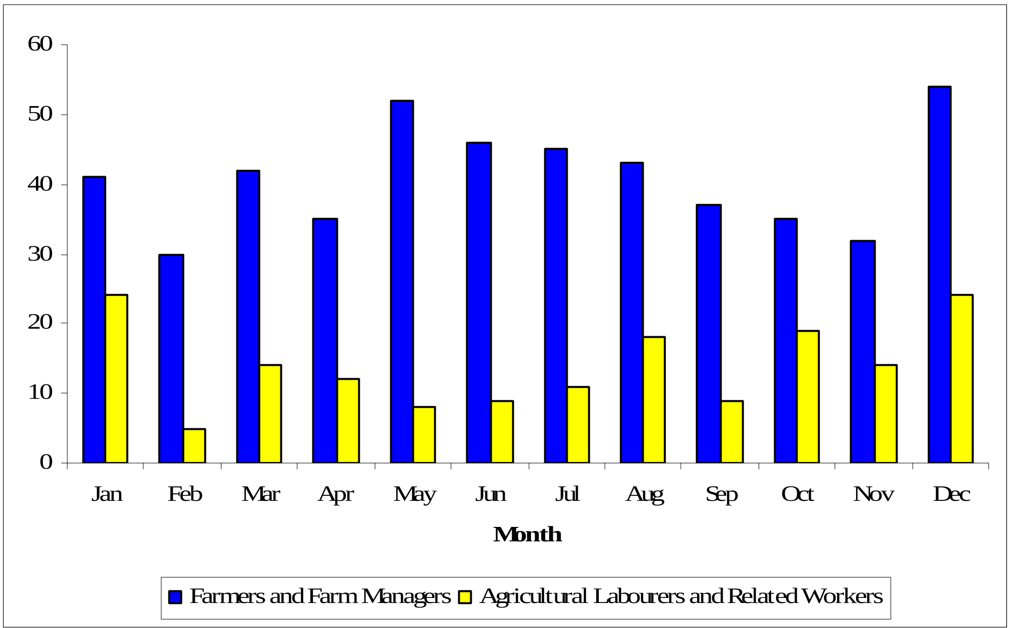
The number of deaths by day of the week was reasonably evenly distributed (P=0.062) across all days for both 'farmers and farm managers' and 'agricultural labourers and related workers' (Table 103).

Unintentional fatalities to 'farmers and farm managers' were more common during the colder months (May to August); however the peak month was December. Unintentional fatalities of 'agricultural labourers and related workers' were more common during spring and the start of summer (Figure 51). This may be due to more 'agricultural labourers and related workers' working at this time of the year but information of employment by month for 'agricultural labourers and related workers' working in NSW is not available.

Table 103 Day of week by 'farmers and farm managers' and 'agricultural labourers and related workers', unintentional fatalities (year of registration 1991-2000)

Day of Week	Farmers and Farm Managers		Agricultural Labourers and Related Workers		Total	
	N	%	N	%	N	%
Sunday	66	13.4	26	15.6	92	14.0
Monday	60	12.2	28	16.8	88	13.4
Tuesday	66	13.4	9	5.4	75	11.4
Wednesday	76	15.4	19	11.4	95	14.4
Thursday	82	16.7	30	18.0	112	17.0
Friday	66	13.4	28	16.8	94	14.3
Saturday	76	15.4	27	16.2	103	15.6
Total	**492**	**100.0**	**167**	**100.0**	**659**	**100.0**

Figure 51 Month by 'farmers and farm managers' and 'agricultural labourers and related workers', unintentional fatalities (year of registration 1991-2000)



7.4.1.1 Falls

There were 123 fatalities due to falls, representing 18.7% of all fatalities. On average there were 12 deaths per annum (Table 104). 'Farmers and farm managers' comprised the majority (90.3%) of the fall related fatalities.

Table 104 Number of fall-related fatalities for 'farmers and farm managers' and 'agricultural labourers and related workers' by year (year of registration 1991-2000)

Year of death	Farmers and Farm Managers		Agricultural Labourers and Related Workers		Total	
	N	%	N	%	N	%
1990	1	0.9	0	0.0	1	0.8
1991	10	9.0	0	0.0	10	8.1
1992	7	6.3	0	0.0	7	5.7
1993	11	9.9	1	8.3	12	9.8
1994	19	17.1	2	16.7	21	17.1
1995	15	13.5	1	8.3	16	13.0
1996	12	10.8	2	16.7	14	11.4
1997	14	12.6	1	8.3	15	12.2
1998	13	11.7	1	8.3	14	11.4
1999	6	5.4	2	16.7	8	6.5
2000	3	2.7	2	16.7	5	4.1
Total	**111**	**100.0**	**12**	**100.0**	**123**	**100.0**

Overall there has been a decrease in the deaths per annum due to falls from a peak in 1997. There has been a slight increase in the number of 'agricultural labourers and related workers' deaths per annum due to falls. In 1999 and 2000, the years where ICD10 was used, the number of deaths due to falls decreased. (Figure 52)

The overall average age of people who died following a fall was 79.9 years (SD=18.1). For 'farmers and farm managers' there was an increase in the number of deaths as age increased. The average age of 'farmers and farm managers' who died following a fall was 82.7 years (SD=14.2). For 'agricultural labourers and related workers' the distribution of falls was bimodal with half occurring to people aged less than 35 years and just under half (41.7%) occurring to people aged 80 years or over (average age = 54.3 years, SD=28.9). Overall 83.7% of fall-related fatalities occurred to people aged over 75 years. (Figure 53)

Figure 52 Number of fall-related deaths per annum for 'farmers and farm managers' and 'agricultural labourers and related workers' by year of death 1991-2000

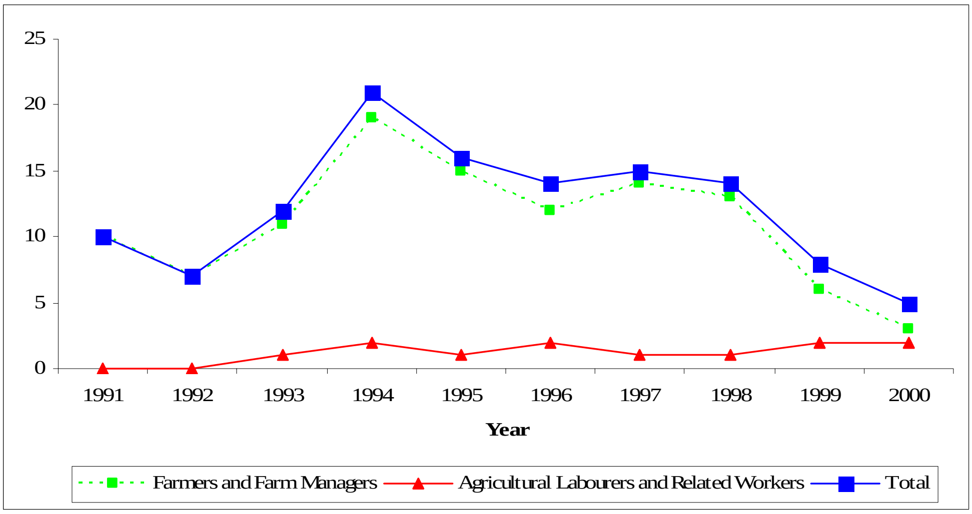
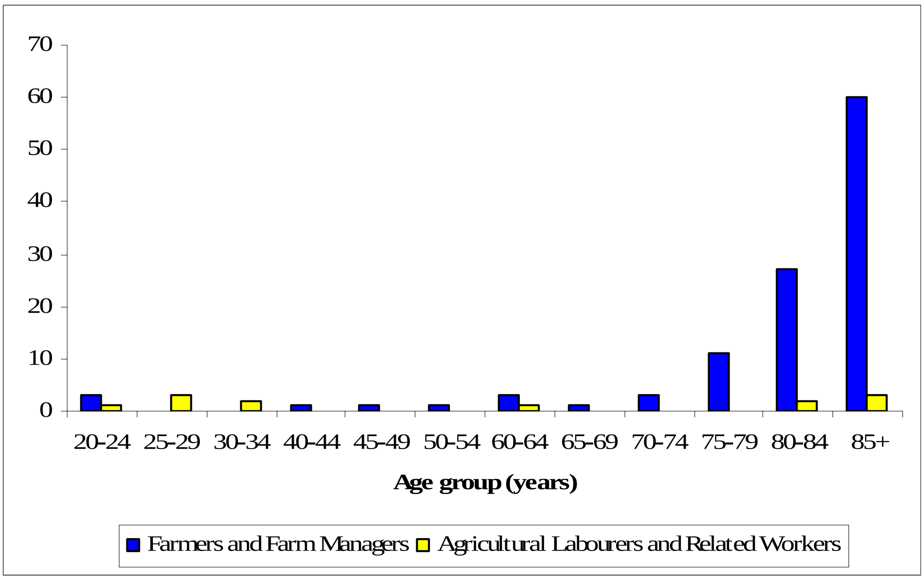
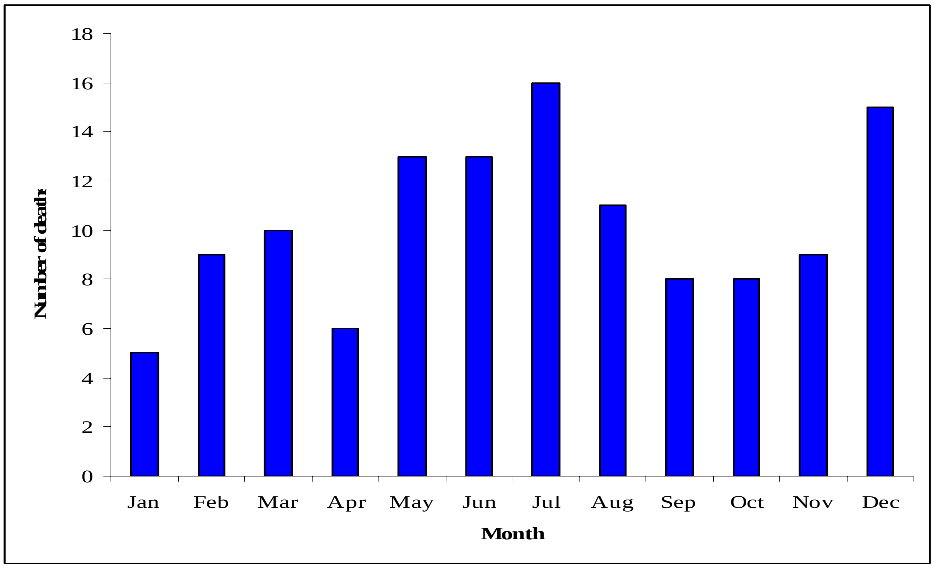


Figure 53 Age groups by occupation for 'farmers and farm managers' and 'agricultural labourers and related workers', fall-related fatalities (year of registration 1991-2000)



There was only one fall-related fatality where alcohol was identified as a contributing factor and no drug-related cases. Fall-related deaths occurred predominantly in the middle of the year (May-August) and December (Figure 54).

Figure 54 Fall-related death by month for 'farmers and farm managers' and 'agricultural labourers and related workers' (year of registration 1991-2000)



7.4.2 Comparison of Intentional vs Unintentional

There were 942 fatalities where the intent was either intentional or unintentional (excludes those fatalities due to medical and surgical procedures). Intentional fatalities are those fatalities due to suicide or homicide. There were 283 intentional fatalities (of which 93.3% were suicides) registered in NSW where the occupation was ‘farmers and farm managers’ and ‘agricultural labourers and related workers’ between 1 January 1991 and 31 December 2000, this is an average of 28 per annum. ‘Farmers and farm managers’ comprised two-thirds (68.6%) of intentional fatalities and 72.8% of intentional and unintentional fatalities combined. There was no association P=0.053) between occupation and intent (Table 105).

Table 105 Intent by ‘farmers and farm managers’ and ‘agricultural labourers and related workers’, (year of registration 1991-2000)

Intent	Farmers and Farm Managers		Agricultural Labourers and Related Workers		Total	
	N	%	N	%	N	%
Unintentional	492	71.7	167	65.2	659	70.0
Intentional	194	28.3	89	34.8	283	30.0
Total	**686**	**100**	**256**	**100**	**942**	**100**

Intentional fatalities occurred in significantly (P<0.001) younger persons (av. =48.9 years, SD=19.3) than unintentional fatalities (av. =56.8, SD=24.0) (Figure 55).

There was no statistically significant difference (P=0.015) between unintentional and intentional fatalities and the proportion of people married (although unintentional were slightly higher), never married (intentional slightly higher), widowed (unintentional slightly higher), and divorced (intentional slightly higher) (Table 106).

Figure 55 Intent by age for ‘farmers and farm managers’ and ‘agricultural labourers and related workers’, (year of registration 1991-2000)

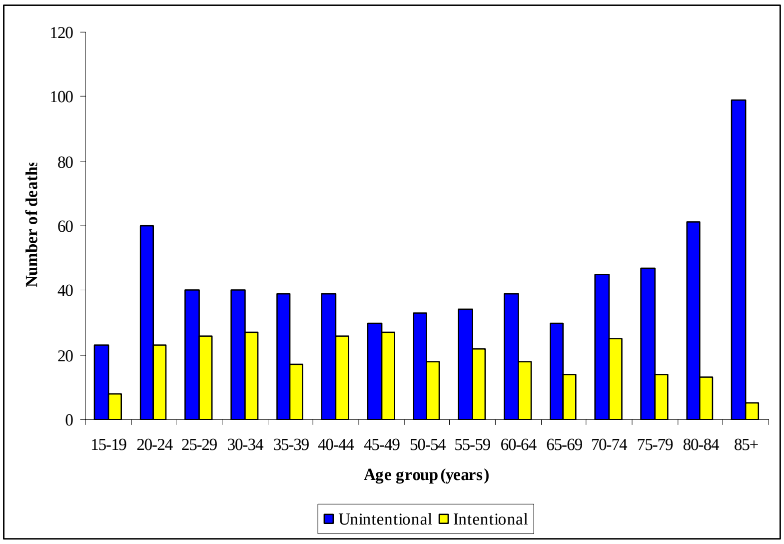


Table 106 Intent by marital status for ‘farmers and farm managers’ and ‘agricultural labourers and related workers’, (year of registration 1991-2000)

Marital Status	Unintentional		Intentional		Total	
	N	%	N	%	N	%
Married (incl. de facto)	326	49.5	121	42.8	447	47.5
Never married	201	30.5	108	38.2	309	32.8
Widowed	79	12.0	22	7.8	101	10.7
Divorced	32	4.9	23	8.1	55	5.8
Unknown	21	3.2	9	3.2	30	3.2
Total	**659**	**100.0**	**283**	**100.0**	**942**	**100.0**

Information about alcohol was known for 470 fatalities, of these 12.8% were due to alcohol. People who died in intentional fatalities were statistically significantly ($P<0.0001$) more likely to have alcohol in their system than those who died in unintentional fatalities.

Information about other drugs was known for 470 fatalities, of these 6.2% were due to other drugs. There was a slight difference in the proportions, with intentional fatalities more likely to have other drugs in their system ($P=0.033$) (Table 108).

Table 107 Intent by alcohol for 'farmers and farm managers' and 'agricultural labourers and related workers', (year of registration 1991-2000)

Alcohol-related death	Unintentional		Intentional		Total	
	N	%	N	%	N	%
No	310	91.4	100	76.3	410	87.2
Yes	29	8.6	31	23.7	60	12.8
Total	**339**	**100.0**	**131**	**100.0**	**470**	**100.0**

Table 108 Intent by drugs for 'farmers and farm managers' and 'agricultural labourers and related workers', (year of registration 1991-2000)

Other drugs-related death	Unintentional		Intentional		Total	
	N	%	N	%	N	%
No	323	95.3	118	90.1	441	93.8
Yes	16	4.7	13	9.9	29	6.2
Total	**339**	**100.0**	**131**	**100.0**	**470**	**100.0**

The number of intentional fatalities by day of the week was reasonably evenly distributed (P=0.229) across all days for both intentional and unintentional fatalities (Table 109).

Table 109 Day of week by intent for 'farmers and farm managers' and 'agricultural labourers and related workers', (year of registration 1991-2000)

Day of Week	Unintentional		Intentional		Total	
	N	%	N	%	N	%
Mon	92	14.0	39	13.8	131	13.9
Tue	88	13.4	40	14.1	128	13.6
Wed	75	11.4	43	15.2	118	12.5
Thu	95	14.4	49	17.3	144	15.3
Fri	112	17.0	32	11.3	144	15.3
Sat	94	14.3	41	14.5	135	14.3
Sun	103	15.6	39	13.8	142	15.1
Total	**659**	**100.0**	**283**	**100.0**	**942**	**100.0**

7.5 Discussion

7.5.1 Utility of ABS Deaths Data

This examination of the Australian Bureau of Statistics Deaths data provides information on male 'farmers and farm managers' and 'agricultural and related workers' who were fatally injured and death recorded in NSW between 1 January 1991 and 31 December 2000. While the data lacks detail about the circumstances surrounding the deaths, the information provides a consistent standardised approach to the collection of information about deaths over the time period. This information does not however provide a comprehensive view of people injured on farms or while employed during agricultural activity as only occupation information was collected, as such the person may have been injured in an activity unrelated to agricultural work.

While the ABS Deaths data for any given year is incomplete (8.5% of cases registered in the next year), this is not a limitation to using the information. The ABS deaths data is used regularly to provide information on the number of deaths that occur in Australia per annum and other studies have presented ABS deaths information by registration years [286 290].

During the study period there was a change from ICD9 to ICD10 [19 55]. The change of coding did not appear to affect the number of cases per annum or the breakdown of these cases into specific categories as identified by Farmsafe Australia; however, there was a small decline in the number of fatalities due to falls [76]. Classification of information is always a time consuming process and the use of standardised classification systems allows for the examination of trends over time and the comparison of information from different collection sources [66].

During the course of this PhD there has been a major change in the way deaths information is managed, i.e. via the National Coroners Information System (NCIS) [287]. The existence of such a system provides researchers a greater opportunity to explore non-natural deaths. The level of detail in the system is a significant step up from the ABS information as it usually provides a narrative from the police, coronial finding and autopsy report [287]. The ABS has recently added information to the NCIS and is using the NCIS to cross-reference its information, improving the accuracy of both the ABS and NCIS data [287].

The NCIS addresses one of the weaknesses of the ABS information for farm related deaths: knowing if the deaths occurred on a farm. Information about the location where the fatal incident occurred is not included in the ABS Deaths data. The NCIS data includes a code for farm (as a location) helping to identify all farm cases. The NCIS also includes information on activity at the time of death, thus those who were working at the time of the fatal incident can be examined separately. [287]

Differences in the work status of people fatally injured on farms has been found to have different mechanisms [14]. The ability to separate out working fatalities from others was one of the major strengths of the Franklin et al study[14]. The different circumstances leading to death suggest that different approaches are required to prevent similar deaths from occurring [14].

Overall deaths of ‘farmers and farm managers’ were 2.7 times more common than deaths of ‘agricultural and related workers’: their rate per 1,000,000 hours worked was approximately 1.4 times higher and their rate per 1,000 workers was 1.7 time higher. The rate for this study was lower than what was found by Franklin et al. This is to be expected as the limitation of the data in the current study was that only farmers and farm workers were included, thus excluding other occupational groups that work on farms [14].

While the classification of deaths into intentional and unintentional is common, it has been criticised for being uncertain, ambiguous, or unknowable [291]. While intentional deaths were outside the scope of this study, an examination of the differences between the intentional and unintentional was undertaken.

7.5.2 Surveillance of Unintentional Fatalities of farmers and farm workers

There were 952 ‘farmers and farm managers’ and ‘agricultural and related workers’ who were identified as being fatally injured over the study period. Of these, 659 (69.2%) were unintentional, 283 (29.7%) were intentional and 10 (1.1%) were due to complications of surgical care. Over the 10 year period of this study there were on average 65 unintentional fatalities per annum to ‘farmers and farm managers’ and ‘agricultural and related workers’.

‘Farmers and farm managers’ made up three quarters of all of the unintentional deaths. The rate of fatalities per 1,000,000 hours worked was consistent over the study period, whereas the rate per 1,000 establishments had three peaks in 1991, 1993 and 1997 and the rate per 1,000 workers had two peaks, one in 1994 and the other in 1997. It is not clear why there were peaks in the rates in these years. Seasonal factors such as drought, increased production and floods may contribute to the rate of injury and as such need to be explored further.

'Farmers and farm managers' were on average older than 'agricultural and related workers'. This was expected as the occupational progression moves from labourer to manager. The rate in this study was approximately five times the rate found by Franklin et al [14]. This was to be expected as the current study included work and non work-related deaths and does not exclude older farmers who are more likely not to be working at their time of death.

There were some differences in the external cause groups between the two occupation groups. The top five external cause categories for 'farmers and farm managers' were motor vehicle accidents, falls, agricultural machinery, other vehicle accidents and drowning. The top five external cause categories for 'agricultural and related workers' were motor vehicle accidents, drowning, falls, other vehicle, fire and flames. Vehicle accidents, tractors, falls, and drowning were common in both occupational groups. Deaths due to electrocution and aircraft crashes of farmers found by Franklin et al were not present in the analysis of ABS data, probably due to occupation coding rather than lack of deaths [14]. Franklin et al also found more deaths due to firearms and horses, again due to occupational coding and females being excluded [14].

The large number of road fatalities is a cause for concern to those working in farm health and safety and road safety. The long distances travelled, quality of the roads, alcohol, fatigue, speed, lack of seat belt use and other temporary hazards (such as animals) have been found to contribute to road accidents of people living in rural locations and farmers [292-294]. There are a number of strategies proposed to prevent these deaths from occurring which will be discussed in greater detail in the next chapter. Prevention strategies for traffic deaths should also be considered in light of the number of other vehicle accidents that occur on farms.

Of those deaths (8.6%) identified by the ABS as having alcohol in their system, 'agricultural labourers and related workers' had a higher proportion of alcohol related deaths than 'farmers and farm managers'. This information needs to be interpreted with caution as there was missing data for the registration years 1991-1993 and 1999-2000. Alcohol has been identified as a factor in other studies, however in the study by Franklin et al only 6.1% of deaths in which alcohol use or non-use was recorded had a blood alcohol reading over 0.05% [14 295-297].

Other drugs were recorded in 4.7% of cases, whereas Franklin et al reported only three cases. This difference may be due to the inclusion of non-work related cases in the current study [14]. The ABS does not differentiate between legally prescribed and illegal drugs.

There were seasonal differences by occupational group, with ‘farmer and farm managers’ more likely to be injured in the middle of the year (May-July) and ‘agricultural and related workers’ more likely to be injured towards the end of the year (August – December) and the start (January). Seasonality of injury on farms has been found elsewhere and is often related to the workload at the time, such as during harvest time where there is a short period of time (days) available to undertake the task [298].

Falls represented 18.7% of all fatalities and were examined in detail. Falls are an issue for all locations and settings and have been identified as priority areas in the two latest injury prevention plans in Australia [35 37 198 299 300]. In agriculture, deaths due to falls have predominantly been from a height [14]. This study found that the majority of fall-related deaths were coded to the ‘fractures, cause unspecified’ category, which was removed in the change of coding form ICD9 to ICD10. Most (83.7%) fall-related deaths in this study were of people aged 75 year or older. Many of the fall-related deaths are unlikely to be work related, as most people in this age group would not be working (at least not full-time). The issue of falls is not confined to older farmers, it is an issue common in older people across Australia [299 301]. However, if another analysis of this information was to be undertaken excluding older farmers, it may provide a more accurate reflection of deaths occurring while undertaking agricultural activity.

There are a number of statistical techniques that can be used to monitor trends over time to determine whether spikes are likely to be due to specific causes or random variability. For example Alsop and Langley [302] used a negative binomial regression analysis in SA using the GENMOD procedure to examine Christmas period road tolls in New Zealand. MacNab [303] in his paper examined injury data using a Bayesian hierarchical spatiotemporal model to allow for fluctuations in time. These other techniques need to be explored further for their usefulness when examining farm health and safety information.

7.5.3 Difference between unintentional and intentional deaths

There were 942 fatalities where the intent was either unintentional or intentional, of which 283 fatalities were intentional. Of the intentional fatalities, the majority were suicides (93.3%) which were predominantly (70.1%) among ‘farmers and farm managers’.

There was no statistically significant difference between the proportion of ‘farmers and farm managers’ and ‘agricultural labourers and related workers’ by intent. ‘Farmers and farm managers’ and ‘agricultural labourers and related workers’ whose cause of death was intentional were younger, and more likely to have alcohol or drugs in their system.

Franklin et al did not include suicides in their study of work-related fatalities, but found 20 homicides during their four year study [14]. Suicides of farmers and farm workers in Australia has been examined in detail by Page and Fragar for the period 1988-1997 using ABS Deaths data [304]. The Page and Fragar study identified that the rate of suicide for male ‘farmers and farm managers’ and ‘agricultural labourers and related workers’ was higher than national rates and rural population rates [304]. It should be noted that while self-harm was outside the scope of this Thesis, mental health is a significant issue and there are a number of strategies being implemented such as better storage of guns, counselling services and self help websites that may reduce the number of intentional deaths.

7.5.4 Priorities for Prevention

The use of the ABS deaths information provides an insight into the major causes of fatalities to ‘farmers and farm managers’ and ‘agricultural labourers and related workers’. The five most common unintentional external cause groupings were: motor vehicle accidents (31.7%); falls (18.7%); agricultural machinery (5.8%); other vehicles in non-traffic accidents (4.6%); and drowning (4.2%). Different patterns of age distribution were present for the two occupation groups, with ‘agricultural labourers and related workers’ being younger.

Priorities for prevention of unintentional fatal injuries of farmers and farm workers include motor vehicle accidents and falls. Specific prevention strategies for ‘farmers and farm managers’ should include: agricultural machinery and firearms. Specific strategies for ‘agricultural labourers and related workers’ should include: machinery excluding agricultural, poisoning and drowning.

This information should however be used with some caution when deciding on prevention activities for people working on farms, the lack of information on work-relatedness or location means that some of the deaths are not related to farming activities. The inclusion of older farmers also skews the data towards those deaths (i.e. falls) as it is well known that falls are a common cause of death in older Australians generally. The use of hours worked for rates is also poor as again those not-working were included and those whose occupations were not farmer or farm worker were excluded.

7.5.5 Limitations

A number of limitations in the data from the ABS were identified as part of this study. These included: lack of information about deaths of children; inclusiveness of occupational information; work-relatedness; inclusions and exclusions; and use of alcohol. These limitations are discussed in detail below.

7.5.5.1 Children

Using occupation information excludes children from the analysis as they do not have an occupation, but are simply coded as ‘student’ or ‘child’. Using the ABS Deaths data limits the ability to capture children’s deaths that occur on farms. In the study by Franklin et al children represented one- fifth of all unintentional deaths occurring on farms (excluding those occurring in the home) or related to agricultural work [14]. The addition of children to the number of deaths would have added approximately 130 deaths.

7.5.5.2 Occupation

Occupation of people working on farms is varied, with a large number of occupations found in the Workers’ Compensation information (Chapter 6) and in the study by Franklin et al [14]. ‘Farmers and farm managers’ and ‘agricultural and related workers’ represented just over half (54.7%) of the cases in the Workers’ Compensation information and three quarters (77.4%) of the deaths in Franklin et al [14]. This study potentially under represents the number of deaths by one-half to one quarter. It also appears that the coding for retired is not well utilised, increasing the number of older workers included in the study who were not working at the time of their death.

7.5.5.3 Work-related

Knowledge of work relatedness would have improved case ascertainment by excluding cases where the person was not working at the time of death (however the death may still occur on a farm). Fatal cases identified as work-related, where the occupation is related to farming, may not occur while working in agriculture, as they may have been working another job at the time of death.

Definition of work is not always easy. Franklin et al used three categories when examining farm-related fatalities: those who were working (those receiving pay, profit, or in-kind for the activity they were performing at the time); those who were bystanders (those who were fatally injured by work activities or by equipment used for work); and other (those fatally injured on the farm but not by work activities or equipment) [14].

This study found a rate of death five times higher than Franklin et al [14]. Limiting the age to less than 75 years (10 years higher than the normal retirement age) would have reduced the number of cases found by 83.7%, which would have brought the rate in this study closer to the rate found by Franklin et al, as only 4.8% of cases in Franklin et al occurred to people aged over 75 years [14].

7.5.5.4 Inclusions and exclusions

Females were excluded from this part of the study due to poor occupational information [289]. Females represented 4.8% of the work related fatalities in the study by Franklin et al [14], and 11.1% of the deaths overall. This current study found 5.3% of fatalities were of female ‘farmers and farm managers’ and ‘agricultural labourers and related workers’, which may be a true reflection of the number of deaths to females. This needs to examined in greater detail in future research.

Deaths due to long term occupational exposure such as those related to chemicals were not included in this study and cannot currently be extrapolated from the information available.

Motor vehicle accidents are those accidents that occur on roads and as such are assumed to be less likely to be work related incidents. Hence, these incidents are relegated to the second part of

Farmsafe Australia external cause groups [76]. It has been proposed that, while many journeys off the farm are not for the reason of work, farmers will often travel to pick up parts or other items required for work. This information may not be captured in the NCIS data as the job was supplementary to the purpose of the trip. Further work is required in understanding the nature of road fatalities occurring among those who work on farms.

7.5.5.5 Alcohol

In the study by Franklin et al, 11.2% of people fatally injured had alcohol in their system, but only 7.7% had a blood alcohol reading of 0.05% or higher [14]. A blood alcohol reading of 0.05% is currently the limit for being able to legally drive a car on the road in Australia. The effect of alcohol is variable and it is sometimes difficult to know if alcohol was a factor in the death [305].

Alcohol as a risk factor in injury fatalities is a significant issue in Australia. A National Alcohol Strategy has been developed and alcohol issues have been included in the current injury prevention strategy [37 306].

7.6 Conclusion

Using ABS Deaths data to examine the deaths of people working and living on farms is limited to males whose occupation is recorded as ‘farmer and farm manager’ and ‘agricultural labourer and related worker’. The information provides a consistent series of cases over time, which allows for the examination of the identified occupation groups. Areas where prevention should be directed for fatalities of ‘farmers and farm workers’ and ‘agricultural labourers and related workers’ include: motor vehicle accidents, falls, agricultural machinery, other machinery, firearms, poisoning, and drowning.

7.7 Summary – Deaths of Male ‘Farmers and Farm Managers’ and ‘Agricultural Labourers and Related Workers’ due to injury

1. An analysis was undertaken of all male ‘farmers and farm managers’ and ‘agricultural labourers and related workers’ who were fatally injured, with their deaths registered in NSW and collected by the ABS between 1 January 1991 and 31 December 2000.
2. There were 952 deaths over the study period, of which 81 (8.5%) were registered in the year following death. The number of deaths registered in the year following death has been decreasing.
3. ‘Farmers and farm managers’ comprised nearly three-quarters (72.8%) of the fatalities.
4. Rates of deaths were calculated for number of establishments, number of workers and hours worked.
    a. The rate per 1,000 agricultural establishments ranged from 1.93 to 2.58 per year over the 10 year study period
    b. The rate per 1,000,000 hours worked ranged from 0.44 to 0.55 per year
    c. The rate per 1,000 workers ranged from 1.18 to 1.72 per year
5. The five most common external cause groups were:
    a. Motor vehicle accidents (22.0%)
    b. Suicides (27.7%)
    c. Falls (12.9%)
    d. Agricultural machinery (4.0%)
    e. Other vehicles non-traffic accidents (3.2%)
6. There were 659 fatalities that were unintentional in their nature, which is an average of 65 deaths per annum. ‘Farmers and farm managers’ comprised three quarters (74.7%) of the unintentional fatalities. Rates of deaths were calculated for number of establishments, number of workers and hours worked for unintentional fatalities.
    a. The rate per 1,000 agricultural establishments ranged from 1.24 to 2.04 per year
    b. The rate per 1,000,000 hours worked ranged from 0.28 to 0.41 per year
    c. The rate per 1,000 workers ranged from 0.75 to 1.29 per year
7. The average age of people injured in unintentional fatalities was 56.8 years. ‘Farmers and farm managers’ were on average older (63.5 years) than ‘agricultural labourers and related workers’ (37.2 years).
8. The fatalities were distributed across NSW.

9. The top five external cause groups for unintentional fatalities of ‘farmers and farm managers’ were:
    a. Motor vehicle accident (29.7%)
    b. Falls (22.6%)
    c. Agricultural machinery (6.5%)
    d. Other vehicle non-traffic accidents (4.7%)
    e. Drowning (3.0%)
10. The top five external cause groups for unintentional fatalities of ‘agricultural labourers and related’ workers were:
    a. Motor vehicle accidents (37.7%)
    b. Drowning (7.8%)
    c. Falls (7.2%)
    d. Fire and flames (5.4%)
    e. Other vehicles non-traffic accidents (4.2%)
11. For unintentional fatalities where information about blood alcohol content was known, alcohol was identified as a factor in 8.6% of these deaths. The average age of those with alcohol in their system was 36.3 years, which was significantly lower than those who did not have alcohol present (59.9 years).
12. For unintentional fatalities where information about drugs other than alcohol was known, drugs were found in the person’s system in 4.7% of deaths. The average age of people who had drugs in their system at the time of death was 41.5 years, which was lower than those who did not (58.7 years).
13. Unintentional fatalities to ‘farmers and farm managers’ were more common during the colder months (May to August), where as ‘agricultural labourers and related workers’ deaths were more common during spring and the start of summer.
14. There were 123 fatalities due to falls, of which ‘farmers and farm managers’ comprised 90.3%. The average age of those who died from a fall was 79.9 years. For ‘farmers and farm managers’ there was an increase in the number of fatalities due to falls with increasing age, where as for ‘agricultural labourers and related worker’ there was a bimodal distribution with younger and older ages being injured.
15. The two most common causes of falls-related deaths were ‘fracture, cause unspecified’ and ‘other and unspecified fall’. It was noted that the category ‘fracture, cause unspecified’ disappeared when the coding changed from ICD9 to ICD10.

16. Fall-related deaths followed a similar monthly pattern to ‘farmers and farm managers’ total deaths.
17. There were 283 intentional fatalities of which 93.3% were due to suicide and two-thirds (68.6%) were ‘farmers and farm managers’.
18. The average age of people fatally injured in intentional fatalities was significantly lower (48.9 years) than unintentional fatalities (56.8 years). Alcohol was more likely to be involved in intentional fatalities than unintentional.
19. ABS data is not a useful source of information about fatalities of people injured on farms. Although occupation is identified, this only provides information for those groups whose occupation is related to agriculture (i.e. farmer and farm managers and agricultural labourers and related workers). Occupational information is poor; females had to be excluded as their occupation classification has been identified by the ABS as being unreliable. There were very few retired agricultural workers increasing the number of deaths of people over 70 years of age in the dataset. There is no information about work relatedness (i.e. was the person working at the time) or if the death occurred on a farm. Children are not included due to them having no occupation status (they are classified as a child).

Chapter 8 Discussion: Comparative analysis of datasets for prevention, monitoring and evaluation

If you don't measure it… you can't improve it
Source Unknown

8.1 Introduction

There is a wide range of information available in the four datasets (Emergency Department, Hospital Separations, Workers' Compensation and ABS Deaths Data) examined in this Thesis. These datasets provide varied information about the circumstances surrounding farm injury events. The analysis of this information provides a representative overview of unintentional injuries occurring on farm or during the course of agricultural work in NSW. It also identifies areas where prevention activities should be targeted.

The aims of this chapter are:

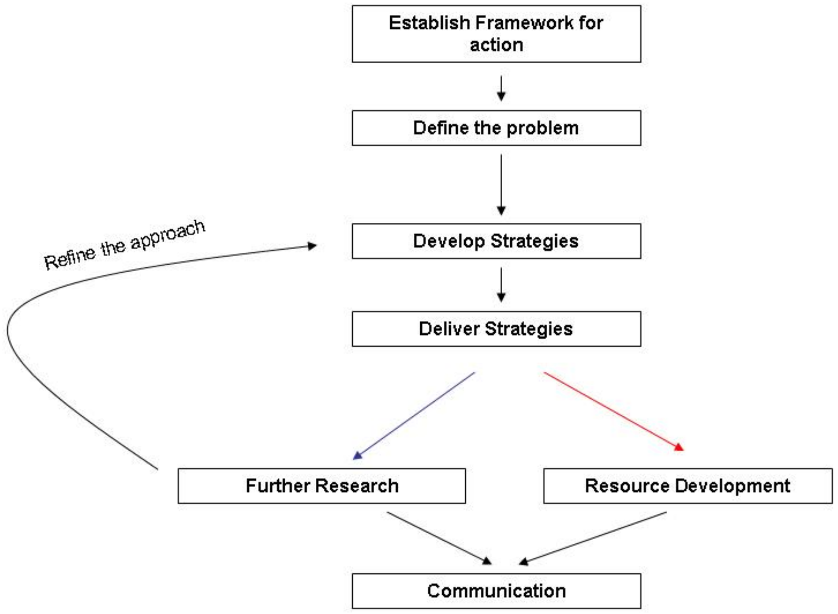
- To critically examine the utility of Emergency Department, Hospital Seperations, Workers' Compensation, and ABS Deaths data for the surveillance of farm injuries in NSW.
- To define the priority areas for farm injury prevention initiatives in NSW based on the information obtained from the examination of the data from Emergency Department, Hospital Seperations, Workers' Compensation, and ABS Deaths.
- To examine the utility of the Farm Injury Optimal Dataset

In 1988 a direction for the prevention of farm injuries in Australia was developed at the inaugural Farmsafe Conference [13]. The formation of Farmsafe Australia in 1993 provided an organisation whose purpose is the monitoring, definition, development and implementation of strategies to combat farm injuries in Australia. Farmsafe Australia's approach has primarily focused on unintentional injuries [76].

There are a variety of methods by which prevention can be approached. In Chapter 2 a number of theories and strategies were provided which have previously been used in injury prevention, particularly in the agricultural setting. Farmsafe Australia has developed a number of strategies for the prevention of farm injuries using the model displayed in Figure 56. Farmsafe Australia approaches to farm injury prevention are based on the 'Hierarchy of Control'. The 'Hierarchy of

Control' is also taught to farmers to use as part of their risk management strategy [122]. This approach is based on having appropriate information to be able to define the problem and develop strategies to ensure that an informed decision can be made.

Figure 56 Farmsafe Australia model of strategy development and implementation



This chapter is divided into five sections: analysis and synthesis - an examination of what was found from the analysis of the four datasets; farm injury optimal dataset - how this reflects what was found in the analysis; discussion about the need for a consistent definition of farm; issues which should be priorities for farm injury prevention in NSW (by hazards, age groups, agricultural industries, contributing factors, trends over time, and other issues); and recommendations for the improvements of the datasets used in this Thesis.

8.2 Analysis and synthesis

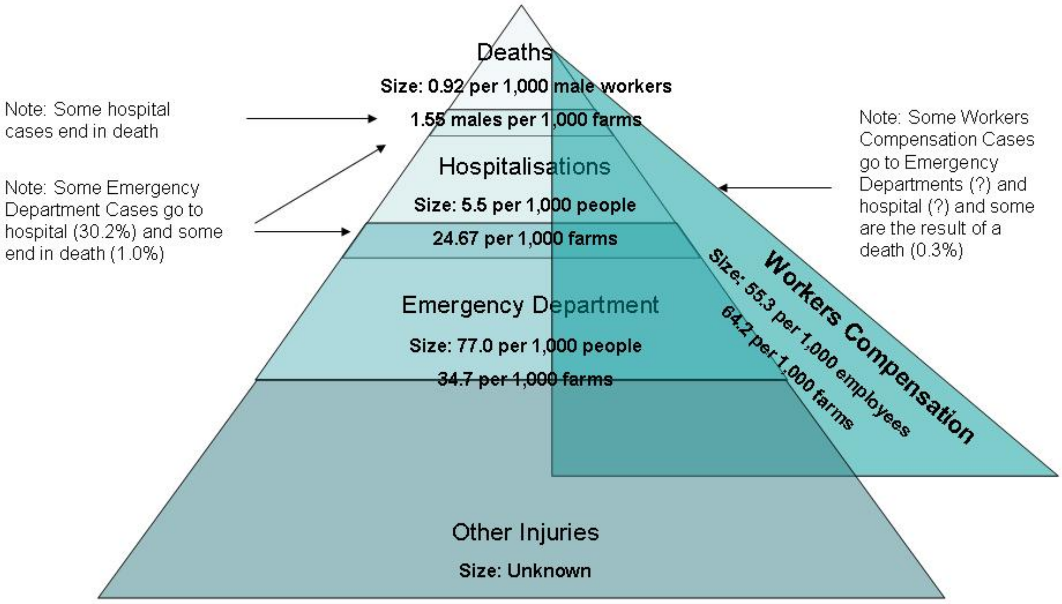
Appropriate information about farm injuries varies according to who wants to use the information. Much of the data presented in the earlier chapters of this Thesis were collected for health services, workers compensation and administrative purposes. As described in those chapters each of the datasets have a number of limitations. Limitations aside, they do provide trend information about farm injuries.

Traditionally injuries have been described in a pyramid formation with most severe injuries (death) at the top and minor injuries at the bottom, reflecting the approximate size relative to the group below (i.e. there are more minor injuries than Emergency Department presentations than hospital cases than deaths). However, for farm injuries there are also data collections which fall outside of the traditional medical approach, such as surveys and Workers' Compensation information. In the 'Farm Injury Pyramid' for injuries in NSW presented in Figure 95, Workers' Compensation information has been added as a side pyramid. Some of the cases would have been included in the other datasets but a number of cases would not have been included, either due to definitional constraints (e.g. the deaths examined in this study were 'Farmers and Farm Managers' and 'Agricultural Labourers and Related Workers'), case ascertainment, or accuracy of the data.

The relative size of the each of the layers of the pyramid needs to be viewed with some caution. The information about Emergency Departments is based on one year of data from a particular region of NSW and may not reflect NSW as a whole. Changes in the coding of the hospital data from ICD9 to ICD10 did produce a change in the number of injuries and the deaths information reflects only two occupations of male workers and not all people who work on farms.

The datasets used in this Thesis provide a unique understanding of the size of the problem and nature of farm injuries in NSW. It is clear that the burden of farm injuries in NSW is extensive with 1 in 15 farms per annum on average making a Workers' Compensation claim, 1 in 28 farms per annum on average seeking medical help at an Emergency Department, 1 in 40 farms per annum on average has a person hospitalised due to a farm injury and 1 in 645 farms per annum on average has a male 'Farmer and Farm Manager' or 'Agricultural Labourer and Related Worker' death. (Figure 95)

Figure 57 Farm Injury Pyramid for NSW



Note: Deaths rates are the average number of deaths registered by year of death for male 'Farmer and Farm Managers' and 'Agricultural Labourers and Related Workers' between 1 January 1991 and 31 December 2000 , hospital rates are the average of hospital separation that were coded as occurring on farm between 1 July 1990 and 30 June 2000, Emergency Department rates are for NSW based on information collected at the Tamworth Base Hospital between 1 September 1997 and 31 August 1998, Workers' Compensation rates are based on NSW Workers' Compensation claims lodged during the period 1 July 1992 and 30 June 2001 and the number of cases presenting to Emergency Departments or Hospitals is unknown.

The cost of farm injuries is not readily available in Australia as there have been very few studies which have tried to estimate the cost of farm injuries. Low and Griffith estimated the average cost of a farm injury in northern NSW in 1992-93 at $1,000 and the average cost of a serious farm injury at $2,600 [307]. Cole and Foley estimated the average cost of a Workers' Compensation claim in Agricultural industries in Australia in 1992-93 was $6,920 and the total cost to the Agricultural sector of work-related injury and disease was between $0.52 billion and $1.29 billion [80]. Ferguson in his studies of farm injury in Queensland found average costs of $2,520 in 1993 and $4,449 in 1995 [114 115]. From the analysis undertaken in this Thesis, the average Workers' Compensation claim was found to be approximately $10,880 an increase of 57.2% on Cole and Foley's figure, however some of this difference may be due to higher costs in NSW [159].

Using number of farms as a denominator does not accurately reflect exposure. Exposure to specific hazards varies by farm industry and farm practices [308]. Actual exposure information is difficult to collect and the reliability of this information can vary depending on methods used and when the information was collected [309].

While not used as a method in this Thesis to estimate the number of farm injuries, surveys are a useful method for providing information about farm injuries. Ferguson has used a postal survey on four separate occasions to estimate the number, severity, and exposure to hazards (including safety practices) on Queensland farms [114-116]. Farm injury has seasonal variations and recall of injuries varies depending on the time frame and severity (i.e. the longer the period into the past the poorer the recall and the more severe the injury the more likely it is to be remembered) [310]. Using a telephone survey to monitor farm injuries has been found to be useful in the US and is used in Australia for other surveys (such as the NSW Population Health Survey program) [69].

Linking survey data to routinely collected information such as hospital and Workers' Compensation information should allow for a better estimate of risk and magnitude of farm injury, improve our understanding of farm injuries and provide a greater level of detail than is provided as part of routine data collections. This does, however, imply cooperation between organisations routinely collecting information on farm injuries. The cost of conducting a full census survey of farm injuries would be substantial, as such a representative sample survey may be a more cost effective method of collecting the information. However, this needs to be explored further given the variations in farm injuries across NSW [39].

While this Thesis provided a large number of tables and figures on farm injuries from the different datasets used, there are a large number of different cross-tabulations which could have been produced. For example, presenting data by location 'on the farm' where the injuries were sustained has been found to be important for prevention. This is due to ownership, responsibility for the space and peoples perception of an area. For example, if a person is taught to be safe at a particular location then this may be more successful than the person being taught to be safe everywhere [39].

Tailoring prevention activities to a specific location increases the probability of safe behaviours being remembered and acted upon, as the prevention program only targets those circumstances which lead to an injury at that location [39]. This logic also applies to type of farm as many farmers, while seeing themselves broadly as a farmer, are more likely to associate with farmers from the same agricultural industry (e.g. grain farmer or beef cattle farmer), thus making strategies targeted at particular agricultural industries more likely to succeed [168].

Overall the information in this Thesis provides the basis for making decisions about where resources should be targeted for prevention activities in NSW. There are, however, a number of recurring issues to be discussed in greater detail before discussing priorities for prevention. These include: a) the use of the Farm Injury Optimal Dataset; b) what information this should contain to help enhance any ad hoc or ongoing studies of farm injury; and c) the definition/s used to collect farm injury, as this varies across farm injury studies and the datasets used in this Thesis [39].

8.3.1 Relative contribution of each dataset to the overall prevention of farm injuries

While each dataset provides a different perspective about injuries occurring to people on farms or working in agricultural industries, there is a need for a better system of surveillance to bring the information together. The following is a suggestion for a more integrated approach to the use of the datasets for a system of surveillance for priority setting, hazard identification and monitoring of farm injuries.

The NCIS will need to be an integral part of any surveillance system on farm injuries. For this to occur the NCIS will need to be explored in some detail to establish how readily farm injury cases are identified and the level of information provided. This will include cross referencing (checking or matching) this information with current datasets such as the Workers' Compensation fatalities information, work health authorities work-related deaths information and the ABS Deaths data. Once this information is known, ongoing and regular checking of the NCIS will be required to establish timeliness, level of detail available and trend information.

Workers' Compensation information provides excellent information about the agents involved and while only including employees could be used as a proxy in some industries for the effectiveness of targeted interventions. Better information about coverage of Workers' Compensation by agricultural industries is required.

For injuries occurring to children, hospital and deaths data will provide the best information for surveillance and priority setting. Unfortunately this means that many injuries will be missed, also the hospital data needs to be investigated further for coverage (i.e. where is farm as a place of occurrence being used well or poorly).

ABS Deaths data currently is not a reliable source of information for deaths of people on farms. It is well known that occupational information is poor for females and due to the varied activities undertaken on farms does not include all people working on farms. It also misses children and other people injured on farms, thus until a place of occurrence code is added the information is of limited value.

Emergency Department information collected as part of this study using the FIOD was found to be very useful in providing information about farm injuries. Due to the method of collection used for this study it is unlikely that this method would be cost effective on a larger scale. However, combined with other methods such as sampling it could be developed into an effective tool.

Data linkage would also provide greater benefit for the study of farm injuries, particularly if hospital, Workers' Compensation and NCIS data was linked. There are currently in Australia a number of studies examining data linkage and its benefits for providing more information about particular health conditions [235 311].

With limited resources available, the datasets that have the greatest benefit for the surveillance, hazard identification, monitoring and priority setting in order are the NCIS, Workers' Compensation and hospital data. Each dataset has both strengths and weaknesses and further study will be required in order to understand these fully.

8.3 Farm Injury Optimal Dataset

The Farm Injury Optimal Dataset (FIOD) is a tool for coding and categorising farm injuries, as clearly demonstrated in Chapter 4 Emergency Department Data. It has also been used successfully in a number of other studies across Australia [72 73]. There are several areas where the FIOD could benefit from revision. These include:

- Closer links to the International Collaborative Effort on Injury Statistics
- Information about risk factors;

- Guidelines for the coding of information where the detail about the injury event is limited or missing;
- Definitions; and
- Information about Personal Protective Equipment worn at the time of injury.

The International Collaborative Effort (ICE) on Injury Statistics has a mission "…to improve international comparability and quality of data to better assess the causes and consequences of injury, differences in injury occurrences over time and place, and the most effective means of prevention and control…" p 264 [312]. There are three primary goals of ICE, which are to provide an international forum, develop and promote international standards, and produce high quality injury information to allow for comparisons [312].

As information about the effectiveness of farm injury prevention is being developed by a large number of countries (including Australia, New Zealand, USA, Canada, Finland and Sweden) the ability to compare information across international boundaries would improve all countries' understanding of farm injury prevention. ICE provides a forum for this to happen and, while there are a number of other coding systems available for farm injury, the FIOD would provide a basis for an international standard.

Most injuries are the result of a series of cascading events. That is, when these events occur in isolation nothing happens, but when occurring together an injury results [123]. These events can each be seen as risk factors and while some may be beyond the control of the farmer, others if acted upon can prevent an injury from occurring. While not all risk factors are currently known, those which are known should be recorded at the same time as the injury (e.g. with road traffic fatalities, if the person was speeding at the time of the crash or not wearing a seatbelt this is recorded). As a minimum, personal protective equipment (e.g. eye protection, helmet, and gloves) worn at the time of injury, alcohol and drugs, and machine modification (such as removal of guards, and lack of ROPS) should be recorded. Ferguson has identified a number of protective factors which prevent or reduce the severity of farm injuries such as rollover protective structures, power take off shaft guard, first aid kit, chemical store, and fencing for child safe area which could also be used [116].

Currently in the FIOD nothing is provided to help understand the order of coding and what to do if unsure about the information presented. An example of this is where it is reported a person was injured while riding a bike. Is this a push bike, a two-wheeled motorbike, a three-wheeled motorbike or a four-wheeled motorbike? If the FIOD is to be used on a wider scale then this issue needs clarification.

The presentation of the FIOD is at times difficult as much of the information is provided in groups, this may not always be helpful and an alphabetical list may help. A review of the FIOD would be useful to see how people code different scenarios and how people use the information.

Definition of farm will be addressed in the next section (8.4 Consistent definition of farm), however there are also several other areas within the FIOD requiring better descriptions and definitions. Improvements in definitions will be required if it is to be used at an international level. Particularly definitions for the work phase information and equipment, as some of the activities and equipment may be called different things or known by many names. There may also need to be exclusions such as: leisure activity does not include sports activity.

8.4 Consistent definition of farm injury

The information presented in this Thesis relies on different definitions of a farm or farm workers and is affected by how the information was collected. Conroy and Sciortino clearly demonstrate how different definitions affect the inclusion of cases [39]. The different definitions used in this study reduce the ability to compare information.

The Emergency Department information was collected by asking the patient information about the accident and placing this information on a specifically designed form. Case selection was for all injuries occurring on a farm or involved in farming activities. This information was checked against hospital separation data over the same period which yielded no extra cases. The Hospital data was collected as part of the routine collection of hospital admission data and then selected based on those cases where the person was injured on a farm. Both the Emergency Department and Hospital data require a person to identify that the injury occurred on a farm. Limitations to the process include: people may not consider the place where the injury occurred to be a farm; or the location may not be reported to the hospital thus reducing the number of cases.

The Workers' Compensation information was based on people working in an agricultural industry, which excludes those people who are injured on farms but not working at the time. In addition, Workers' Compensation only includes people covered by the scheme, which is estimated to be approximately 55% of those who work on farms [265]. Workers' Compensation includes cases not included in other datasets. This information can be broken down into specific agricultural industries and provides information about the occupation, enabling rates to be calculated. Workers' Compensation also includes people injured while engaged in agricultural work but not on a farm at the time.

The ABS Deaths Data used in this study included only people fatally injured whose occupation was either 'farmer and farm manager' or 'agricultural labourer and related workers'. Due to the poor quality of occupational information about females, their deaths were not included [289]. It was not possible to separate deaths which were not related to agricultural work or off the farm, thus creating an overestimation of the number of deaths.

Denominator information was also difficult to obtain as there is no regular count of people living on farms. Visitors to farms also provide a unique problem as they are injured while visiting but there is no estimation of the number or amount of time people spend visiting farms. The number of people employed by industry was used to calculate rates for the Workers' Compensation information and therefore is the most reliable. A rate per number of farms, while consistent across all datasets, provides very little understanding of exposure.

While prevention of injuries will not be affected by better definition of farm injury, the monitoring and gathering of evidence about the effectiveness of a particular intervention will [271]. Further work needs to be undertaken to ensure studies on farm injuries are able to link into routinely collected data and provide clear definitions of what information they contain.

8.5 Priorities for prevention

There are multiple ways in which priorities for prevention can be set. Farmsafe Australia has developed strategies for specific age groups, agricultural industries, and agents. For the development of the latest Australia Injury Prevention Plan the National Injury Surveillance Unit (NISU) produced a report examining what should be a priority for prevention [38]. NISU's approach used life stages to define the direction for prevention [38]. The Australia Water Safety Plan took a more holistic approach and identified areas such as research, education, risk management and targeting specific populations (such as rural, Aboriginal and Torres Strait Islanders, youths, and parents of toddlers) [313].

The surveillance of farm injuries provided in this Thesis is useful for identifying areas for prevention and intervention; however, care needs to be taken when suggesting prevention activities, as there is a paucity of evidence to back up many of the suggested prevention activities [69 236]. This section of this Thesis provides direction for where prevention programs need to be targeted to prevent farm injuries in NSW. It does not try to provide a program or prevention strategy.

To describe where prevention should be undertaken, four areas have been identified: hazards; age groups; agricultural industries; and other.

8.5.1 Hazards

There were a large number of hazards identified by the four datasets in this Thesis as being involved in injuries on farms. However, only a few were found in all or most datasets. Motorcycles, horses and farm machinery were the most common agents. Agents involved in farm injury included:

- Farm vehicles
    - Motorcycles
    - Cars, station wagons, vans and utilities
- Farm machinery
    - Sheep shearing plant
    - Tractors
- Animals
    - Horses
    - Cattle
    - Sheep and goats
    - Poultry
- Farm structure and materials
    - Fencing
    - Ladders, mobile ramps and stairways
- Farm Equipment

- Knives
- Cartons, crates, boxes, cases, drums, kegs, barrels

8.5.2 Age groups

In all datasets, except for the fatalities data, the age range of 15-34 years olds was the largest grouping. In the fatalities data, 70+ years was the largest. This is partially due to older people being less likely to be working in agriculture and thus excluded from Workers' Compensation information. Age-related factors such as reduced reaction time, vision/hearing problem, slower reflexes, and their bodies being less resilient to injuries, increase the probability of older farmers being injured, including reducing their ability to recover from the injury [314 315].

8.5.3 Agricultural industries

The only two datasets which collected information about agricultural industries were the Emergency Department Data and Workers' Compensation. Meat cattle industry was common across datasets and poultry, grain-sheep and grain beef cattle farming, and sheep farming were common in the Workers' Compensation information.

8.5.4 Other

The other areas identified as requiring specific attention were the farm workshop (a number of hazards, in particular eye injuries from flying metal), manual handling and falls. Fall related injuries and deaths were common across all datasets; however, manual handling appears to be specific to Workers' Compensation. This may be because people do not seek the medical services of Emergency Departments or Hospital for manual handling injuries.

8.5.5 Contributing factors

While it is hard to measure the impact of other contributing factors to injuries, it is acknowledged that agriculture in Australia has undergone and continues to go through restructuring [304]. This restructuring involves farming becoming more economically driven, farm size increases, commodity price fluctuations depending on world production, skill level and skills required increasing, administrative burdens increasing and support to rural areas decreasing as the population becomes more urbanised.

The move to higher levels of mechanisation creates other pressures, including less reliance on workers but increased work hours to pay off machinery. The availability of a workforce to undertake tasks on farms is also decreasing as young rural people migrate to larger rural or metropolitan centres.

Further examination of the data to adjust for weather conditions, such as droughts and floods, commodity price fluctuation, hours worked, and other contributing factors is required to understand these influences on injury.

8.5.6 Monitoring trends over time

Farmsafe Australia has used for the last decade a coding system based on ICD9 to monitor trends in farm injury, in particular those requiring hospitalisation. With the advent of ICD10 there is a need to revise this coding. The new coding, while able to be mapped across to ICD9, provides greater detail about certain types of injuries that should be monitored over time (e.g. all-terrain vehicles). Now that there are a number of years of data available, the use of ICD10 for the monitoring of farm injuries needs to be considered. Table 110 provides a revised coding schema for the study of farm injuries using ICD10 based on information from this Thesis.

Table 110 Proposed Farmsafe Australia Coding Schema

ICD10 E-codes	Description
FSA Main Codes	
Non-traffic accidents	
V01-09,.0	Pedestrian
V10-19-,.0,.1,.2	Cyclist
V20-29-.0,.1,.2	Motorcycle
V30-39-.0,.1,.2,.3	Three-wheeled vehicle
V40-49-.0,.1,.2,.3	Car
V50-59-.0,.1,.2,.3	Pick-up truck or Van
V60-69-.0,.1,.2,.3	Heavy Transport Vehicle
V70-79-.0,.1,.2,.3	Bus
V80	Animal ridden
V84	Special Vehicles used in agriculture
V86	Special all-terrain vehicle designed for off road use (note in the Australian CM version there is also a fifth character for 2, 3 and 4 wheeled vehicles)
Contact with inanimate mechanical forces	
W20	Struck by thrown, projected or falling object
W22	Struck against or by other objects
W23	Caught, crushed, jammed or pinched in or between objects
W24	Contact with lifting and transmission devices, NEC
W25	Contact with sharp glass

ICD10 E-codes	Description
W26	Contact with knife, sword or dagger
W27	Contact with non-powered hand tool
W30	Contact with agricultural machinery
W31	Contact with other and unspecified machinery
W32, W34, &22, Y24	Firearms
W35-41, Y25	Explosion
W42	Noise
W43	Vibration
W44-45	Foreign body
Exposure to Animate Mechanical Forces	
W54	Dog Bite
W53, W55-59	Other animals
W85-87	Electricity
X12-14, X16-19	Contact with heat and hot substances
X20-29	Venomous animals and plants
X40-47, X49, Y10-16, Y19	Poisoning
X48, Y18	Pesticides
X50	Overexertion
X00-X09, Y26	Fire and Flames
Other Codes	
Traffic Accidents	
V01-09-.1,.9	Pedestrian
V10-19-0.3,.4,.5,.9	Cyclist
V20-29-.3,.4,.5,.9	Motorcycles
V30-39-.4,.5,.6,.7,.9	Three-wheeled vehicle
V40-49-.4,.5,.6,.7,.9	Car
V50-59-.4,.5,.6,.7,.9	Pick-up truck or Van
V60-69-.4,.5,.6,.7,.9	Heavy Transport Vehicle
V70-79-.4,.5,.6,.7,.9	Bus
V81-82, V87-89, Y32, Y85	Other Transport
V83	Special Vehicle used on industrial premises
V85	Special construction vehicle
V90, V92, W65-74, Y21	Drowning
V95-97	Air and Space transport accidents
V91, V93, V94	Other transport accidents
W00-W19, Y30	Falls
W21, W28, W29, W49	Other exposure to inanimate mechanical forces
W75-84 X51-59, Y20, Y29, Y31, Y33-34, Y86, Y89	Other
W88-99	Exposure to radiation and extreme ambient air temperature and pressure
X10-11, X15, Y27	Contact with heat and hot substances
X30-39	Exposure to forces of nature
X60-84, Y87	Intentional Self Harm
X85-Y09	Assault
Y35-36	Legal Intervention and war
Y40-84, Y88	Complications of Medical and Surgical Care

Changes in coding from ICD9 to ICD10 have appeared to reduce the number of fall related deaths. This is largely because the "falls unspecified" code has been removed and the injuries previous coded to this category are now coded elsewhere.

One of the weaknesses of both ICD9 and ICD10 coding is the inability to separate tractors from other agricultural machinery. There is a code for tractor-related items in ICD10 (V84 used for ‘occupant of special vehicle used in agriculture injured in transport accident’ and W30.2 ‘contact with equipment towed or powered by tractor’) but no specific tractor code [55]. Adding a specific tractor in the agricultural machinery sections would address this problem.

8.6 Recommendations

Overall the information collected from the four datasets used in this Thesis allows for a picture of people injured on a farm or during agricultural work. The calculation of rates was not easy as the exposed population was not recorded, except for those working in agricultural industries. A better understanding of the exposed population would provide greater accuracy in the calculation of rates. Exposure to particular risks is not well understood and work should be undertaken examining risk factors and their contribution to farm injuries. These risk factors include: alcohol; legal and illegal drugs; fatigue; exposed machinery and equipment including working parts, such as Power-Take Offs; noise; stress; animals; and water [297].

Data linkage has been found to provide greater detail about injury events [236]. Linking of Workers’ Compensation, hospital and deaths data would provide a greater understanding of the circumstance surround farm injuries and in particular the true extent of the problem. Linking farm injury data should be examined further.

A major problem is that information collected about farm injuries is not routinely examined on a regular basis. The ongoing analysis and reporting of farm injury could contribute to raising the awareness of the issue, communicate success of programs and provide possible strategies to prevent injuries from occurring in the future [254].

While outside the scope of this Thesis, work needs to be undertaken to validate the Workers’ Compensation, hospital and ABS deaths information. The information for each section was provided by the appropriate authority, and was assumed to be accurate; however, the accuracy of this information for agriculture sector is unknown.

8.6.1 Emergency Departments

The Emergency Department Data was the most detailed information examined. This was due to the study being developed to examine farm injuries exclusively and the use of the FIOD.

Areas of weakness reflect the nature of the data elements of the FIOD, such as the lack of information about preventive measures, in particular personal protective equipment (PPE). The lack of appropriate denominator data (i.e. people living on farms) was also a limitation of the analysis. The catchment area from which people attended the Emergency Department was not only large but crossed over other areas where Emergency Departments were located, making it difficult to define the study area.

8.6.2 Workers' Compensation

Examination of Workers' Compensation information in Australia is rare; however, the information provides a comprehensive coverage of all people employed on farms and injured who require five or more days off work due to their injury [257]. The information does not include those who are self employed, which is approximately 45% of the agricultural workforce [263].

This examination did not drill down into the individual agents involved in the injury. Further investigation, particularly of those agents associated with a large number of claims, needs to be undertaken to determine the cause of the injuries. Exposure to particular agents is a problem, as well as information about a person's experience. This information could be collected via survey or follow-up of the Workers' Compensation claims.

8.6.3 Hospital data

Hospital data is a useful tool for examining injuries occurring on farms. However very few of the injuries which occur on farms required hospitalisation (5%) and were often treated out of hospital (87%) by a health care professional or not at all (8%) [69].

The lack of detail about each case is offset by a complete set of injuries for those people who required admission to hospital. While hospital admission has been used as a proxy for severity of injury, there are now a number of other methods being used to provide an indication about the severity of an injury such as Abbreviated Injury Scale (AIS), Injury Severity Score (ISS), Comprehensive Injury Scale (CIS), and Barell method [248 316-318]. This Thesis did not attempt to use any measure of severity; however, future studies should consider using a severity rating.

Unfortunately there are a number of areas where errors in hospital data can occur. These include: incorrect diagnosis; missing information (both coded or collected); incorrect interpretation;

inaccurate coding; and errors in transferring the information to a central source [236]. The validation of the hospital data from the original source was outside the scope of this Thesis and should be considered for future studies.

The information from the hospital admission data did include a location code, thus allowing for the examination of all deaths occurring on farms but not those deaths due to agricultural work which did not occur on farms. The hospital data did not include activity at time of death in the data provided for this Thesis. However, the NSW Health Department has included this since the introduction of ICD10 [243]. Thus future studies will be able to separate out work related injuries from non work related injuries. There is also no recording of the occupation of the person injured. Collection of the occupations 'farmers and farm managers' and 'agricultural labourers and related workers' would allow those two occupation groups to be included.

8.6.4 Deaths data

Overall the use of the ABS Deaths Data was limited as it did not include information about work status, location of death and children. The ICD10 has a provision for both work status and location. Including these two additional codes would improve our understanding of fatal injuries on farms.

The NCIS is a new initiative in Australia for the collation of coronial records. The information provided by the NCIS contains the Coroners Findings, autopsy results, police report, information about age, gender, employment status, date of death, date of birth, case type, intent, occupation, location of death, cause of death, mechanism of death, and agent of death. The information provided by the NCIS is more detailed than what is available from the ABS. However, due to Coronial procedures, this information may not be available until a number of years after the death of the person.

The ABS and the NCIS have entered into an agreement. The ABS gains access to the information contained in the NCIS to validate and check their data and the NCIS receives occupational, location of residence and ICD10 cause of deaths coded information. By combining this information and using a combination of ABS and NCIS analysis it should be possible to provide more accurate information about deaths on farm in NSW.

8.7 Conclusion

The datasets used in this Thesis each provide a different perspective on farm injury in NSW. By examining the information together, there are a number of areas which are consistently represented in each dataset, such as falls and agricultural machinery. While no one dataset provided all the information which would be useful for the prevention of injuries, the available information does provide direction for the development of prevention strategies. There are a number of additional codes which could be included in each dataset which would provide a better understanding of the different groups at risk of sustaining an injury on a farm or during agricultural work.

Chapter 9 Case Study: Evaluation of Rollover Protective Structure (ROPS) Retro-fitment Campaign

> Have a bias toward action -- let's see something happen now. You can break that big plan into small steps and take the first step right away. - Richard Thalheimer

9.1 Introduction

This chapter examines the effectiveness of a farm injury prevention program. The evaluation of the Rollover Protective Structure (ROPS) retro-fitment campaign in NSW is used in this Thesis as a case study on how to evaluate farm injury prevention initiatives in the absence of good routinely collected data. While randomised controlled trials (RCT) provide the best evidence for the effectiveness of interventions, it was clearly not possible when evaluating this policy change. Due to limitations in current data collections (hospital data; Workers' Compensation data; and Australian Bureau of Statistics (ABS) deaths data) to provide information about tractor deaths, it was not possible to measure the effectiveness of the campaign from these data sources.

The aims of this chapter are to:

- Examine the effectiveness of the ROPS rebate scheme;
- Examine the utility of the data currently available to measure the performance of the program;
- Provide direction for future farm injury evaluations to help improve the evaluation process.

In May of 2000 the NSW State Government announced funding for ROPS retro-fitment campaign. Each farmer who fitted a ROPS during the campaign was eligible to receive a $200 rebate. This historic announcement followed the very successful campaign in Victoria where 12,129 rebates were provided for ROPS on farm tractors in the 1997/98 financial year [155].

The successful Victorian campaign followed three less successful rebate schemes:

- 1987 for two months ($100 rebate – 389 ROPS fitted);
- 1990 for 10 months ($100 rebate – 1436 ROPS fitted); and
- 1994 for 7 months ($120 rebate – 1,116 ROPS fitted). [155]

Farmsafe Australia have been working for many years towards ensuring all tractors in Australia are fitted with a ROPS, to this end they have undertaken two significant pieces of work. Firstly, a national conference on tractor safety in 1991, then a major project examining tractor safety in Australia [153 319].

The Tractor Safety Conference in 1991 identified tractor safety problems around four issues (engineering-related problems, farmer/consumer-related problems, information and support services, and defining the problem). At the conclusion of the conference four areas were identified where work was required:

- old tractors, ROPS & insufficient maintenance;
- run-overs and access;
- attitude and culture; and
- definition of the problem. [320]

The syndicate examining the problem of 'old tractors, ROPS & insufficient maintenance' identified the following issues:

- to their knowledge no person had died in a tractor rollover where a ROPS was fitted;
- the problem was caused by complacency;
- cost (i.e. fitting a ROPS to an old tractor is not economically viable);
- inconvenience;
- legislation (i.e. tractors before a particular date did not need a ROPS);
- economic downturn;
- geographic isolation; and
- lack of policing of current legislation. [320]

The syndicate recommended the following actions:

- promotion of need for ROPS;
- publicity/education/demonstration of ROPS and death from tractor rollover including impact on family; and
- examining legislative options (including compliance).[320]

There have been a number of studies which have examined tractor deaths in Australia and world wide, including the effectiveness of ROPS [14 91 93 154 203 321-325]. While the evidence shows ROPS are effective in significantly reducing the probability of a death when the tractor rolls over, there are still large numbers of tractors without one. In NSW in 1994 Davidson estimated that there were 88,000 tractors on NSW farms and of these 23,766 did not have a ROPS [319]. This is despite there being legislation in NSW since 1982 requiring all tractors between 560kg and 15,000kg to be fitted with a ROPS [326].

Since 2000 there have been five deaths from tractor rollovers in NSW recorded in WorkCover NSW data [327]. In the five years prior (1995-1999) to the introduction of the ROPS scheme there were six deaths and between 1990-1994 there were 13 rollover deaths [327 328]. In the last five years there was also a death where the ROPS hit an overhead structure which fell onto the driver [327]. Overall there has been a downward trend in the number of deaths on NSW farms from tractors rolling over (Table 111). This information should be interpreted with caution as it may not include all tractor deaths; Franklin et al found that only 60% of farm-related fatalities in NSW were recorded in WorkCover NSW data [14].

Table 111 Number of tractor run-over and rollover deaths in NSW between 1988 and 2004

Year	Run-over	Rollover	Total
1988	4	2	6
1989	1	1	2
1990	0	3	3
1991	8	3	11
1992	4	3	7
1993	2	2	4
1994	4	2	6
1995	1	2	3
1996	1	1	2
1997	0	1	1
1998	0	1	1
1999	2	1	3
2000	2	0	2
2001	0	1	1
2002	1	2	3
2003	0	0	0
2004	0	1	1
Total	**30**	**26**	**56**

Note: 1998-1995 [328], 1996-2004 [327]

9.2 Objectives

9.2.1 NSW ROPS Rebate Scheme

The objective of the ROPS Rebate Scheme was to increase the proportion of tractors on farms in NSW that are fitted with an approved ROPS in order to reduce the number of deaths from tractor rollovers.

To achieve this objective the NSW government provided $2 million in funds for 10,000 $200 rebates to be provided to farmers who fitted a ROPS on their tractor from May 2000 until the funds were depleted. WorkCover NSW (a statutory body of the NSW government), NSW Farmers (a member organisation of farmers), Farmsafe NSW (a farm safety organisation), and Unions NSW (an employee advocacy body) formed the reference group who met on a regular basis to oversee the scheme.

A booklet was produced providing information about the scheme and the benefits of fitting a ROPS and distributed throughout NSW to machinery dealers, stock and station agents, WorkCover inspectors, and Farm Safety action groups. Throughout the project a number of advertising campaigns were undertaken via the television, radio, and local, region and state-wide newspapers (such as The Land newspaper).

The Australian Centre for Agricultural Health and Safety was the administering body for the scheme. They received and processed all of the forms, responded to any enquiries and sent out the rebate. Also during the rebate scheme WorkCover ran a number of enforcement programs where they would visit farms to see if the tractors on the farms were fitted with a ROPS.

The scheme came to a conclusion in June 2004 when 10, 449 ROPS rebates had been approved. The scheme was extended three of times (in December 2001, December 2002 and December 2003) as not all of the funds had been used at each of these stages.

9.2.2 NSW ROPS Rebate Scheme Evaluation

The objectives of the NSW ROPS Rebate Scheme Evaluation were:

1. To report on the uptake of the program by: month; commodity group; location; and characteristics of the tractors protected.

2. To describe the implementation and administration of the program: work undertaken by WorkCover, Farmsafe, ACAHS toward the program; and describe the work of the Steering committee (based on the minutes)
3. To assess the cost of the ROPS Scheme, including costs to the farmer (based on information provided by the farmer)
4. To describe the factors that contributed to the uptake of the program
5. To describe the factors that limited the uptake of the program

The objectives of the ROPS Evaluation were developed to answer the following questions:

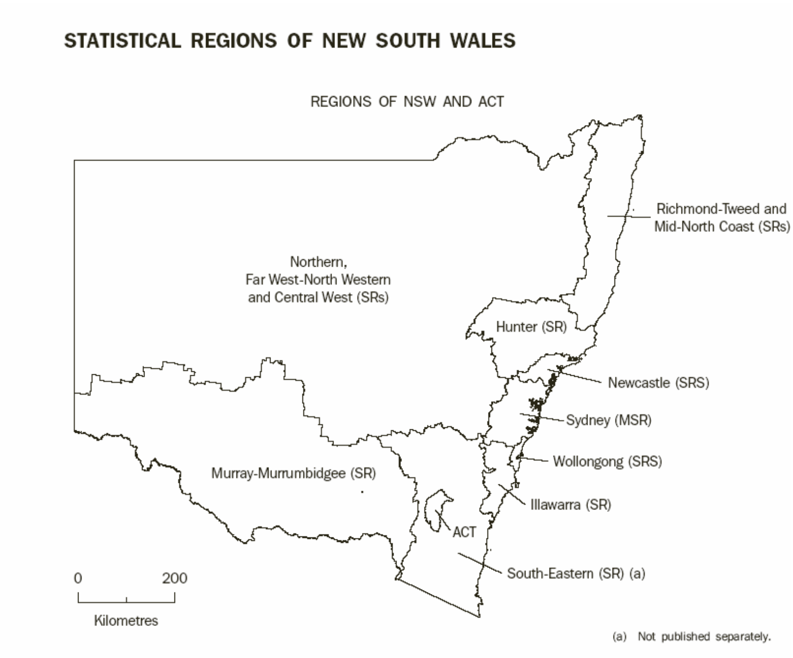
1. Was the ROPS rebate scheme successful in reducing the number of tractors in NSW without a ROPS?
2. Has the number of tractor rollover deaths decreased as a result of the ROPS scheme?
3. What was the uptake of the ROPS scheme over time?
4. Did different commodity groups or regions utilise the scheme more than others?
5. Was the scheme administered effectively and did the ROPS committee work?
6. What was the cost of the ROPS scheme?
7. If the ROPS scheme was to be undertaken again what issues should be considered?

9.3 Methodology

To achieve each evaluation objective a number of different methods were used, with each utilising a separate methodology.

Information relating to the ROPS scheme is presented by 14 Regions (these 14 regions represent the NSW WorkCover regions) and analysed by 12 regions (four regions were grouped into two regions dues to small numbers and availability of agricultural establishments numbers – Murray & Murray LW to Murray and South Eastern & ACT were grouped to South Eastern all). The 12 Regions for analysis are; Sydney, Hunter, Illawarra, Richmond-Tweed, Mid-North, Northern, Central, Murrumbidgee, Murray (includes Murray and Murray LW), and South Eastern (includes South Eastern and ACT) Figure 58).

Figure 58 Statistical Regions of New South Wales



Source: [329]

The number of agricultural establishments is based on the information from the Report by the Australian Bureau of Statistics '1362.1 Regional Statistics, New South Wales' [329]. Commodity information for NSW was gained from the publication '7121.0 Agricultural Commodities' and is not available at region level [54].

9.3.1 Methodology for Focus Groups

The first step of the evaluation was to undertake focus groups across NSW to discuss the ROPS rebate scheme and why farmers have or have not fitted ROPS to all of their tractors. Four focus groups were run in NSW during the program at: Moree; Glen Innes; Goulburn; and Hay. These areas were identified by NSW Farmers as areas diverse from one another and broadly reflective of farming in NSW. The focus groups ran for approximately one hour.

A letter was sent to the local farmer group President/Chairman to ask for their group's participation (a copy of the letter was sent to the local NSW Farmers Association field officer) explaining the reasons for the focus group. Once participation had been granted and a date organised for the focus group, local farmers were recruited to participate. The focus groups were facilitated by Associate Professor Lyn Fragar and Mr Richard Franklin. The focus groups were also asked if they would commit to the conversation being recorded (there were no refusals). A recording and notes of the focus groups' discussion were taken. The information from the focus groups was summarised. Information gathered from the focus groups was used to develop the final questionnaire.

During the focus groups a number of prompting questions were used to keep the conversation on track, these prompting questions were:

- Why would a farmer fit a ROPS?
- Have you heard about the ROPS rebate scheme?
- How did you hear about the ROPS rebate scheme?
- Is $200 enough of an incentive?
- Why are farmers not fitting a ROPS?
- Have there been any deaths in the area from tractor rollovers that you can remember?
- Did you know that under the legislation you need to have a ROPS fitted to a tractor that weighs between 560kg-15,000kg?
- How would you let people know about the ROPS scheme?
- Do you think the price of ROPS has increased because of the scheme?

The information was summarised under these questions.

During the discussion, probing was undertaken to gather further information. While there were only four focus groups undertaken the range of answers was broad with the majority of issues being raised at each forum. Some of the focus groups raised local issues.

The focus group sessions were all recorded on a Sony Walkman ™ tape player and notes taken by the moderator and assistant. Each focus group session was then transcribed verbatim from the recording and supplemented with information from the notes by the moderator and assistant. The transcripts were then examined by the author line by line to identify:

- The range of feelings and opinions about ROPS, tractors and the NSW ROPS Rebate scheme (this information was used to develop the surveys that were used for both the follow-up survey and the general community survey).
- Themes and issues revealed at all or the majority of the focus group session.
- Answers to the questions:
    - Reasons for fitting a ROPS;
    - Have your heard about the ROPS scheme and how;
    - Why wouldn’t a farmer fit a ROPS;
    - What would it take for a farmer to fit a ROPS;
    - Knowledge about effectiveness of a ROPS; and
    - Difficulties arising from fitting a ROPS.

Where additional information was found this has been placed in an ‘other issues identified in the focus group’ section.

9.3.2 Methodology for Delivery of ROPS Scheme

To receive the rebate, farmers were required to provide the following details:

- Name, contact details including address and phone numbers
- Information on their farming status (e.g. fulltime, hobby)
- If they were a member of NSW farmers or another association
- Their enterprise type (commodities produced)
- ROPS information: supplier, including contact details; cost of ROPS; installer, including contact details; cost of installation; brand and type; serial number; and date of installation.
- Tractor information; engine serial number; make; model; and year of manufacture.
- Scheme information: date information received and date rebate sent

This information was then analysed to provide details on the uptake of the scheme. The persons address was used to establish the Statistical Local Area (SLA) in which they lived which was then used to establish the WorkCover region.

9.3.2.1 Coding Enterprise Type

From the information provided by the farmer, enterprise was coded to the Australian New Zealand Standard Industrial Classification (ANZIC) [2].

When no information was provided they were given the code 199 = “Unknown”. Where they identified as a hobby farm even when other commodities were present they were coded as 198 = “hobby farm”.

Where two or more commodities were identified but could not be matched to ANZSIC the first code was used as the classification e.g. if the commodities identified by the farmer were ‘citrus’ and ‘beef’ in that order, their farm would be coded as 199 = ‘fruit growing NEC’, if however there were three commodities identified and two of them could be coded into a group then they were used e.g. if a farmer identified the commodities ‘beef’, ‘grapes’ and ‘grains’, this would be coded as 122 = ‘Grain-Sheep and Grain-Beef Cattle Farming’. Where there were three or more that could not be coded into a group these would be coded to 197 = ‘Mixed Farming’. Where the farmers were identified as ‘mixed’ they were coded to 197 = ‘Mixed’. The use of the first commodity to code enterprise is based on the assumption that this commodity would be the larger of the two. Where somebody was using the farm for purposes other than farming this was called 197 = “Other’ e.g. tourism.

Table 112 Australian and New Zealand Standard Industrial Classification (ANZIC) for agriculture and services to agriculture

Subdivision 01: Agriculture	
011: Horticulture and Fruit Growing	
0111	Plant Nurseries
0112	Cut Flower and Flower Seed Growing
0113	Vegetable Growing
0114	Grape Growing
0115	Apple and Pear Growing
0116	Stone Fruit Growing
0117	Kiwi Fruit Growing
0119	Fruit Growing NEC
012: Grain, Sheep and Beef Cattle Farming	
0121	Grain Growing
0122	Grain-Sheep and Grain-Beef Cattle Farming
0123	Sheep-Beef Cattle Farming
0124	Sheep Farming
0125	Beef Cattle Farming
013: Dairy Cattle Farming	
0130	Dairy Cattle Farming
014: Poultry Farming	
0141	Poultry Farming (Meat)
0142	Poultry Farming (Eggs)
015: Other Livestock Farming	
0151	Pig Farming
0152	Horse Farming
0153	Deer Farming
0159	Livestock Farming NEC
016: Other Crop Growing	
0161	Sugar Cane Growing
0162	Cotton Growing
0169	Crop and Plant Growing NEC
Subdivision 02: Services to Agriculture; Hunting and Trapping	
021: Services to Agriculture	
0211	Cotton Ginning
0212	Shearing Services
0213	Aerial Agricultural Services
0219	Services to Agriculture NEC
022: Hunting and Trapping	
0220	Hunting and Trapping

9.3.3 Methodology for follow-up survey of people who had fitted a ROPS

A random sample of participants based on WorkCover regions and agricultural industry groups at the 3 digit level ANZIC codes (Table 112) was selected using a 10% criterion (i.e. at least 10% of an industry group was randomly selected). Where the numbers were less than 20 all people were surveyed [2]. The random sampling of participants occurred at two stages in the evaluation, in June 2002 and August 2004.

From the random sample 1,219 surveys were sent; 503 in June 2002 and 716 in August 2004. There were 652 (53.5%) returned questionnaires, of these one was removed because it did not have a registration number to be able to match it with a participant.

Information collected in the survey included:

- Confirmation of the farming enterprise
- Age group
- Information about the ROPS Scheme (including received rebate in 4 weeks, happiness, reason for fitting a ROPS, heard about scheme, and publicity)
- Farming experiences (including knowledge of a tractor rollover death, involvement in a rollover, risk of rollover, employees, and WorkCover visits)
- Information about the fitting of the ROPS (including time taken, if the tractor needed to leave the farm, difficulties, reasons for not fitting, and prompts to fit a ROPS)
- Information about the ROPS (including cost, finding one, changes in work practices, effectiveness, legal requirement, why some tractors are not fitted with a ROPS, and prompt to other farmers)
- Information about tractors (including number, number without a ROPS, life of new tractors, purchase of a new one, and life left in tractor with a ROPS)

Reasons for not fitting a ROPS were classified into the following categories:

- Antique / collectable
- Cabin present
- Working conditions
- Can't justify expense
- Couldn't find a ROPS
- Don't use tractor
- Haven't got around to it
- Implements attached
- Not used often enough
- Old
- Selling tractor
- Tractor not working
- Can't afford it / cost / too expensive

Prompts (reasons) for farmers to fit a ROPS were classified into the following categories:

- Able to make own ROPS
- Accident / near accident
- Availability of ROPS
- Compulsory
- Fine / Legal Action / Threat of fine
- WorkCover inspections
- Higher Rebate
- Increased awareness
- Increased workers comp if no ROPS
- Keeping rebate program
- Threat of prosecution
- Reducing problems caused by ROPS
- Safety
- Some people will never comply
- Not able to sell tractor without ROPS
- Higher rebate & possibility of fine (carrot & stick)

9.3.4 Methodology for survey of general farming population

A total of 12,000 questionnaires were sent out to randomly selected Road Side Mail Boxes (RMB) in New South Wales in April 2004. The locations were selected from towns within each WorkCover Region. One thousand questionnaires were distributed in each Region except for the ACT, Far West, Illawarra and Murray LW where all RMB's were surveyed. Each region's questionnaire was sent on a different colour paper so that the number returned from a region was known.

Although a mail out survey response rate is traditionally poor and was anticipated to be poor in this case, cost and ability to find farmers meant that this was the most effective method of reaching the target population. The responses were examined to see if there was a difference from the ABS information regarding the number of enterprise types (i.e. commodities) from the region selected.

Two response rates were calculated for the survey. Response rate is the number of returned surveys over the number of survey sent out. This yielded an average response rate of 4.7% ranging from 0.9 to 10.0%. An adjusted response rate was also calculated is it is known that some RMBs do not belong to farms. The adjusted response rate was calculated using the number of returned surveys over the expected number of farms (i.e. the average number of farms per centre for a region by the number of centres surveyed). The adjusted response rate yielded an average response rate of 23.2% ranging from 2.7 to 48.9% across regions. The actual response rate is likely to be higher, as not all farms have RMBs.

Information collected included:

- Tractors (including number, age, horse power, purchases choices, replacement, and factors in buying a new tractor)
- ROPS (including tractors with a ROPS, compliance plates, effectiveness, legal requirement, why not fitted, and prompts to get farmers to fit a ROPS)
- ROPS Scheme (including how heard about, fitting a ROPS using the scheme, prompts, and publicity)
- Experiences (including people injured or killed from a tractor rollover or themselves, drivers at risk, and WorkCover visit)
- Age
- Farm commodities

- Size of farm

For the questions “What would you estimate to be the working life of a new tractor?” and “How often do you buy a new tractor for your enterprise?”, those people who answered in words with no numerical value (e.g. rarely, depends, etc) were excluded. For those that put a range, the mid point was taken (e.g. 30-40 years = 35 years). Where a number with a plus was used the number was taken (e.g. 10+ = 10); and where people answered in hours, these were excluded.

9.3. 5 Methodology for examination of Minutes

The ROPS Committee had representation from: NSW Farmers; Farmsafe NSW; NSW WorkCover Authority; Australian Centre for Agricultural Health and Safety; Tractor and Machinery Association of Australia; and the Labour Council of NSW.

The ROPS Committee Minutes were examined for the following themes: partnerships; communication / promotion; logistics; and monitoring.

Table 113 Response rates for the return of the surveys.

Region	No. RMB	No. of Centres	No. sent	No. of returned surveys	Response Rate %	No. of farms	Av. farms per centre	No. of centres surveyed	Expected number of farms	Adjusted Response Rate %
North Western	9,483	51	1,090	109	10.0	4,286	84	5	420	25.9
Northern	13,887	72	1,100	92	8.4	6,496	90	5	451	20.4
Richmond-Tweed	21,004	87	1,105	21	1.9	3,183	37	8	293	7.2
South Eastern All	18,918	91	1,895	57	3.0	4,429	49	9	438	13.0
South Eastern	18,674	86	1,651	37	2.2			4		
ACT	244	5	244	20	8.2			5		
Sydney	16,584	62	1,110	10	0.9	1,920	31	3	93	10.8
Central West	9,195	29	1,051	84	8.0	5,542	191	5	956	8.8
Far West	288	4	288	22	7.6	286	72	4	286	7.7
Hunter	13,468	177	943	51	5.4	3,075	17	6	104	48.9
Illawarra	297	2	297	25	8.4	918	459	2	918	2.7
Mid-North Coast	16,849	74	1,009	63	6.2	3,134	42	6	254	24.8
Murray All	25,923	104	1,753	116	6.6	3,991	38	9	345	33.6
Murray	25,518	98	1,348	59	4.4			3		
Murray LW	405	6	405	57	14.1			6		
Murrumbidgee	8,449	70	1,303	129	9.9	4,692	67	4	268	48.1
Total	**154,345**	**823**	**16,592**	**779**	**4.7**	**41,952**	**51**	**66**	**3,364**	**23.2**

9.4 Results

9.4.1 Focus Group Information

The focus groups were undertaken in Moree, Glen Innes, Goulburn and Hay.

There were six areas that the focus groups examined in their discussions:

- reasons for fitting a ROPS;
- have your heard about the ROPS scheme and how;
- why wouldn't a farmer fit a ROPS;
- what would it take for a farmer to fit a ROPS;
- knowledge about effectiveness of a ROPS; and
- difficulties arising from fitting a ROPS.

There were twenty eight people who participated and group size ranged from five to twelve. People were recruited through a range of methods including through the NSW Farmers Association networks, community radio announcements, phone book searches and contacts of staff at the Australian Centre for Agricultural Health and Safety.

The examination of the information collected was grouped and direct quotes from the participants are used to highlight points raised. The primary aim of the focus groups was to gather information about the reasons why people were or were not fitting ROPS, so that this information could be incorporated into a questionnaire for evaluating the effectiveness of the ROPS rebate scheme in NSW.

9.4.1.1 Reasons farmers and hobby farmers would fit a ROPS:

The reasons for fitting a ROPS were many and varied and ranged from more advertising to issues surrounding safety.

Many people reported that if a farmer lived on a property that had hills or river banks with steep sides then they would identify this as a potential risk and place a ROPS on a tractor. However, if they lived on flat country, then the farmer was less likely to identify tractor rollover as a risk.

It was felt that students and employees (particularly inexperienced employees) are at a greater risk of a tractor rollover due to their lack of experience, skills, and knowledge (both about tractors and terrain). Where farms had students or employees they would be more likely to fit a ROPS, whereas sole operators were less likely to fit a ROPS (farmers considered themselves to be more skilful). This was also discussed in context of their legal responsibilities and that farmers were more likely to fit a ROPS if they had employees.

Farmers thought that the cost of the ROPS was not worth it if they were the only person at risk.

Complying with your legal responsibility was another reason farmers would fit a ROPS. This was discussed in the context that if a farmer did not comply with the legislation and there is an accident they may lose the farm and it was easier to go along with the system than fight the system. "*…if you did have an accident on your farm, then WorkCover would visit and investigate and that if you didn't have a ROPS you would be fined/prosecuted..*"

Liability was also discussed as a reason for fitting a ROPS and that the farmers insurance may not cover them if they had a tractor rollover or someone else had a tractor rollover and a ROPS was not fitted.

The farmer's wife was identified as a person that may encourage the farmer to fit a ROPS through gentle persuasion for his safety. It was also identified that if there was a death due to a tractor rollover where the person would have been saved by the ROPS, particularly where they knew the person, this would persuade farmers to fit a ROPS. The information about the death may be relayed to the farmer through the media or local networks. The use of the media to inform farmers about the issues and to give advice on how to resolve these issues was discussed as a means of encouraging farmers to fit a ROPS.

It was acknowledged that OHS / safety was becoming a major issue in farming "*…people are becoming more aware of OHS issues…*" Fitting a ROPS will save your life if the tractor did rollover was also identified as reasons to fit a ROPS. "*…If you do fit a ROPS and roll it won't kill you but may squash a leg…*"

The rebate was also identified as a way of helping farmers fit a ROPS. "*…Farmers are used to rebates and this would be an incentive…*"

9.4.1.2 Have you heard about the ROPS Rebate Scheme and How:

Most people at the focus groups had heard about the scheme but not all. People who had heard about the scheme had predominantly heard via NSW Farmers Association Newsletter, the Land Newspaper and television. Other means that people had heard about the scheme included agricultural field days (AgQuip and Tocal), ABC Radio, Farm Trader, Rural Lands Protection Board Newsletter, local Farm Safety Action Groups, Farmsafe NSW, Weekly Times, Rural News, Local Machinery Dealers (on bills and in person), local papers, and other farmers.

Most people thought the amount of information about the scheme had been OK, however when asked nobody could recall when the scheme started and many were unsure of when it would finish. Although each group had identified the television as a means of hearing about the scheme nobody could remember the advertisement and admitted that they used other means to gather information about farming practice.

People that focus group members thought may not have heard about the scheme included: farmers whose produce was not considered mainstream, who would be getting their information from other sources (such as commodity magazine) "*…there has been nothing in the alternative farmer magazine…*"; weekend farmers – those farmers who owned property but only visited on weekends "*…Sydney people are not reading the rural press, if anything they are looking at small farmer magazine. It is also hard to educate these farmers about their role in the community such as fire safety…*"

The other group of farmers identified as possible people who may not have fitted a ROPS were those with numeracy and literacy problems, as they may not have seen it in a the newspaper and may not be members of farmers groups. "*…What about people who cannot read or write, what are you doing to help them fit a ROPS…*"

There were several methods identified to inform farmers about the ROPS scheme: putting a message with rate notices, via commodity specific organisations (e.g. alpaca association, olive growers association), invoices from machinery dealers and stock and station agents, and hard hitting advertisements.

9.4.1.3 Why do you think farmers will not fit a ROPS:

There were many reasons put forward as to why farmers are not fitting ROPS. The four major suggestions were amount of use of the tractor, value of the tractor, cost of ROPS, and the farmer being a sole operator.

The amount of time during the year that a tractor is used, particularly an old tractor may be quite small and as such many farmers don't see the need to fit a ROPS, "*…A bloke that drives a tractor three or four times a year is going to say she'll be right why spend $600…*" Many of the tractors without ROPS are used for specific jobs such as digging post holes, and have the posthole digger permanently fitted or a power source for a pump, where the tractor is moved between jobs or the tractor is used as a backup if their main tractor broke down "*…Owner of a small family farm would have a small tractor in the shed with a posthole digger attached…*",

The value of the tractor and the cost of the ROPS was another common theme in all focus groups. It was identified that tractors without ROPS were often old and not worth much money and thus to spend any money on the tractor was seen as not worthwhile. Often the cost of the ROPS was the same or of greater value than the tractor"*…ROPS may be more costly than the tractor…*" The cost of the ROPS was not seen as a huge impediment except that many said they could build one for less cost "*…People have not done it because three pieces of steel costs $1000, but you have all the stuff on the farm and could knock it together if you were allowed to…*".

The sole operator was also identified as a person who may not fit a ROPS because they considered themselves to be skilful at their work and also know that the only person who will be injured is themselves. They are also often busy and do not have the time to know all about the legislation.

Other reasons why farmers do not fit a ROPS included: farmers being resentful of bureaucrats telling them what to do; the tractor will not fit in the shed if a ROPS is fitted; the farmer has never rolled a tractor and thinks it will not happen to him "*..never rolled one before…*"; and don't have any hills "*…the steepest part of the farm would be the levy bank…*". The last two reasons deal with risk perception (i.e. the perceived risk is minimal or nonexistent).

9.4.1.4 What would it take for a farmer to fit a ROPS to their tractor under the scheme:

This question was asked after the focus group participants had discussed the reason why farmers had not fitted a ROPS and they had also discussed that there were still tractors in NSW that did not have a ROPS fitted.

All groups said that more enforcement was the crucial factor for farmers to fit a ROPS. This was however countered by the need to have friendly visits allowing the farmer time to fix the problem "*…friendly visit by a health and safety inspector…*" "*…those who have not will probably not do it until they get a visit from WorkCover…*" Many identified the lack of support from WorkCover as a problem stating "*… the only time you see an inspector is when something goes wrong…*" "*…Will come and bomb you when an accident occurs but are conspicuous by their absence when there are no accidents…*"

It was identified that what was needed are people in the field who can advise the farmer about the regulations. The focus groups then went on and said that after a person had been given a warning, they should be fined "*…Should give a notice and then come back and if still not done fine them the cost of the ROPS plus the fine…*" It was also discussed that if random inspections were to occur there should be publicity, as word of mouth only informs some farmers "*…word of mouth is only good to a certain extent, unless you put it in the paper…*" It was also suggested that publicity about a farmer who had not fitted a ROPS may be useful in encouraging other farmers fit a ROPS.

Other comments included:

"*…if they came with the right attitude that they were not going to prosecute and are there to help we would appreciate it…*"

"*…farmers are waiting to be approached but are only approached after an accident, too late, why don't they have time before the accidents…*"

Although increasing the amount of the subsidy was discussed as a means of getting farmers to fit a ROPS, this was then considered unfair to those who had already fitted a ROPS and may be counter productive as farmers would keep on waiting for it to go up. "*…more cash back would be unfair on those that went first…*"

It was also identified that the type of advertising was important. Graphic ads, accident scenarios, cost of ROPS similar to the cost of a couple of drums of roundup and people stating that a ROPS had saved their life were all identified as ads that would grab the farmers attention. It was also stated that the amount of the fine for not fitting a ROPS should be highlighted. "*…If you think you are going to lose money you would put one on…*" "*…ROPS are not that dear, at the end of the day it is about the cost of a couple of drums of roundup…*"

9.4.1.5 Knowledge of the effectiveness of the Rollover Bar:

All the focus groups acknowledged that a ROPS was an effective measure for preventing the death of a person driving a tractor and there was no dissenting discussion or further discussion about effectiveness.

9.4.1.6 Difficulties that have arisen from fitting a ROPS (Fitting & Post of Fitting):

There were a few difficulties identified by focus group participants in both the fitting of the ROPS and after the ROPS had been fitted.

The majority of the complaints about the ROPS were after they had been fitted, and were about not being able to see the ROPS "*…you tend to hit things that you would not normally hit*…" Things that farmers tended to hit were trees, with slashing under trees identified as a common job undertaken by the smaller tractors "*…Problem with ROPS is the restriction it gives you on the tractor, small tractors are used for slashing under trees and some ROPS frames are tall...*" and sheds "*…now that I have put a ROPS on I can't get my tractor into the shed…*" "*…you forget that the ROPS is behind you…*"

The complaints about fitting the ROPS included that they had to remove the mud guards to fit the ROPS and this may have caused further problems such as needing to rewire lights, not being able to used the tool box, and that often the bolts on the mud guards had not been moved since the tractor was new and taking the bolts out took time. "*…It didn't fit well and I had to remove mud guards and had to cut through wiring for the lights at back of the tractors and it is now too costly to get them rewired…*"

The other complaints about fitting the ROPS were that: the rebate did not take into account the farmer's time to fit the ROPS; there were no instructions; it was not a one man job and if the ROPS was fitted by a dealer there was an additional cost to get the tractor to town. "*...Didn't take into account the farmer's time to fit the ROPS and there were no instructions just a picture…*" "*…It cost $200 each way to transport tractor to dealer to have ROPS fitted…*"

The other post fitting complaint was that there was no canopy or shade as sometimes the canopy had to be removed to fit the ROPS or to attach a canopy the farmer would need to weld something to frame which is illegal or use U-bolts which tend to come undone. "…*Can't fit a lid to solve the UV problem*…" "…*U-bolts not good as they come loose*…"

Some solutions were proposed to the problem of not knowing the ROPS was behind the person sitting on the tractor. These included using the exhaust or extending the exhaust to the height of the ROPS; putting a whip aerial on the front of the tractor to the same height of the ROPS; or putting on a canopy. "…*I have put a whip aerial on the front of my tractor so I can see the height of the ROPS…*"

9.4.1.7 Other issues identified in the focus groups:

There were three other issues identified during the course of the focus groups.

The selling of tractor without ROPS by dealers and at clearing sales was raised at several of the focus groups. "…*I have been to a number of clearing sales which have had tractors being sold without ROPS and maybe the agents don't know anything about it? Or they may be turning a blind eye to it…*"

There should be a list of suppliers available so that people know where they can get a ROPS. "A *list of suppliers and where you can get them from would be useful…*"

It was identified in one of the focus groups that there are some farmers who do not have the money to buy a ROPS and could not afford to be fined as it would put them out of business. "…*What are you doing about low income farmers that can not afford a ROPS and could not afford to be fined?...*"

9.4.2 Delivery of ROPS Scheme

The NSW ROPS Retrofitment campaign ran from May 2000 to the end of June 2004. The initial campaign was to run from May 2000 to 31 December 2001, but was extended three times, the first from January 2002 to December 2002, the second from January 2003 to December 2003 and the last from January 2004 to June 2004. During the scheme 8,799 people fitted 10,449 ROPS receiving $2,089,800 in rebates.

9.4.2.1 Fitment by Region

There were 10,449 ROPS fitted over the period of the scheme, this equated to a fitment rate of 25 ROPS per 100 agricultural establishments. The rate of fitment did vary by region from 9.1 per 100 establishments in the Far West to 59.5 in Sydney. (Table 114)

Table 114 Number of ROPS fitted by Division and Year

DIVISION	2000	2001	2002	2003	2004	Total	Number of Establishments	ROPS fitted on Tractors per 100 establishments
Central West	133	407	506	331	220	1,597	5,542	28.8
Far West	1	4	8	4	9	26	286	9.1
Hunter	67	112	106	54	66	405	3,075	13.2
Illawarra	15	46	37	27	22	147	918	16.0
Mid-North Coast	86	203	150	123	110	672	3,134	21.4
Murray All	24	237	322	221	97	901	3,991	22.6
Murray	*21*	*148*	*140*	*129*	*80*	*518*		
Murray LW	*3*	*89*	*182*	*92*	*17*	*383*		
Murrumbidgee	104	368	438	436	185	1,531	4,692	32.6
North Western	115	335	245	161	166	1,022	4,286	23.8
Northern	183	628	343	248	240	1,642	6,496	25.3
Other	0	14	12	13	8	47		
Richmond-Tweed	47	150	132	146	44	519	3,183	16.3
South Eastern All	100	265	196	131	106	798	4,429	18.0
South Eastern	*96*	*255*	*177*	*123*	*104*	*755*		
ACT	*4*	*10*	*19*	*8*	*2*	*43*		
Sydney	96	357	311	241	137	1,142	1,920	59.5
Total	**971**	**3,126**	**2,806**	**2136**	**1,,410**	**10,449**	**41,952**	**24.9**

9.4.2.3 Fitment by Commodity Group

There was a large variation by enterprise for the rate of ROPS on tractors per 100 establishments, ranging from 4.0 for pig farmers to 37.9 for crop and plant growing NEC Hobby farmers and farmers that identified their enterprises as mixed farming accounted for a third (37.5%) of all ROPS fitted on tractors. (Table 115)

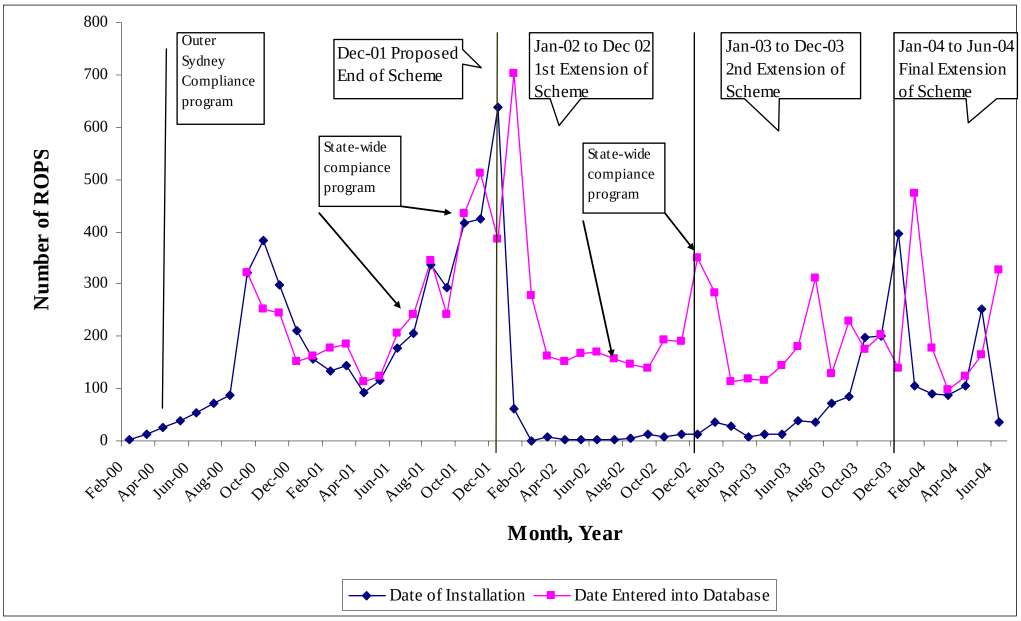
Table 115 Number of ROPS fitted by Enterprise Type

Enterprise Type	Number of ROPS	%	Number of Establishments	ROPS fitted on Tractors per 100 Establishments
Unknown	299	2.9		
Horticulture and Fruit Growing	1,822	17.4	6130	29.7
Horticulture and Fruit Growing	*1108*	*10.6*		
Plant Nurseries	*124*	*1.2*	*974*	*12.7*
Cut Flower and Flower Seed Growing	*20*	*0.2*	*295*	*6.8*
Vegetable Growing	*130*	*1.2*	*986*	*13.2*
Grape Growing	*280*	*2.7*	*1175*	*23.8*
Apple and Pear Growing	*13*	*0.1*	*233*	*5.6*
Stone Fruit Growing	*13*	*0.1*	*465*	*2.8*
Fruit Growing NEC	*134*	*1.3*	*2002*	*6.7*
Grain-Sheep and Grain-Beef Cattle Farming	1,026	9.8	7205	14.2
Grain Growing	289	2.8	4206	6.9
Sheep-Beef Cattle Farming	674	6.5	4036	16.7
Sheep Farming	356	3.4	5457	6.5
Beef Cattle Farming	1,378	13.2	10806	12.8
Dairy Cattle Farming	100	1.0	1943	5.1
Poultry Farming	93	0.9	482	19.3
Poultry Farming	*80*	*0.8*		
Poultry Farming (Meat)	*11*	*0.1*	*351*	*3.1*
Poultry Farming (Eggs)	*2*	*0.0*	*131*	*1.5*
Pig Farming	13	0.1	328	4.0
Horse Farming	51	0.5	770	6.6
Deer Farming	1	0.0	56	1.8
Livestock Farming NEC	63	0.6	415	15.2
Sugar Cane Growing	39	0.4	489	8.0
Cotton Growing	43	0.4	490	8.8
Crop and Plant Growing NEC	94	0.9	248	37.9
Hobby Farming	2,261	21.6		
Mixed Farming	1,660	15.9		
Shearing Services	1	0.0		
Services to Agriculture NEC	154	1.5		
Forestry	20	0.2		
Logging	2	0.0		
Services to Forestry	1	0.0		
Marine Fishing NEC	4	0.0		
Aquaculture	5	0.0		
Total	**10,449**	**100.0**		

9.4.2.4 Fitment over time

There were 6,577 (62.9%) people who supplied a date for when they fitted their ROPS. From the beginning of the scheme to the end of January 2002 there were 4,855 ROPS rebates provided. The ROPS Rebate Scheme was extended for 12 months, during this time there were 2,307 ROPS rebates provided (February 2002 to End January 2003). The scheme was then extended again for 12 months and 2,351 ROPS rebates were provided (February 2003 to End January 2004). The scheme was then extended for a final six months during which 936 ROPS rebates were provided (February 2004 to July 2004). (Figure 59) The dates for when the ROPS rebate was entered into the database is more complete and should reflect fitment of ROPS and so this information was used for analysis.

Figure 59 ROPS installed and ROPS rebates entered into database by Month and Year, with identification of Key ROPS Scheme Dates



9.4.2.5 Full-time farmer, hobby farmer, other

The majority (69.4%) of people who fitted a ROPS were full-time farmers. This did vary by region from 37.4% in the Illawarra region to 86.9% in the Murray region (Table 116).

9.4.2.6 Members of Associations

There were 7,445 (71.3%) people who fitted ROPS who did not identify themselves as belonging to any association. Of the remaining 3,004 people, 2,229 (72.4%) were members of NSW Farmers, 641 (21.3%) were members of another association and 134 (4.5%) were members of NSW Farmers and another association. Common other associations identified were Victorian Farmers Federation, Rice Growers, Meat and Livestock Association, and Citrus Growers Association. There was some variation in the percentage of people who put a ROPS on their tractor and were members of a professional organisation by region (Table 117).

Table 116 ROPS fitted by region, full-time, hobby and other farmers

Region	Fulltime Farmer		Hobby Farmer		Other		Total
	No.	%	No.	%	No.	%	
Central West	1,191	74.6%	362	22.7%	65	4.1%	1,597
Far West	21	80.8%	1	3.8%	4	15.4%	26
Hunter	202	49.9%	196	48.4%	15	3.7%	405
Illawarra	55	37.4%	83	56.5%	11	7.5%	147
Mid-North Coast	305	45.4%	349	51.9%	31	4.6%	672
Murray	783	86.9%	99	11.0%	21	2.3%	901
Murray	*439*	*84.7%*	*61*	*11.8%*	*18*	*3.5%*	*518*
Murray LW	*344*	*89.8%*	*38*	*9.9%*	*3*	*0.8%*	*383*
Murrumbidgee	1,325	86.5%	175	11.4%	33	2.2%	1,531
North Western	784	76.7%	205	20.1%	41	4.0%	1,022
Northern	1,230	74.9%	360	21.9%	84	5.1%	1,642
Other	34	72.3%	11	23.4%	3	6.4%	47
Richmond-Tweed	339	65.3%	167	32.2%	19	3.7%	519
South Eastern All	466	58.4%	310	38.8%	39	4.9%	798
ACT	*9*	*20.9%*	*31*	*72.1%*	*5*	*11.6%*	*43*
South Eastern	*457*	*60.5%*	*279*	*37.0%*	*34*	*4.5%*	*755*
Sydney	520	45.5%	569	49.8%	76	6.7%	1,142
Total	**7,255**	**69.4%**	**2,887**	**27.6%**	**442**	**4.2%**	**10,449**

Note there were 135 people who answered yes to more that one question

Table 117 Region by members of professional associations

Region	NSW Farmers Member		Member of Other Association		Total
	No.	%	No.	%	
Central West	456	28.6	57	3.6	1,597
Far West	12	46.2	3	11.5	26
Hunter	55	13.6	23	5.7	405
Illawarra	14	9.5	15	10.2	147
Mid-North Coast	58	8.6	45	6.7	672
Murray	219	24.3	181	20.1	901
Murray	*165*	*31.9*	*81*	*15.6*	*518*
Murray LW	*54*	*14.1*	*100*	*26.1*	*383*
Murrumbidgee	396	25.9	131	8.6	1,531
North Western	350	34.2	25	2.4	1,022
Northern	467	28.4	97	5.9	1,642
Other	10	21.3	8	17.0	47
Richmond-Tweed	44	8.5	58	11.2	519
South Eastern All	162	20.3	50	6.3	798
ACT	*3*	*7.0*	*9*	*20.9*	*43*
South Eastern	*159*	*21.1*	*41*	*5.4*	*755*
Sydney	120	10.5	82	7.2	1,142
Total	**2,363**	**22.6**	**775**	7.4	**10,449**

9.4.2.7 Time before rebate was sent

In the data available there are two possible dates that could be used for time before rebate was sent. The first was an administrative measure: the date the information was entered into the database, which reflects most closely the time when the rebate form arrived (the day that the rebate form arrived was not collected). The second was a personal response to getting the form to the administrative centre for it to be processed, which is the date between fitment and the information being entered into database. The date of entry into the database was used for analysis. There were 10,446 ROPS rebates sent out in an average of 4.5 days (Median = 0 days range = 0-440 days). Five percent took longer than 30 days to process.

The time taken from fitment to the information being entered into the database was available for 6,469 ROPS fitments (information was either missing or the fitment date was post the date the information was entered into the database for 3,980 cases and were excluded from the analysis). The average time for the farmer to return the completed form was 60.1 days (Median = 20 days, range = 0-1311 days).

9.4.2.8 Tractor make

The most common make of tractor was the Massey Ferguson (45.6%), followed by International (9.6%), Ford (9.3%) and Fordson (9.2%) (Table 118)

Table 118 Make of tractor on which a ROPS was fitted

Tractor Make	No.	Percentage
Case	93	0.9
Chamberlain	636	6.1
David Brown	498	4.8
Deutz	23	0.2
Fiat	647	6.2
Ford	970	9.3
Fordson	965	9.2
International	1,004	9.6
Iseki	25	0.2
John Deere	278	2.7
Kubota	208	2.0
Leyland	45	0.4
Massey Ferguson	4,761	45.6
Nuffield	156	1.5
Universal	14	0.1
Zetor	18	0.2
Other/Unknown	108	1.0
Total	**10,449**	**100.0**

9.4.2.9 Year Tractor was manufactured

The year the tractor was manufactured was unknown for 44.6% of the tractors fitted with ROPS. Where the age of tractor was known, the 1960's (23.6%) was the most common decade followed by 1950's (14.6%) and 1970's (12.8%) (Table 119).

Table 119 Decade tractor was manufactured by number of ROPS fitted

Decade	Number of ROPS	Percentage
Pre 1950	183	1.8
1950-1959	1,522	14.6
1960-1969	2,471	23.6
1970-1979	1,336	12.8
1980-1989	235	2.2
1990 or newer	43	0.4
Unknown	4,659	44.6
	10,449	**100.0**

9.4.2.10 Costs

The cost of the ROPS was known in 10,411 cases. The average cost was $576.06 (range $145.00 to $7,397), with a total of $6,519,406 spent on ROPS (Table 120). The cost of fitment of a ROPS was known in 1,188 ROPS fitments. The average cost of fitment was $132.33 (range $2 - $3,152), total costs was $157,203 (Table 121). With $2,089,800 provide in ROPS rebates, the farming community spent $4,586,809.

Table 120 Cost of ROPS ($)

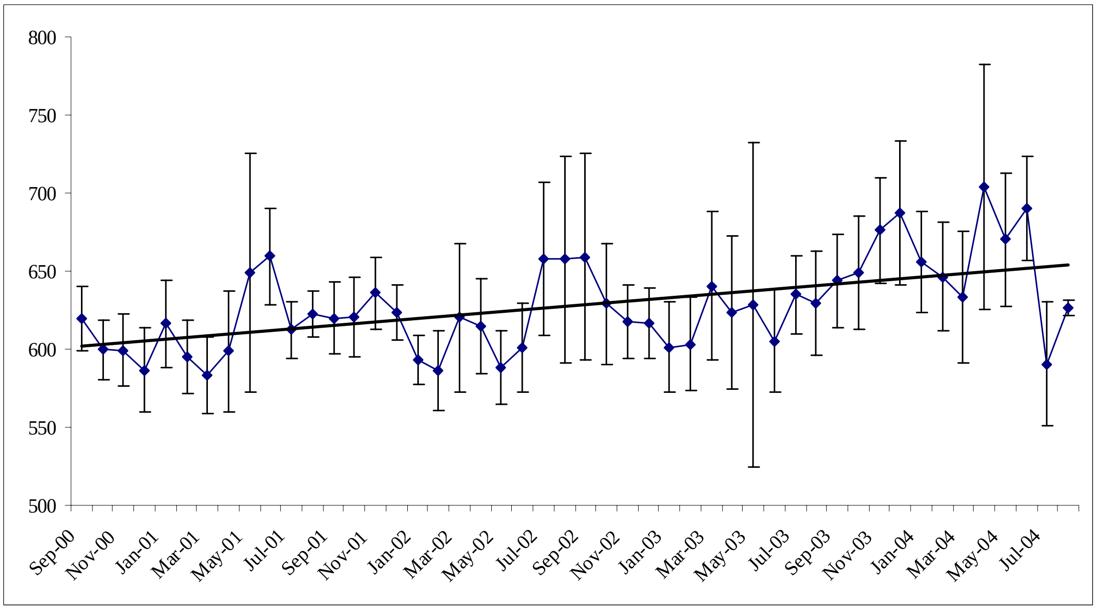
Region	N	Mean ($)	Median	Sum	Minimum	Maximum	Std. Deviation
Central West	1,586	647.70	660	1,027,253	112	6,976	288.89
Far West	26	530.54	478	13,794	341	960	183.39
Hunter	403	607.40	555	244,784	138	1,765	189.15
Illawarra	146	605.41	544	88,390	330	1,818	200.82
Mid-North Coast	670	571.51	502	382,914	220	2,640	187.13
Murray	518	646.75	659	335,017	210	4,917	278.45
Murray LW	383	532.74	495	204,040	308	2,363	183.25
Murrumbidgee	1,529	615.72	614	941,433	100	3,746	213.15
North Western	1,020	662.10	676	675,341	225	2,650	212.52
Northern	1,633	687.12	676	1,122,060	100	5,197	289.08
Other	47	636.49	640	29,915	341	1,652	226.58
Richmond-Tweed	517	600.75	594	310,589	100	1,665	171.22
South Eastern	753	617.37	582	464,881	250	2,550	215.64
ACT	43	558.44	511	24,013	363	913	140.88
Sydney	1,137	576.06	504	654,982	145	7,397	324.46
Total	**10,411**	**626.20**	**614**	**6,519,406**	**100**	**7,397**	**254.10**

Table 121 Cost of fitment of ROPS ($)

Region	N	Mean ($)	Median	Sum	Minimum	Maximum	Std. Deviation
Central West	143	131.85	100	18,855	3	789	120.47
Far West	2	52.50	52.5	105	50	55	3.54
Hunter	26	136.23	90	3,542	3	693	138.46
Illawarra	40	137.73	110	5,509	48	638	100.22
Mid-North Coast	87	127.21	100	11,067	35	500	93.48
Murray	84	100.83	78.5	8,470	2	300	64.10
Murray LW	44	94.77	80	4,170	30	264	47.60
Murrumbidgee	139	114.64	100	15,935	3	754	92.68
North Western	102	151.56	110	15,459	30	800	129.89
Northern	207	156.45	100	32,386	3	3,152	245.59
Other	6	140.00	110	840	30	250	90.33
Richmond-Tweed	80	119.68	100	9,574	25	360	65.64
South Eastern	94	148.82	102.5	13,989	30	607	110.15
ACT	4	137.50	140	550	70	200	53.77
Sydney	130	128.86	100	16,752	25	450	70.06
Total	**1,188**	**132.33**	**100**	**157,203**	**2**	**3,152**	**136.12**

There was a small but significant ($F=49.1$ $P<0.0001$) increase in the cost of the ROPS being fitted over the life of the scheme (Figure 60).

Figure 60 Cost of ROPS by date entered into database.



9.4.3 Follow-up survey of people who fitted a ROPS

To check on the information in the database and gain a greater understanding of why people where fitting ROPS, a survey was sent out to a random sample of people in the scheme. This survey was sent out twice the first on the 22 May 2002 and the second on 22 June 2004. In total 1,219 survey was sent out and 651 (53.4%) were returned.

9.4.3.1 Commodity Group

To help examine the accuracy of the information collected in the ROPS database, the participants sampled were asked if the information about the commodity they produced was correct. For 587 (90.2%) this information was correct. For those that were not correct (64), 53% (34) provided updated enterprise details.

There was a mix of commodity groups sampled, with Deer Farming and Shearing Services being the only groups not sampled. The percentage of those sampled ranged from 4.2% (Grain Growing) to 100.0% (Service to Forestry). (Table 122)

Table 122 Enterprise type by number of ROPS fitted, enterprise correct, sampled and % sampled

Enterprise Type	Number of ROPS Fitted	Farming enterprise was correct		Total Sampled	% Sampled
		Number	%		
Unknown	299	12	48.0	25	8.4
Horticulture and Fruit Growing	1,822	85	94.4	90	4.9
Horticulture and Fruit Growing	1,108	32	94.1	34	3.1
Plant Nurseries	124	9	100.0	9	7.3
Cut Flower and Flower Seed Growing	20	3	75.0	4	20.0
Vegetable Growing	130	10	90.9	11	8.5
Grape Growing	280	15	93.8	16	5.7
Apple and Pear Growing	13	1	100.0	1	7.7
Stone Fruit Growing	13	3	100.0	3	23.1
Fruit Growing NEC	134	12	100.0	12	9.0
Grain-Sheep and Grain-Beef Cattle Farming	1,026	60	95.2	63	6.1
Grain Growing	289	12	100.0	12	4.2
Sheep-Beef Cattle Farming	674	36	97.3	37	5.5
Sheep Farming	356	23	100.0	23	6.5
Beef Cattle Farming	1,378	79	87.8	90	6.5
Dairy Cattle Farming	100	11	84.6	13	13.0
Poultry Farming	93	10	90.9	11	11.8
Poultry Farming	80	8	88.9	9	11.3
Poultry Farming (Meat)	11	1	100.0	1	9.1
Poultry Farming (Eggs)	2	1	100.0	1	50.0
Pig Farming	13	2	100.0	2	15.4
Horse Farming	51	9	100.0	9	17.6
Deer Farming	1				0.0
Livestock Farming NEC	63	10	83.3	12	19.0
Sugar Cane Growing	39	8	100.0	8	20.5
Cotton Growing	43	6	85.7	7	16.3
Crop and Plant Growing NEC	94	18	94.7	19	20.2
Hobby Farming	2,261	111	90.2	123	5.4
Mixed Farming	1,660	80	92.0	87	5.2
Shearing Services	1				0.0
Services to Agriculture NEC	154	7	70.0	10	6.5
Forestry	20	2	66.7	3	15.0
Logging	2	1	100.0	1	50.0
Services to Forestry	1	1	100.0	1	100.0
Marine Fishing NEC	4	1	50.0	2	50.0
Aquaculture	5	3	100.0	3	60.0
Total	**10,449**	**587**	**90.2**	**651**	**6.2**

9.4.3.2 Division

There was a good mix of Divisions sampled, ranging from 4.2% in the Murray LW to 20.9% in the ACT (Table 123).

Table 123 Division by number sampled, ROPS fitted and percentage sampled

Division	Sampled	% of sample	ROPS Fitted	% Sampled
Central West	75	11.5	1,597	4.7
Far West	5	0.8	26	19.2
Hunter	32	4.9	405	7.9
Illawarra	14	2.2	147	9.5
Mid-North Coast	41	6.3	672	6.1
Murray All	42	6.5	901	4.7
Murray	*26*	*4.0*	*518*	*5.0*
Murray LW	*16*	*2.5*	*383*	*4.2*
Murrumbidgee	73	11.2	1,531	4.8
North Western	64	9.8	1,022	6.3
Northern	113	17.4	1,642	6.9
Other	5	0.8	47	10.6
Richmond-Tweed	45	6.9	519	8.7
South Eastern All	68	10.4	798	8.5
South Eastern	*59*	*9.1*	*755*	*7.8*
ACT	*9*	*1.4*	*43*	*20.9*
Sydney	74	11.4	1,142	6.5
Total	**651**	**100.0**	**10,449**	**6.2**

9.4.3.3 ROPS Scheme

Overall 88.8% of people surveyed said they received their cheque within four weeks of submitting the forms. The majority of people were happy with the scheme, however those who did not receive the cheque within four weeks were significantly ($P<0.0001$) more likely to be unhappy with the program. It should be noted that in some of these cases the farmer may have been required to provide more information to complete the application.

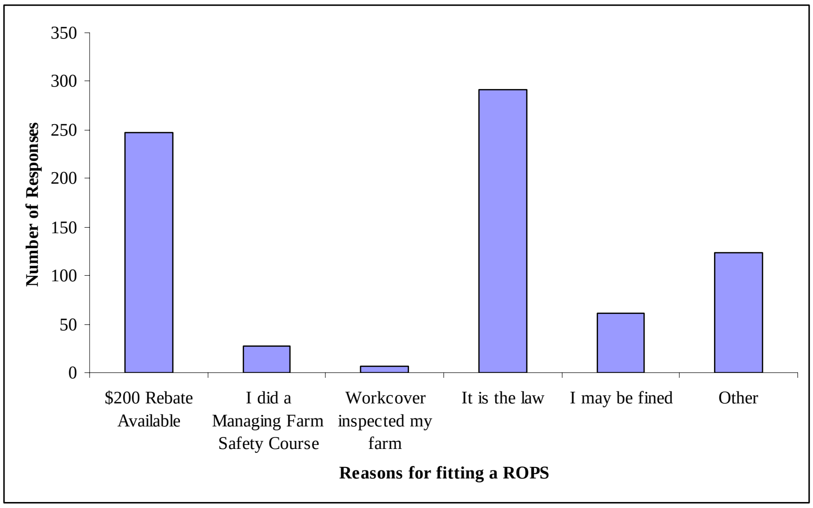
Table 124 Received rebate within four weeks by happy with program

Did you receive your rebate within four weeks?	Where you happy with the program?		
	No	Yes	Total
No	17	56	73
Yes	43	535	578
Total	**60**	**591**	**651**

Of the 60 people who were unhappy with the program, 24 gave a reason. The most common reasons were the cost of the ROPS (i.e. the rebate did not cover enough of the cost), working conditions (i.e. working on flat land, working in areas where ROPS did not fit), and administration (this mainly related to problems with processing and paperwork). Other reasons for being unhappy included freedom of choice, price of ROPS increasing due to program, a long time from purchasing the tractor to having to fit a ROPS.

As part of the survey people who fitted a ROPS were asked what prompted them to fit a ROPS. While the question asked them to select one response, 106 people selected more than one. The two most common reasons were that it is the law followed by the $200 rebate. In the other category, safety (69.4%) was the most common reason for fitting a ROPS. It is interesting to note that while many people put the ROPS on for safety reasons, the rebate provided the impetus for them to do so. (Figure 61) A third of people surveyed said they would not have fitted a ROPS if there was no rebate.

Figure 61 Reason for fitting a ROPS



The people surveyed who fitted a ROPS were asked where they heard about the scheme. Just over a third (38.6%) identified hearing about it in ‘The Land’ newspaper, while 18.0% heard about it from a farming organisation, and 17.4% heard about it from the local news paper. Television (16.0%), dealer (14.4%), and radio (11.8%) were other common methods people heard about the scheme. (Table 125)

The majority (487, 74.8%) of people surveyed thought there was enough publicity. People who heard about the scheme through all mechanisms, except magazine or field days, were statistically significantly more likely to have thought that the scheme had enough publicity. (Table 125)

Table 125 Enough publicity by how people heard about the scheme

How Heard About Scheme	Enough Publicity Yes	No	Heard about Scheme Total	P
Local Newspaper	100	13	113	<0.001
The Land	211	40	251	<0.001
Other Newspaper	21	0	21	<0.01
Television	91	13	104	<0.01
Radio	70	7	77	<0.001
Magazine	19	2	21	=0.0927
Field Day	50	11	61	=0.176
Farming Organisation	99	18	117	<0.001
Other	79	77	156	<0.0001

9.4.3.4 Farmers perceptions of ROPS

As part of the survey, people who had fitted a ROPS were asked a number of questions about their perceptions of ROPS and its fitment. The people who fitted the ROPS were asked if they thought the cost of the ROPS was “cheap”, “just right” or “too expensive”. Most thought it was just right (43.9%) or too expensive (41.6%).

The majority (82.6%) of people who fitted a ROPS said it was easy to find one for their tractor. The time taken to fit a ROPS ranged from half an hour to 96 hours (avg 3.7 hours). Only a small number of people surveyed (11.5%) needed to take the tractor off the farm to fit the ROPS. One-fifth (21.4%) of all people said they had difficulties fitting the ROPS. There were seven major categories of difficulties encountered and reported in the survey (n=138): having to make modification/s (29.7%), removing existing tractor components (25.5%), alignment of holes for fitments (15.9%), fitting the ROPS (15.2%), acquiring the ROPS (5.8%), poor quality of ROPS (5.1%) and poor fitment instructions (2.9%).

Most people (81.6%) did not identify fitting a ROPS as changing the way they worked. Changes to the way people work were predominantly about working in areas where the ROPS was too high (62.5%) (e.g. under trees), and being more aware of safety on their farms (16.7%). One-fifth (20.1%) of people who fitted a ROPS said that they were unable to fit the tractor in the shed. There were 129 people who identified six categories of other problems caused by the ROPS, mainly (62.2%) related to getting access under things. The other categories were operational problems with the tractor (15.5%), having to modify the tractors (10.9%), reduced visibility (7.0%), hitting the ROPS with their body (4.7%) and in one case the ROPS falling on the person.

The majority (77.0%) of people thought their new ROPS was effective.

9.4.3.5 Experience

Of the people surveyed who fitted a ROPS, 22.9% said that they knew of a farmer in their area who had died or been seriously injured from a tractor rollover and 17.1% said they had been involved in a tractor rollover or where the tractor had nearly rolled over.

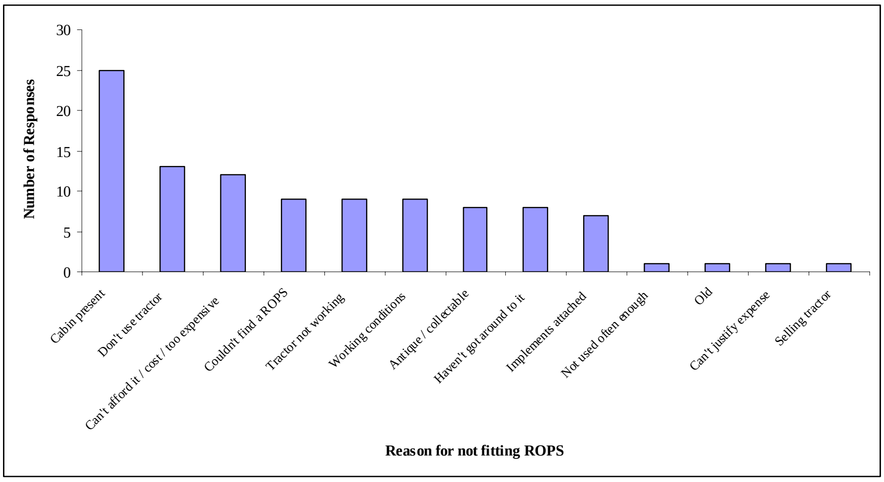
Of the farmers surveyed 278 (42.7%) felt they were not at risk of a tractor rollover, of whom 222 (79.9%) provided a reason why they were not at risk. The most common reasons were: their farm or where they worked was flat (46.4%); awareness of safety / careful / had common sense (26.1%); and they had a lot of experience so were not at risk (13.5%). Other reasons provided were categorised as follows: carried out risk assessments (2.7%), no known rollover in the area (0.9%), type of jobs being undertaken (5.9%), rollovers are rare or extreme events (1.4%), they have a ROPS or cabin on the tractor (1.8%). One person said they were not at risk because of training. Another said they were not at risk because they can jump from the tractor while it is rolling and another said they only used their tractor at low speeds.

The majority of farmers knew a ROPS was a legal requirement before the rebate was introduced (62.8%). Approximately a third (30.7%) of farms had employees. There were only 40 (6.1%) respondents who had had a WorkCover inspector on their farm.

9.4.3.6 Tractor

There were 600 farmers who provided information on the number of tractors on their farm. Overall there was 2.9 tractors per farm (n=1,744 tractors, range 1 to 40 per farm). Less than half of the farmers (41.3%) had a tractor without a ROPS. There were 531 (30.4%) tractors identified as not having a ROPS. Only 104 respondents gave a reason why they had not fitted their tractor with a ROPS, the most common answer being “a cabin was present” (24.0%), followed by the “don’t use tractor” (12.5%) and “can’t afford it / cost / too expensive” (11.5%) (Figure 62).

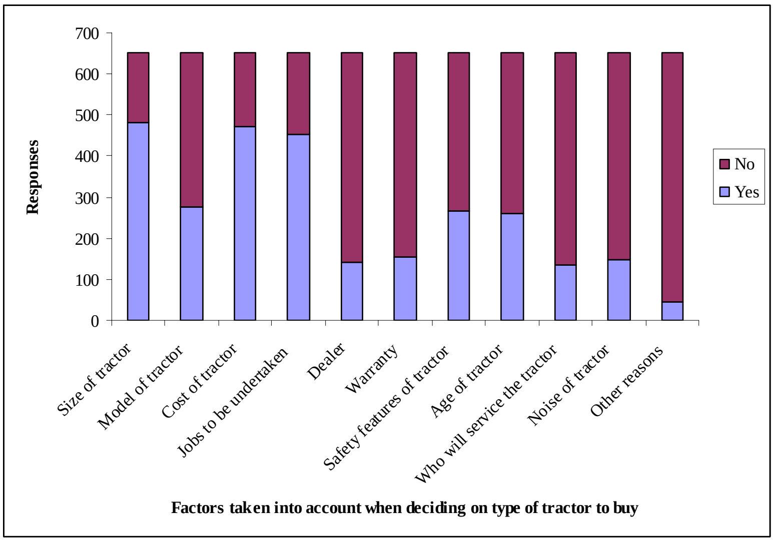
Figure 62 Reason for not fitting a ROPS



The life of a new tractor was not well answered, with only 464 respondents giving a valid answer. Overall the average estimated life of a new tractor was 24.8 years, ranging from 5 to 100 years. There were only 422 people who provided an answer to how often they buy a tractor, partly due to many people only ever buying one tractor and keeping it for their whole farming life. On average, every 14.3 years a tractor was bought for the farm, ranging from 2 to 50 years. Of the 472 who responded to the question of estimating the life left in the tractor they had fitted with a ROPS, the average was 14.2 years (range 1-100 years). Reasons for buying a new tractor included: financial; improvements in tractor technology; and when the current tractor could no longer be fixed or became too costly to fix.

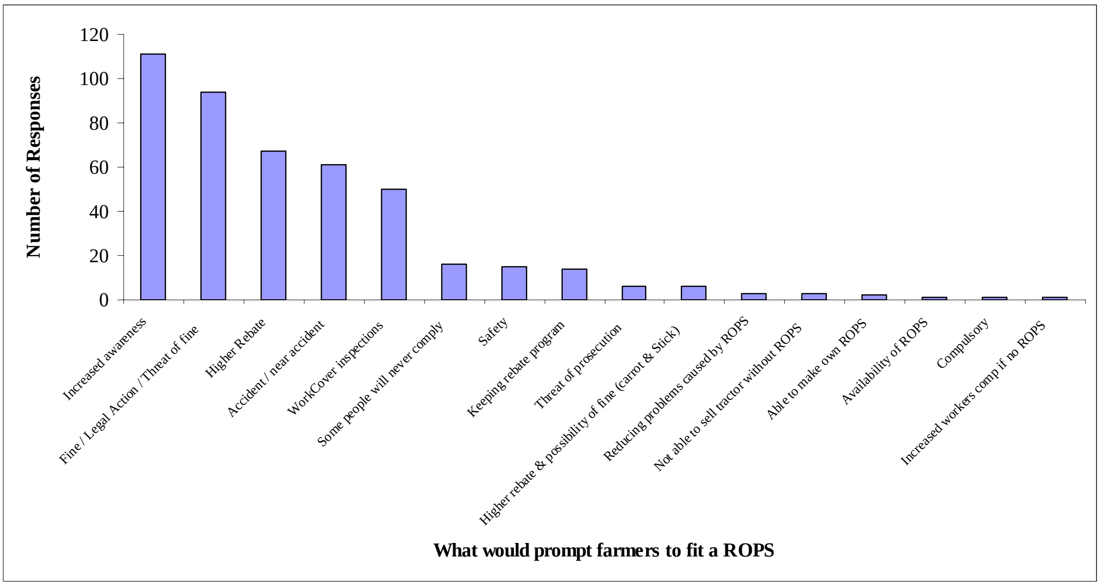
Common factors taken into account when deciding on the type of tractor to buy included size; cost of the tractor; and jobs to be undertaken (Figure 63). There were 64 people who provided other reasons: proven reliability; condition; design; comfort; availability of parts; resale value; accessibility; fuel consumption; tyre condition; and weight.

Figure 63 Factors taken into account when deciding on the type of tractor to buy



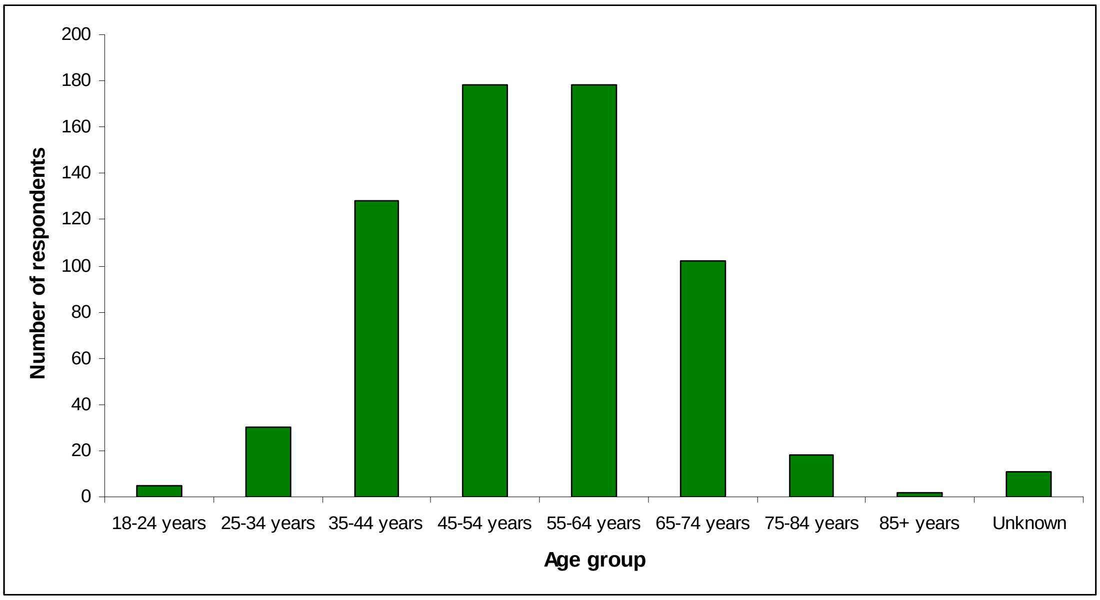
There were 451 responses to the final question of the survey which asked the people who had fitted a ROPS what would prompt farmers to fit a ROPS. The five most common answers were increased awareness (24.6%); fine / legal action / threat of fine (20.8%); higher rebate (14.9%); having an accident or near accident (13.5%); and inspection from WorkCover (11.1%). (Figure 64)

Figure 64 Prompts for farmers to fit a ROPS



The people who fitted a ROPS and responded to this question were mainly (54.8%) aged between 45 and 64 years (Figure 65).

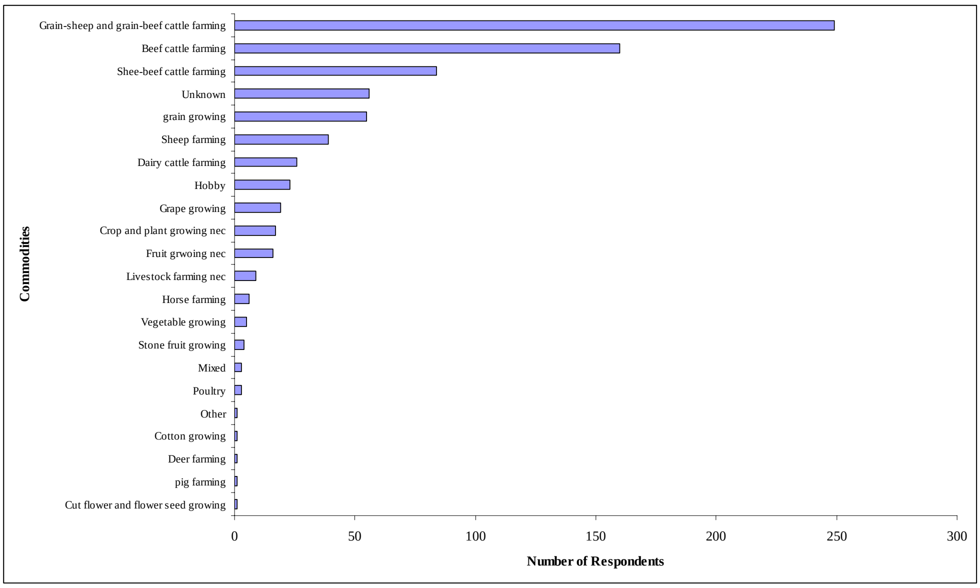
Figure 65 Age of respondents to Follow-up survey



9.4.4 General Farming Community Survey

There were 779 General Farming Community surveys returned. The most common commodities produced, classified by Australian New Zealand Standard Industry Classification were 'grain-sheep and grain-beef cattle farming', 'beef cattle farming' and 'sheep-beef cattle farming'. (Figure 66)

Figure 66 Respondents reported commodities produced by ANZSIC (N=779)



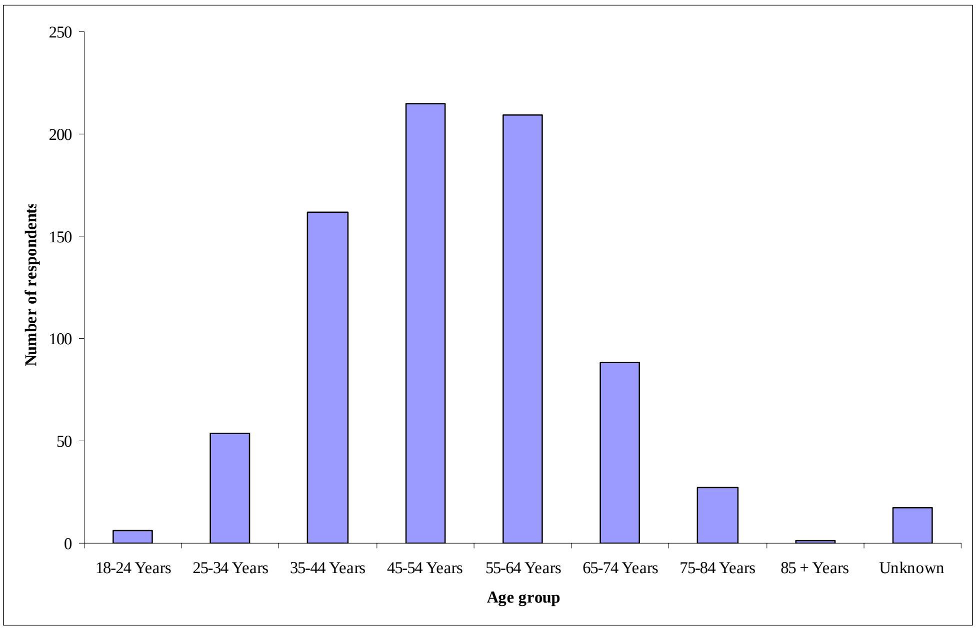
The size of a farm varied by region, the smallest being 1 Hectare in Hunter and Illawarra regions and the largest being 144,000 Hectares in the Far-West Region. The average size of respondent farms was 3,002 Hectares. (Table 126)

Table 126 Size of Farm (Hectares)

Region	Valid Responses	Mean Size	Minimum	Maximum	Std. Deviation
ACT	20	239.4	8	2,400	532.7
Central West	79	767.5	5	5,000	972.1
Far West	22	39469.0	250	144,000	33,410.1
Hunter	47	139.1	1	900	180.1
Illawarra	24	154.1	1	1,580	342.0
Mid-North Coast	58	208.9	2	1,800	402.6
Murray	56	1682.2	2	53,000	7,662.2
Murray LW	55	6907.6	2	80,000	13,741.0
Murrumbidgee	123	1417.9	4	56,000	5,406.1
North Western	105	4794.3	5	60,000	9,060.2
Northern	88	1029.8	4	80,00	1,224.8
Richmond-Tweed	20	273.9	2	2,000	581.1
South Eastern	36	671.0	8	10,000	1,665.7
Sydney	10	249.1	60	480	161.8
Total	**743**	**3002.4**	**1**	**144,000**	**10,543.0**

The respondents to the survey were predominantly (54.4%) aged between 45 and 64 years (Figure 67).

Figure 67 Age group of respondents general farming community survey (N=779)

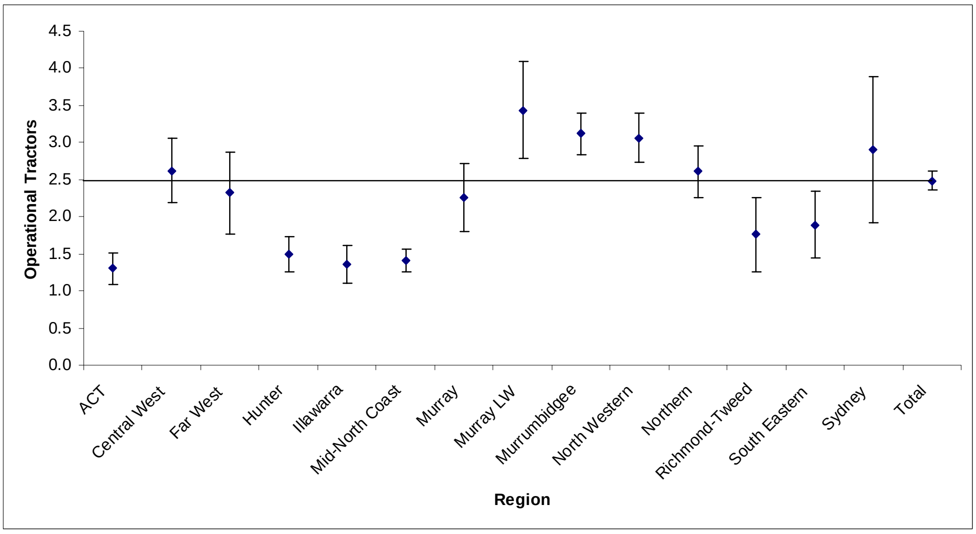


9.4.4.1 Tractors on Farms

There was on average 2.5 (median 2) operational tractors per farm. However, this varied significantly by WorkCover region, with ACT, Richmond-Tweed, Hunter, Illawarra and Mid-

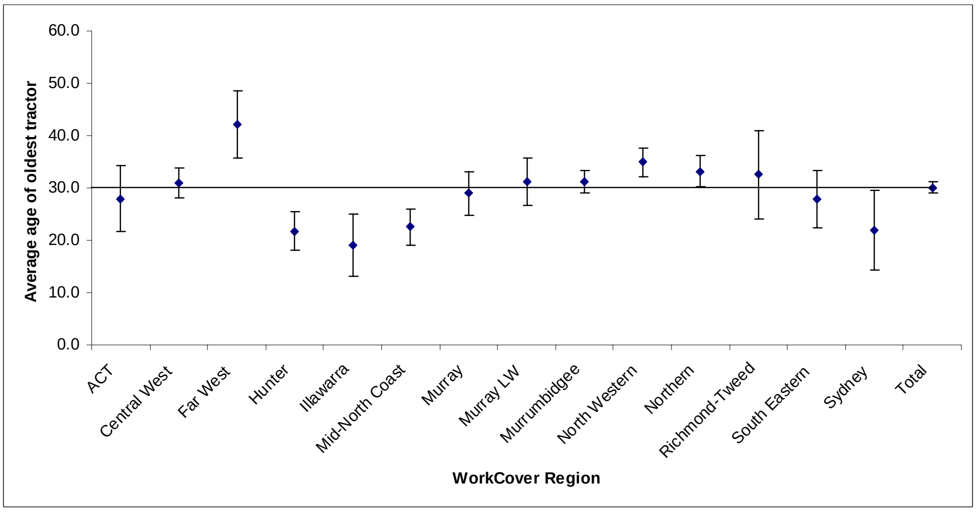
North Coast having significantly fewer tractors per farm than the State average and North-Western, Murray LW and Murrumbidgee having significantly more (Figure 68).

Figure 68 Average number of operational tractors per farm by WorkCover region



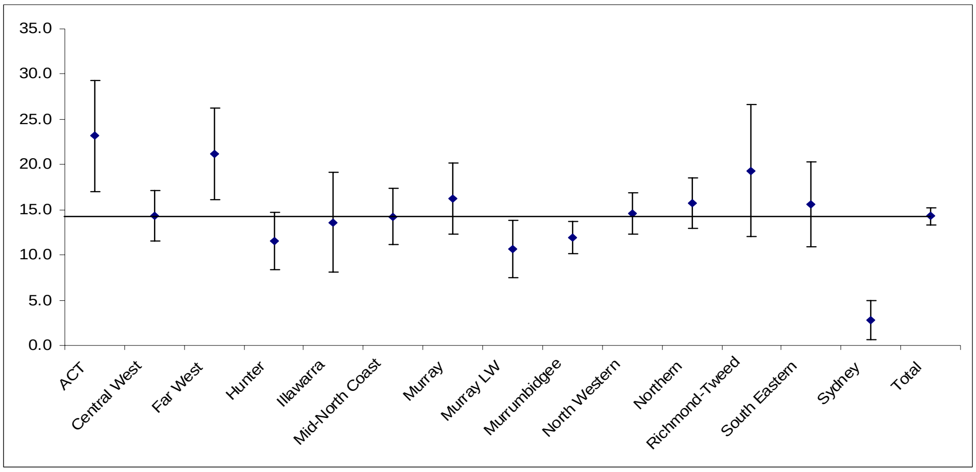
The average age of the oldest operational tractor overall was 30.1 years (median 30 years). Far-West region farmers had tractors on average significantly older and Hunter, Illawarra and Mid-North Coast region farmers had tractors on average significantly younger than the State average (Figure 69).

Figure 69 Average age of oldest operational tractor by WorkCover region.



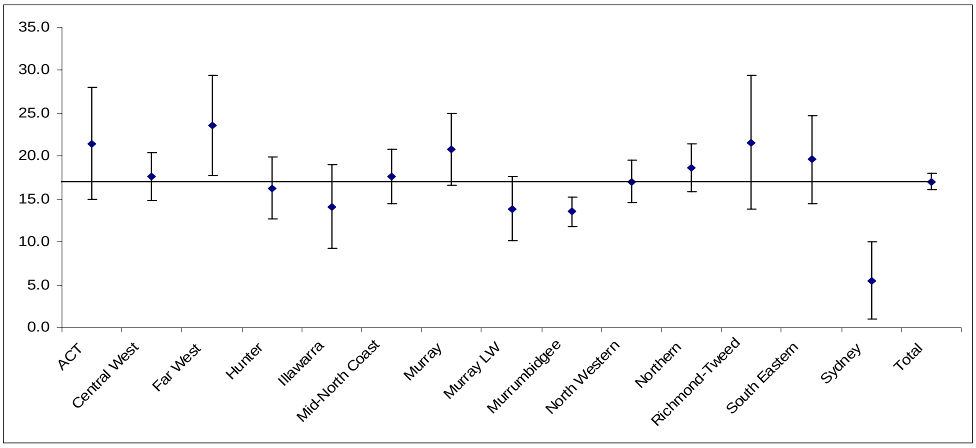
The average age of the newest operational tractor overall was 14.3 years (median 12 years), with the Far-West region farmers having on average significantly older 'newest' tractors and Sydney region farmers having on average significantly younger 'newest' operational tractors than the State average (Figure 70).

Figure 70 Average age of newest tractor by WorkCover region.



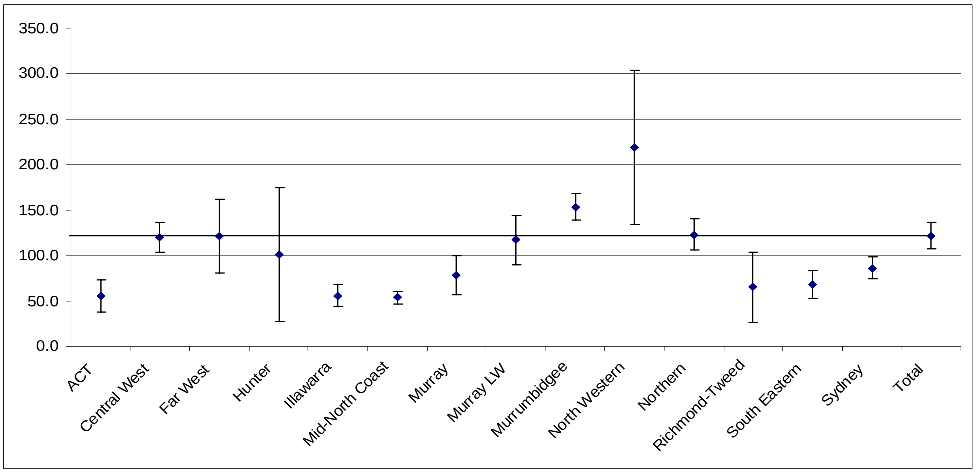
The average age overall of the primary tractor (the tractor that was used most often) was 17.1 years (median 15 years), with only Sydney region farmers having on average significantly younger tractors (Figure 71).

Figure 71 Average age of the primary tractor by WorkCover region.



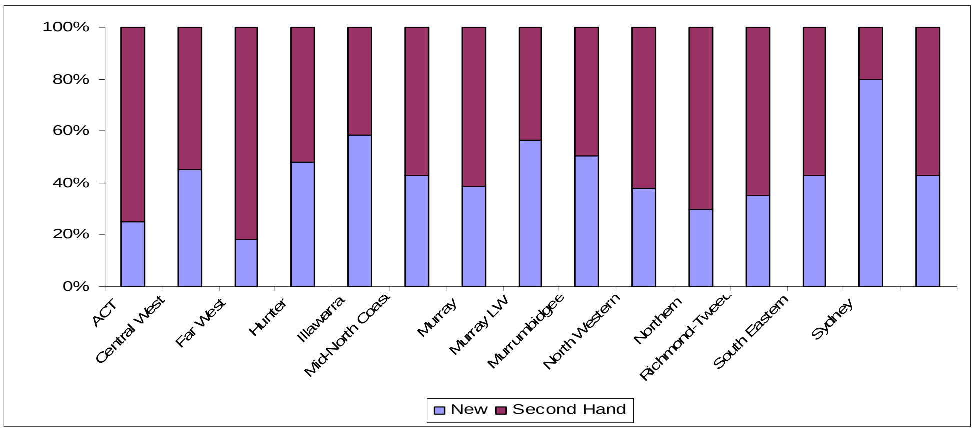
The average overall horse power of the primary tractor was 122.3 hP (median 85 hP), with ACT, South-Eastern, Sydney, Illawarra, Mid-North Coast, and Murray all having tractors with significantly lower horse power (Figure 72).

Figure 72 Average Horse power of tractor by WorkCover region.



Most (57.3%) of the farmers who responded to the survey purchased their primary tractor second hand. This varied by region, with 80% of farmers in the Sydney region buying their tractors new and 18.2% of farms in the Far-West Region buying their tractors new (Figure 73).

Figure 73 Purchase of primary tractor, new vs second hand by WorkCover region.



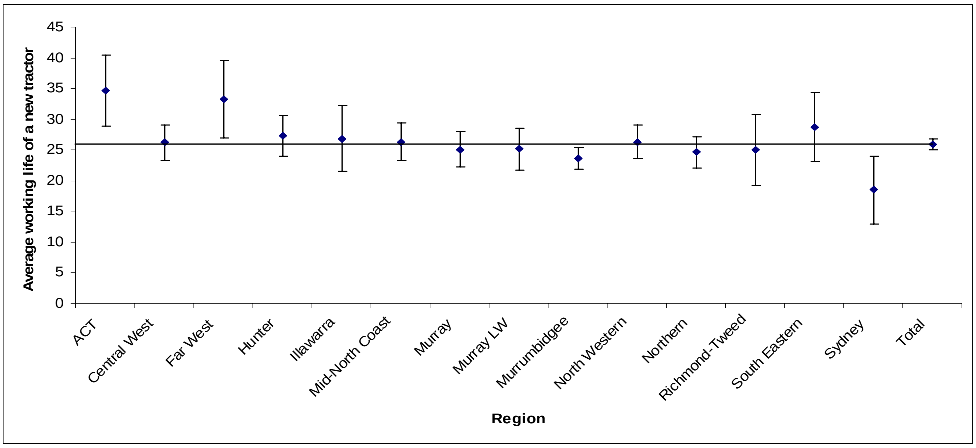
Since 1982 all new tractors were to be fitted with a ROPS. It was hypothesised that farmers who bought their tractor new were more likely to have all their tractors fitted with a ROPS than those who bought them second-hand. To test this hypothesis purchase of tractor by all tractors fitted with a ROPS was examined. People who bought their tractors new were significantly more likely to have all their tractors fitted with a ROPS (χ^2=25.089, P<0.0001). (Table 127)

Table 127 Purchase primary tractor new or second hand by all tractors fitted with a ROPS

Did you purchase your primary tractor?	Do all your tractors have a ROPS No	Yes	Total
New	61	262	323
Second Hand	154	280	434
Total	**215**	**542**	**757**

There were 605 farmers who answered the question "What would you estimate to be the working life of a new tractor?" The average estimate of working life was 25.9 years. There was no statistical variation by region. (Figure 74)

Figure 74 Average age of the estimated working life of a new tractor (n=605)



There were 311 farmers who answered the question "How often do you buy a new tractor for your farm enterprise?" The average was 14.2 years. There was no statistical difference between regions (Figure 75)

There were 651 farmers who answered the question "What would you estimate is the life left in your primary tractor?" The average estimated life left in the primary tractor was 13.4 years. This did not vary statistically by region. (Figure 76)

Figure 75 Average duration between purchases of a tractor (n=311)

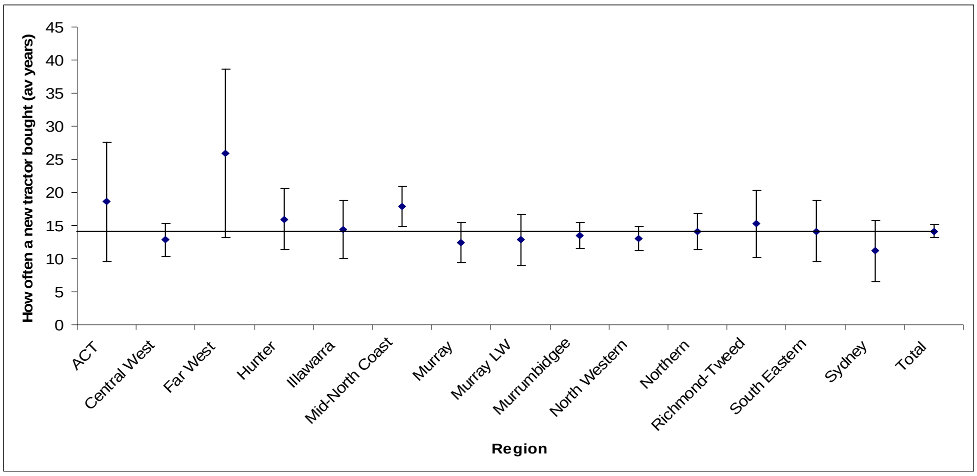
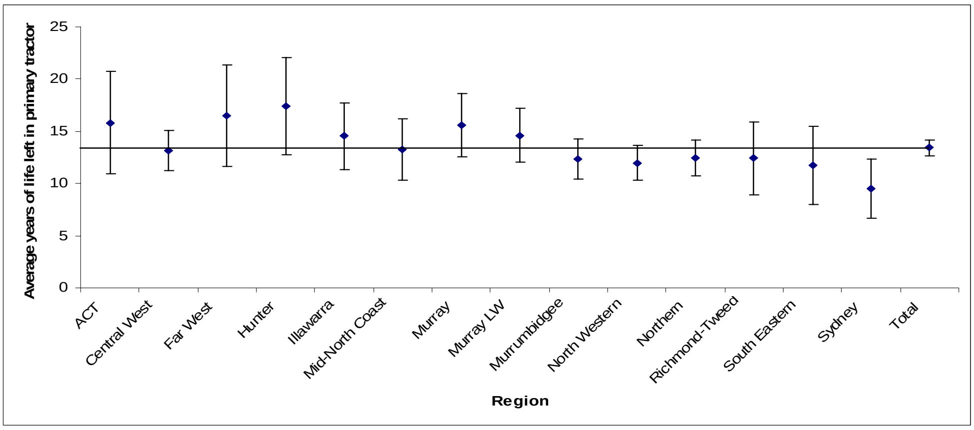


Figure 76 Average estimated life left in primary tractor (n=651)

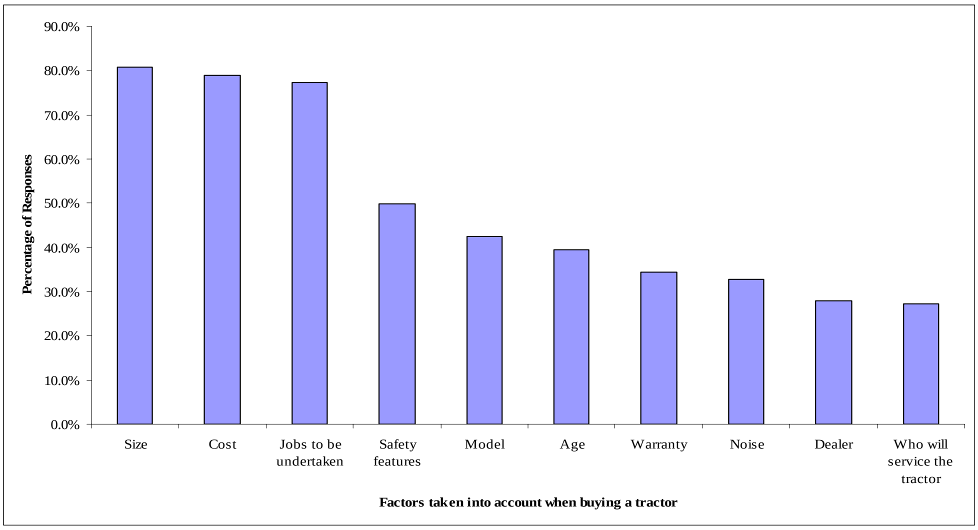


Reasons farmers gave for the replacement of their tractors fell into four groupings:

1. Old / replacement (e.g. old, out of date, old tractor died, too many hours, maintenance - too costly / too often, no longer able to be maintained)
2. Change in work practices (e.g. additional planted area, bought more land, changing to growing a new commodity, change of uses, expansion)
3. Technology (e.g. improved technology, air conditioning, 4WD, new attachments, more horse power, better fuel economy)
4. Management practices (e.g. replace on a regular basis, out of warranty, availability of finances, economics, good business practices, update machine, improved reliability, lower maintenance costs)

There were ten factors examined for influence on decision to buy a tractor. The top four identified were size, cost, jobs to be undertaken, and safety features (Figure 77). Other factors identified in the decision process were the general features of the tractor, availability of parts, efficiency, colour and condition.

Figure 77 Factors that influence farmers decision to buy a tractor (N=779)



9.4.4.2 Rollover Protective Structures (ROPS)

Most (70.5%) of the farmers who responded to the survey had a ROPS on all of their tractors. This did, however, vary by region. All farms in the Sydney region had a ROPS and only 40.9% of farms in the Far-West Region had a ROPS on all their tractors (Figure 78).

There were on average 0.44 ($CI_{95\%}$ 0.37-0.50) tractors per farm that did not have a ROPS. In NSW in 2003 there were 41,952 agricultural establishments with an estimated value of agricultural operations (EVAO) of $5,000 [329]. Thus there are potentially 18,430 ($CI_{95\%}$ 15,522-20,976) tractors without a ROPS in NSW (Table 128).

Figure 78 Percentage of farms by region for all tractors on the farm having a ROPS (N=779)

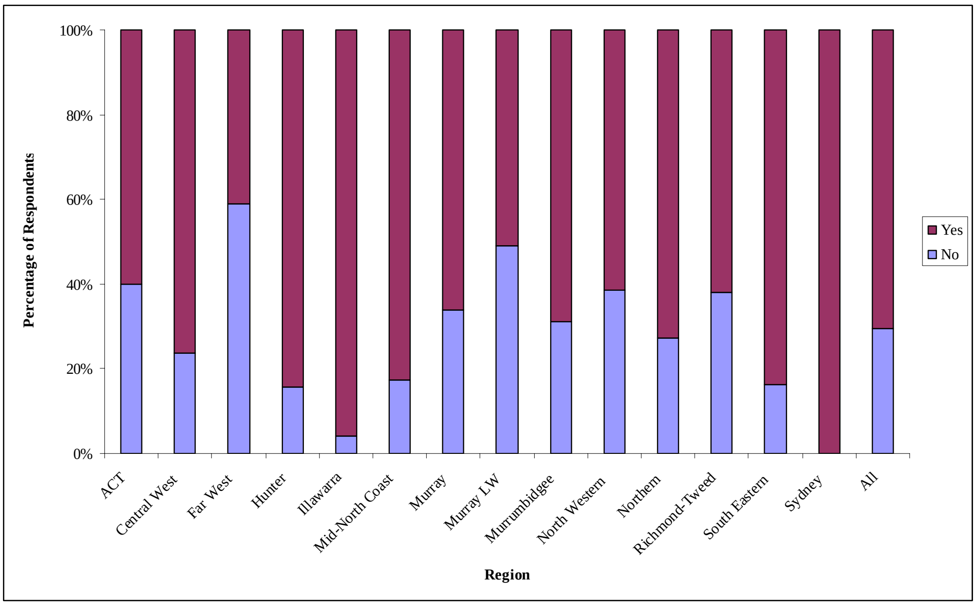
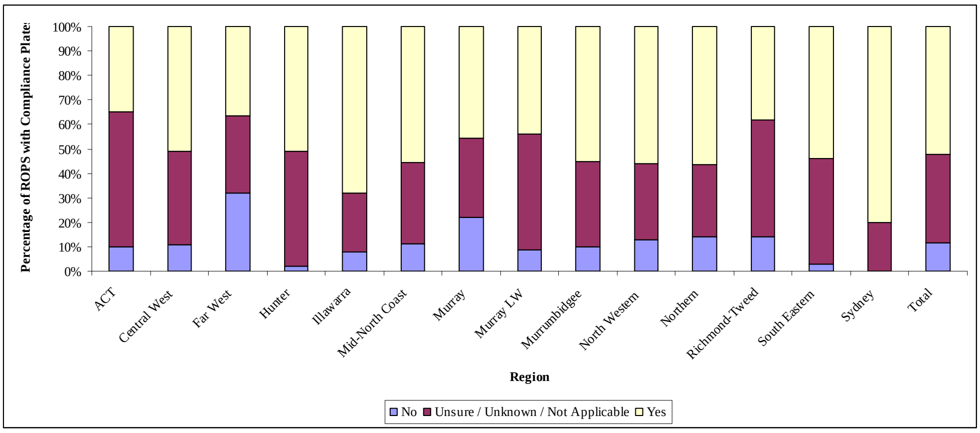


Table 128 Number of tractors without a ROPS by Region

Region	Number of respondents	Number of tractors without a ROPS	Mean	Number of establishments	Potential number of tractors without a ROPS
Central West	81	34	0.42	5,542	2,326
Far West	22	20	0.91	286	260
Hunter	48	6	0.13	3,075	384
Illawarra	23	1	0.04	918	40
Mid-North Coast	62	13	0.21	3,134	657
Murray All	115	64	0.56	3,991	2,221
Murray	*58*	*37*	*0.64*		
Murray LW	*57*	*27*	*0.47*	,	
Murrumbidgee	126	66	0.52	4,692	2,458
North Western	106	75	0.71	4,286	3,033
Northern	89	30	0.34	6,496	2,190
Richmond-Tweed	21	8	0.38	3,183	1,213
South Eastern All	55	16	0.29	4,429	1,288
South Eastern	*36*	*7*	*0.19*		
ACT	*19*	*9*	*0.47*		
Sydney	10	0	0.00	1,920	0
Total	**758**	**333**	**0.44**	**41,952**	**18,430**

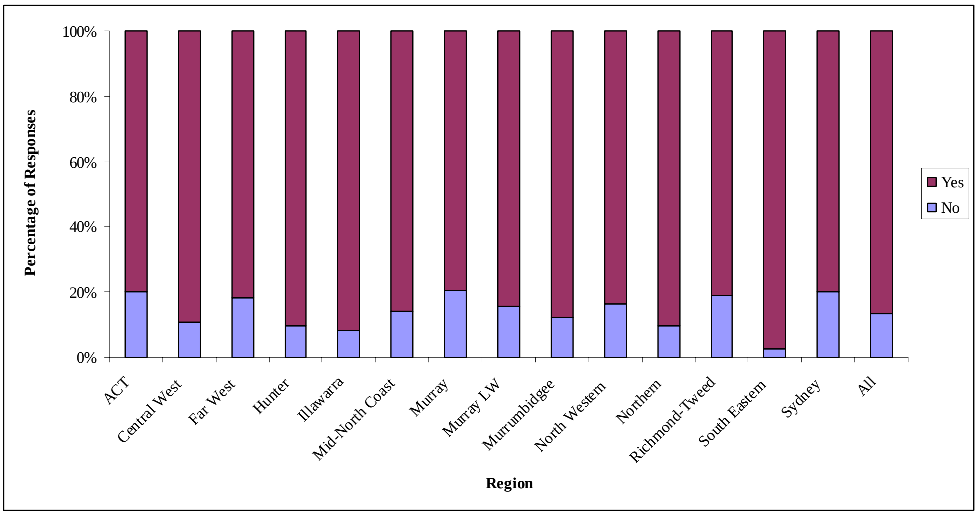
Half (52.4%) of the farmers surveyed responded that the ROPS on their tractor had a compliance plate. In the Sydney Region 80.0% of farmers said their ROPS had a compliance plate whereas only 35.0% in the ACT said their ROPS had a compliance plate. (Figure 79)

Figure 79 ROPS with compliance plates by region (N=779)



The majority (86.6%) of farmers believed that a ROPS is effective, there was very little variation by region (Figure 80)

Figure 80 Perceive ROPS is effective by region (N=779)



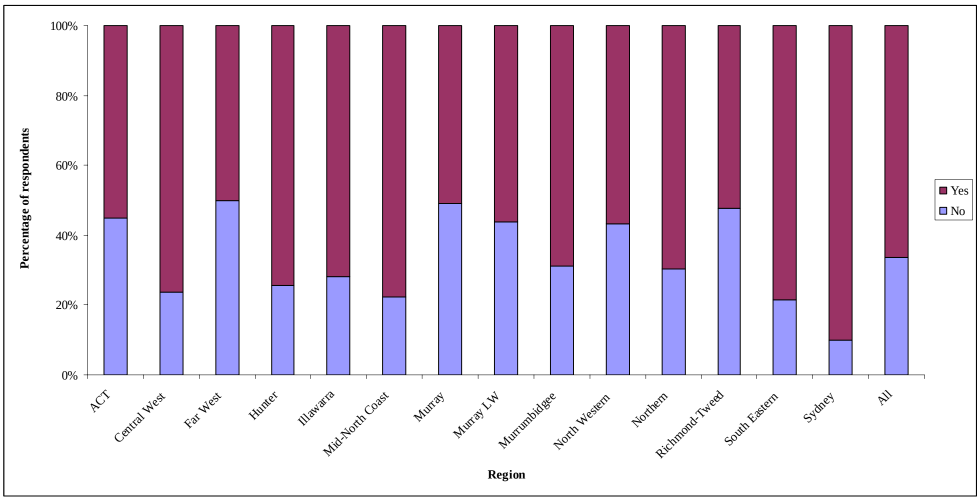
It was hypothesised that those people who thought that a ROPS was not effective would be less likely to have a ROPS on all of their tractors. To test this hypothesis an examination of farmers thinking ROPS was effective by all tractors having a ROPS was undertaken. People who thought that a ROPS was not effective were less likely to have ROPS on all their tractors (χ^2=24.182, P<0.0001). (Table 129)

Table 129 Effectiveness of ROPS by all tractors having a ROPS

Do you think a ROPS is effective?	Do all your tractors have a ROPS		
	No	**Yes**	**Total**
No	52	52	104
Yes	178	497	675
Total	**230**	**549**	**779**

Two-thirds (66.4%) of farmers knew that having a ROPS on a tractor had been a legal requirement since 1982. In the Far-West region only half (50.0%) knew, whereas in the Sydney Region 90% of farmers knew. (Figure 81)

Figure 81 Knew ROPS was a legal requirement since 1982 by region (N=779)



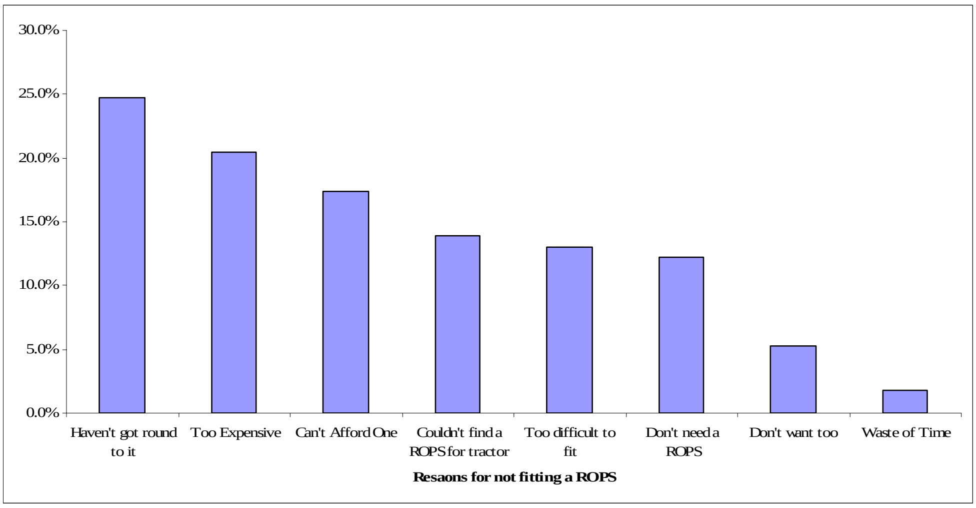
It was hypothesised that people who knew that having a ROPS was a legal requirement would be more likely to have ROPS on all their tractors that those that did not. To test this hypothesis an examination of respondents knowledge of ROPS as a legal requirement by all tractors having a ROPS was examined. It was found than those who knew that a ROPS was a legal requirement were more likely to have put ROPS on all their tractors (χ^2=65.401, P<0.0001). (Table 130)

Table 130 Knowledge of ROPS as a legal requirement by all tractors having a ROPS.

Did you know that ROPS are a legal requirement?	Do all your tractors have a ROPS?		
	No	**Yes**	**Total**
No	126	136	262
Yes	104	413	517
Total	**230**	**549**	**779**

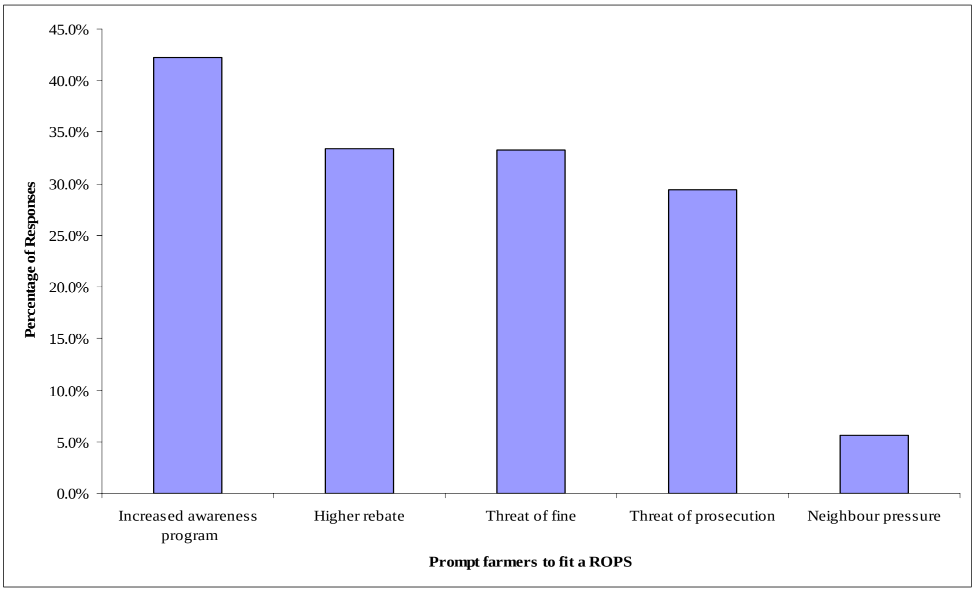
Of the 230 farmers who responded that at least one of their tractors does not have a ROPS, one quarter (24.8%) said they had not got around to it. Other common reasons for not having a ROPS were too expensive (20.4%) and can't afford one (24.8%) which comes back to cost (Figure 82). Other reasons given included ROPS not suitable for working conditions, don't use tractor enough, didn't know I needed one, antique, cabin present, old tractor, made my own, and only person driving tractors.

Figure 82 Reasons for not fitting a ROPS (n=230)



The most popular prompt for getting other farmers to fit a ROPS identified by the farmers who responded to the survey was increased awareness program (42.4%), followed by higher rebate (33.4%), threat of fine (33.2%) and threat of prosecution (29.4%). Pressure by a neighbour was not seen as a method for prompting farmers to fit a ROPS (5.6%) (Figure 83). Other prompts for farmers to fit a ROPS were a death or accident in the local area, inspection program, reduced insurance, employee pressure, and training.

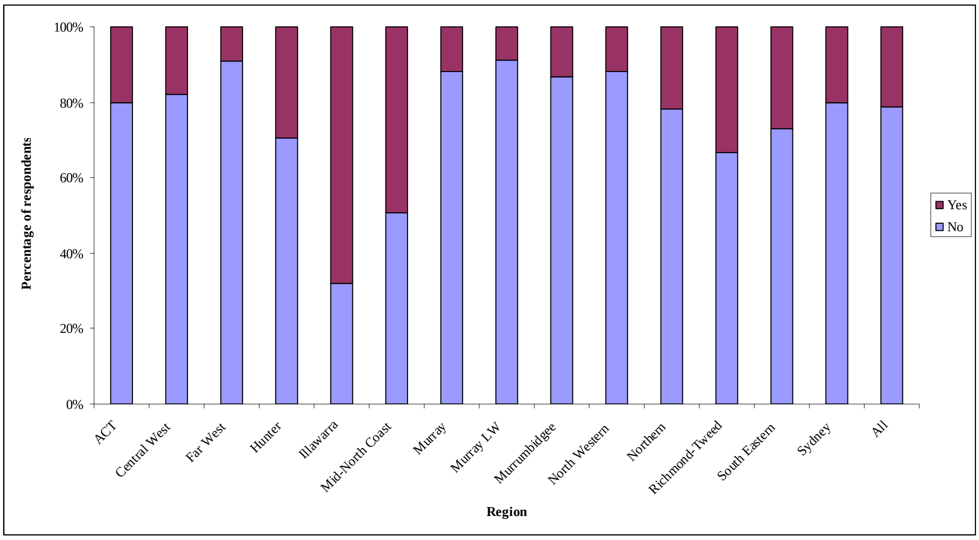
Figure 83 Prompts for getting farmers to fit a ROPS (N=779)



9.4.4.3 Experience of a tractor rollover

Only one-fifth (21.2%) of farmers who responded had heard about a person in their area that had been seriously injured or died from a tractor rollover. In the Illawarra Region 68% of respondents knew about an injury or death from a tractor rollover whereas in the Far West Region only 9.1% knew of one. (Figure 84)

Figure 84 Percentage of respondents that knew about a serious injury or death in their region from a tractor rollover (N=779)



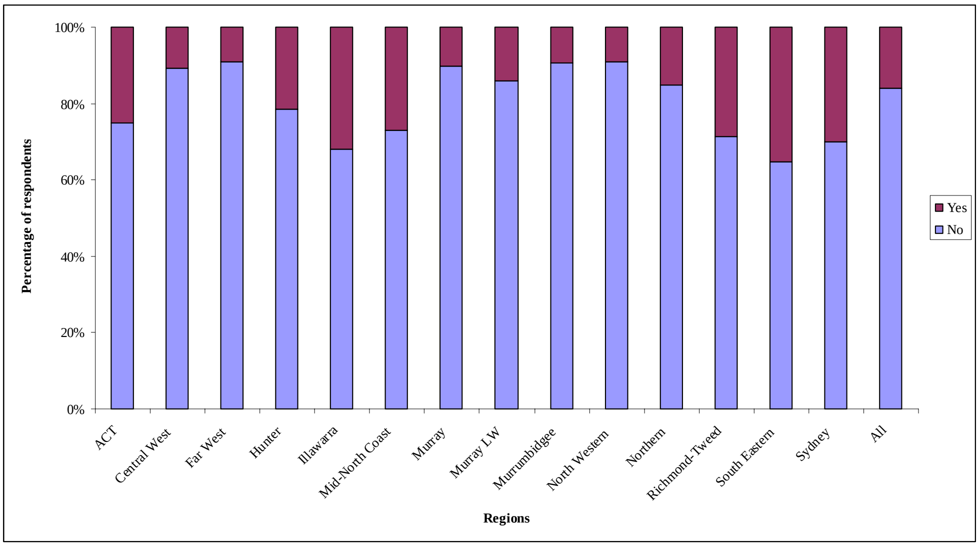
Knowledge of a tractor rollover locally was identified as a method of getting farmers to put a ROPS on their tractor. To test this, an examination of farmer's responses where they said that all their tractors have a ROPS by knowledge of a tractor rollover was examined. People who knew of a tractor rollover were more likely to have fitted a ROPS on all their tractors (χ^2=15.859, P<0.0001). (Table 131)

Table 131 Knowledge of a serious injury or death from a tractor rollover by all tractors having a ROPS fitted

Do you know of any serious injuries or deaths from a tractor rollover	Do all your tractors have a ROPS		
	No	**Yes**	**Total**
No	202	412	614
Yes	28	137	165
Total	**230**	**549**	**779**

Only a small percentage (15.9%) of farmers had been involved in a tractor rollover or near rollover. This did vary by region with 35.1% of respondents in the South Eastern Region and only 9.1% in the Far West Region having experience with a rollover or near-rollover. (Figure 85)

Figure 85 Percentage of respondents that had a rollover or near rollover experience (N=779)



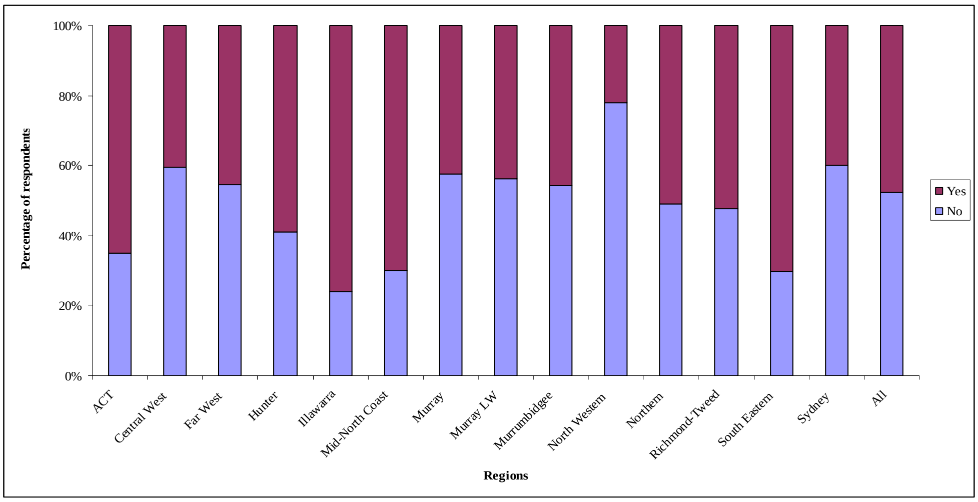
Experience of a tractor rollover was identified as likely to increase the possibility of a farmer having a ROPS on all of his tractors. To test this, an examination of farmers' responses where they had a rollover or near rollover versus all tractors having a ROPS was examined. Farmers who had experienced a rollover or near rollover were more likely to put a ROPS on their tractor (χ^2=7.331, P<0.01), however this relationship was not as strong as for those who knew of a serious injury or death from a tractor. (Table 132)

Table 132 Involvement in a tractor rollover or near rollover by all tractors having a ROPS

Have you been involved in a rollover or near rollover of a tractor	Do all your tractors have a ROPS		
	No	**Yes**	**Total**
No	206	449	655
Yes	24	100	124
Total	**230**	**549**	**779**

Half (47.6%) of all respondents felt that drivers of their tractors were at risk of a tractor rollover, with variation by region. Three-quarters (76.0%) of respondents from the Illawarra Region and only one-fifth (22%) of respondents from the North Western Region thought drivers of their tractors were at risk of a rollover. (Figure 86)

Figure 86 Percentage of respondents that thought drivers of their tractors were at risk of a rollover by region (N=779)



It was expected that if people considered there is a risk from a rollover they would do something about this risk. To test this assumption an examination of risk of tractor rollover (Are drivers of tractors on your farm at risk of a rollover?) by all tractors with a ROPS was undertaken. Those respondents who thought drivers of their tractors were likely to have a rollover were more likely to have ROPS on all their tractors (χ^2=10.433, P<0.001) (Table 133).

Table 133 Thought drivers of tractors on their farms were at risk of a rollover by all tractors having a ROPS

Are drivers of tractors on your farm at risk of a rollover	Do all your tractors have a ROPS		
	No	Yes	Total
No	141	267	408
Yes	89	282	371
Total	**230**	**549**	**779**

There were four main reasons given for not considering that drivers of a tractor on their farm were at risk of a rollover:

- The most common was that their land was flat or only slightly undulating;
- The second most common was that there was not a risk (e.g. everybody drives safely, common sense is used on my farm, only use the tractor as a power source, all drivers have had training, because we drive carefully);
- Third was that the respondent was the only driver of the tractor,
- Fourth was that a ROPS or cabin was fitted to the tractor.

Slightly under half (42.6%) of all respondents had employees (including contractors and casual labour) on their farms. The respondents from the Hunter Region were least likely (19.6%) to have employees on their farm and the respondents from the Murray LW region were the most likely (56.9%) to have employees on their farm. (Figure 87)

Are farmers who have employees on their farm more likely to have ROPS on all their tractors? To test this hypothesis an examination of farms that employed people by all tractors having a ROPS was undertaken. While there was a slight difference (i.e. those that have employees were slightly more likely to fit ROPS to all their tractors) it was not statistically significant (P=0.08) (Table 134).

Figure 87 Percentage of respondents who had employees on their farm by region (N=779)

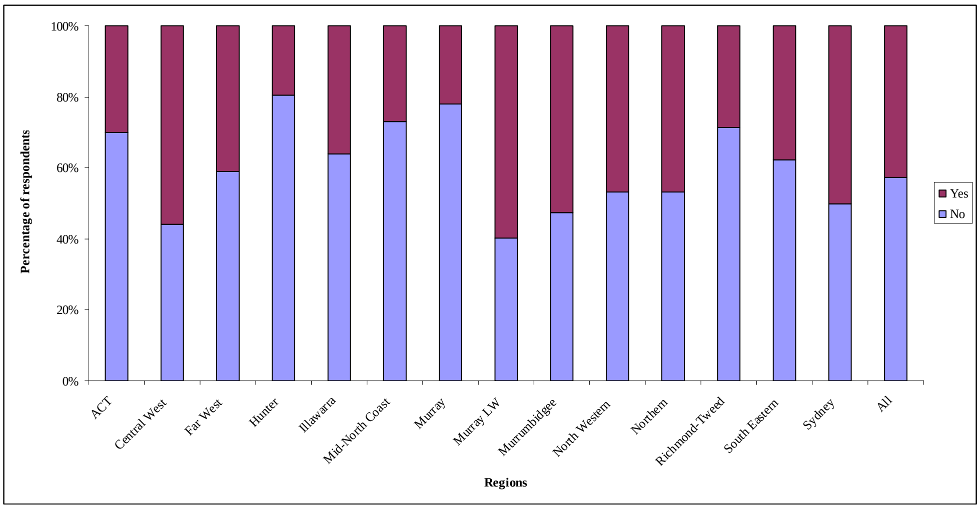


Table 134 Employees on farm by all tractors have a ROPS

Do you have any employees on the farm?	Do all your tractors have a ROPS		
	No	**Yes**	**Total**
No	143	304	447
Yes	87	245	332
Total	**230**	**549**	**779**

9.4.4.4 Information about the ROPS Scheme

Three-quarters (76.0%) of respondents had heard about the ROPS scheme. Less than half (45.5%) of the respondents from the Far West Region had heard about the scheme, whereas the in Central West Region, 91.7% of respondents had heard about the scheme. (Figure 88)

It was hypothesised that if a farmer had heard about the scheme they were more likely to have ROPS on all of their tractors. To test this hypothesis an examination of hearing about the ROPS schemes by all tractors having a ROPS was undertaken. While those who had heard about the scheme were more likely to have ROPS on all of their tractors this was not statistically significant (P=0.07) (Table 135).

Figure 88 Percentage of respondents that had about the ROPS scheme by region (N=779)

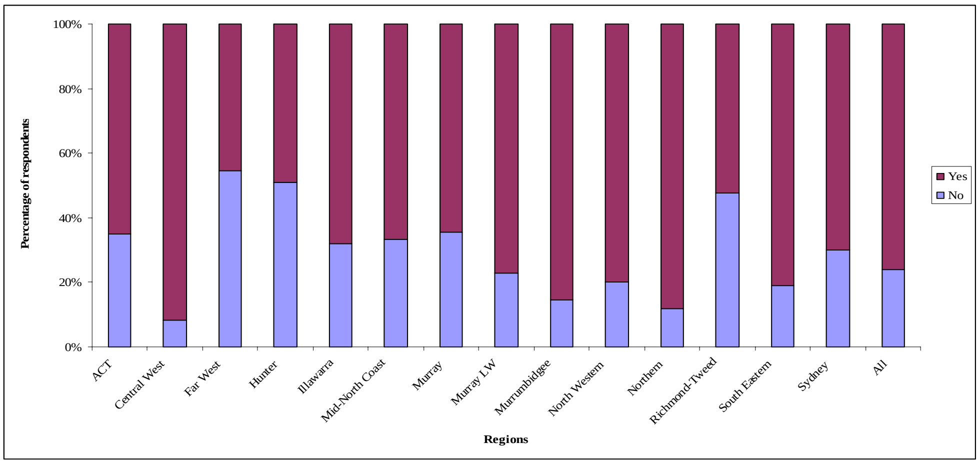


Table 135 Heard about the ROPS scheme by all tractors have a ROPS

Have you heard of the NSW ROPS Scheme	Do all your tractors have a ROPS		
	No	**Yes**	**Total**
No	65	122	187
Yes	165	427	592
Total	**230**	**549**	**779**

The most common way in which people had heard about the scheme was through The Land newspaper (54.2%), followed by radio (24.0%) and the local newspaper (22.5%). Other ways people heard about the scheme was through machinery dealers and word of mouth (Figure 89).

A quarter (28.4%) of the people who had heard about the scheme had fitted a ROPS under the scheme (Figure 90). In the Far-West Region 40.0% of respondents who had heard about the scheme had fitted a ROPS, whereas 9.1% of respondents had heard about the scheme in the Richmond-Tweed Region and fitted a ROPS.

Figure 89 How respondents heard about the ROPS Scheme (n=592)

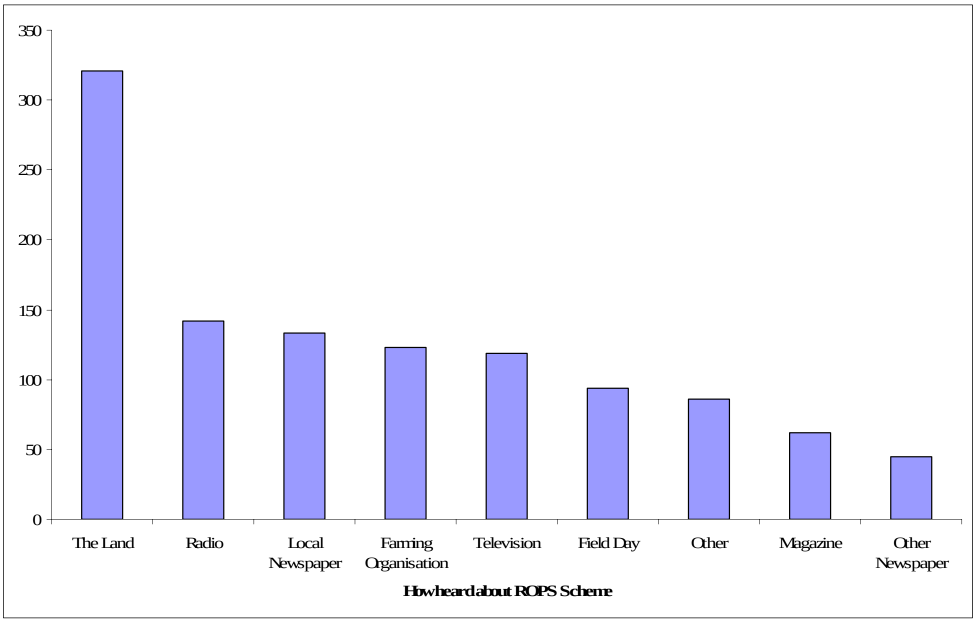
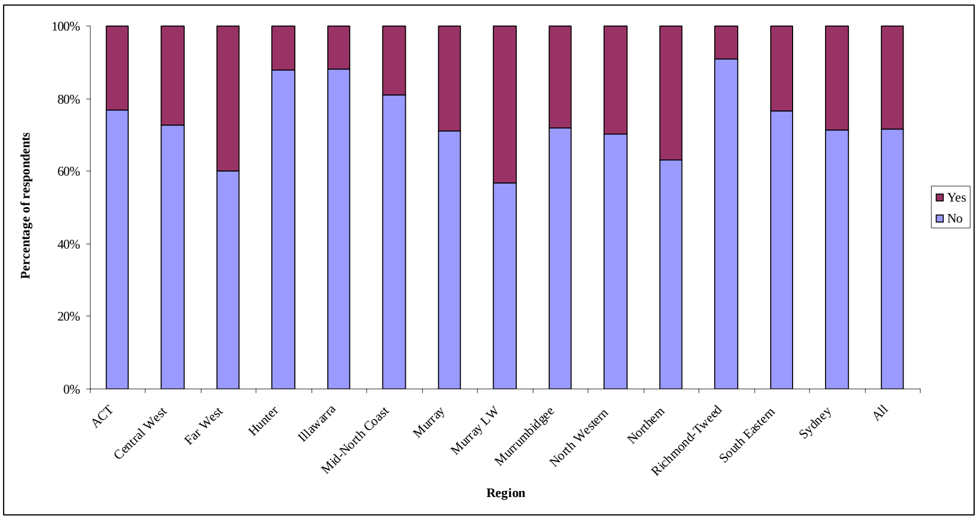


Figure 90 Percentage of people who had heard about the ROPS Scheme that fitted a ROPS under the scheme (n=592)



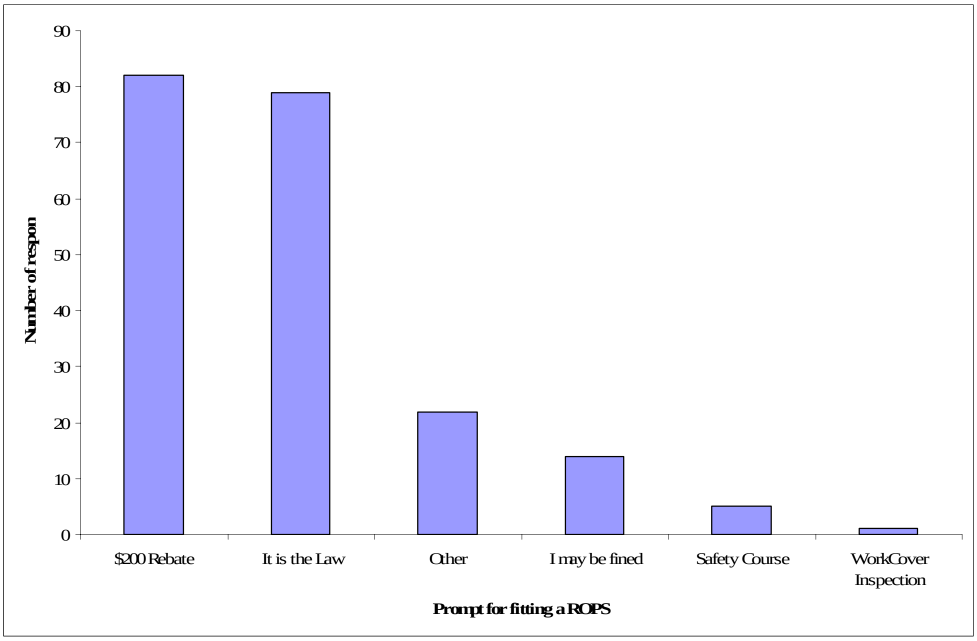
It was hypothesised those who had heard about the scheme and fitted a ROPS during the scheme were more likely to have all their tractors with a ROPS. To test this hypothesis an examination of fitment of ROPS under the scheme by all tractors with a ROPS was undertaken. It was found those who fitted a ROPS under the scheme were more likely to have all tractors with a ROPS (χ^2=10.352, P<=0.001). (Table 136)

Table 136 Fitted a ROPS under scheme by all tractors have ROPS

Did you fit a ROPS under the scheme?	Do all your tractors have a ROPS		
	No	Yes	Total
No	134	290	424
Yes	31	137	168
Total	**165**	**427**	**592**

The most common reason given for fitting a ROPS was the '$200 rebate', closely followed by 'it is the law'. The main other reason given was personal safety. (Figure 91)

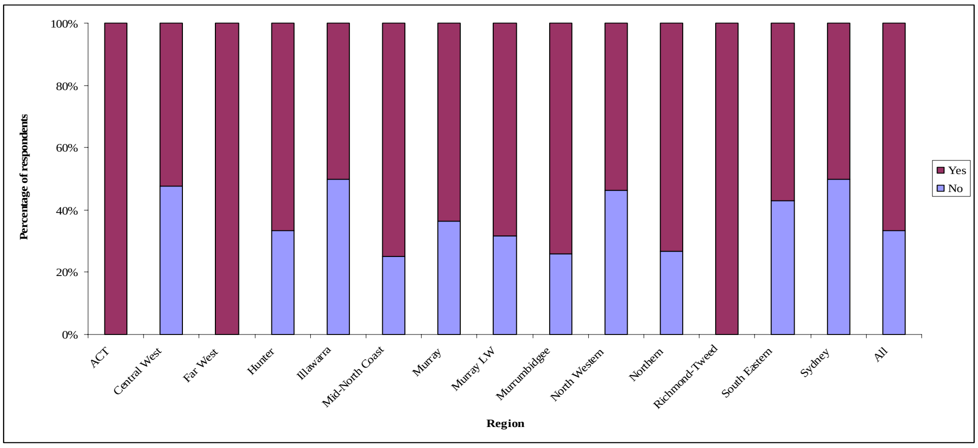
Figure 91 Reason for fitting a ROPS (n=168)



Note: Sums to 203 as some people gave more than one answer.

Of the people who heard about the scheme and fitted a ROPS, two-thirds (66.7%) said they would have done so even without the rebate. In the Far-West and ACT regions 100% of respondents who had heard about the scheme and fitted a ROPS said they would have fitted a ROPS even without the rebate, however in the Sydney and Illawarra regions only 50.0% said they would.

Figure 92 Respondents who had heard about the ROPS scheme and fitted a ROPS and said they would have fitted the ROPS without the rebate by Region (n=168)



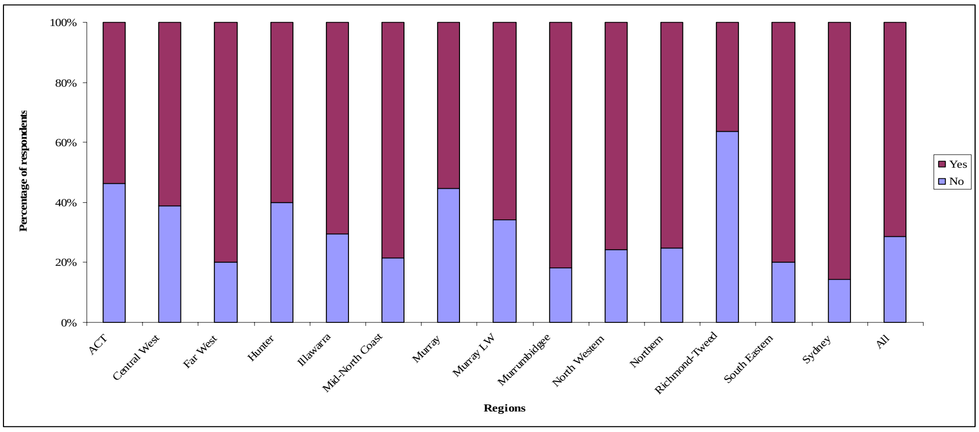
It was hypothesised that those respondents who said they would have fitted a ROPS even without the scheme are more likely to have fitted ROPS on all their tractors. To test this hypothesis all people who had heard about the scheme and said they would have fitted a ROPS even without the rebate were compared against all tractors with a ROPS. It was found that people who said they would have fitted a ROPS even without the rebate were more likely to have ROPS on all their tractors (χ^2=13.142, P<0.001). (Table 137)

Table 137 Would have fitted a ROPS if there was no rebate by all tractors having a ROPS

Would you have fitted a ROPS if there was no rebate?	Do all your tractors have a ROPS? No	Yes	Total
No	130	270	400
Yes	35	157	192
Total	**165**	**427**	**592**

Of the respondents who had heard about the scheme nearly three-quarters (71.5%) thought there was enough publicity, this did vary by region. In the Richmond-Tweed Region only 36.4% thought there was enough publicity, whereas in the Sydney Region 85.7% thought there was enough publicity. (Figure 93)

Figure 93 Percentage of respondents that had heard about the ROPS scheme and thought there was enough publicity by Region (n=592)



9.4.5 Minutes of ROPS Committee

Examination of the ROPS Committee minutes by communication / promotion, logistics, monitoring, and partnership for the years 2000, 2001 and 2002 were undertaken. There were no minutes produced in 2003 and 2004 as the Committee resolved that it would not meet unless there was a need.

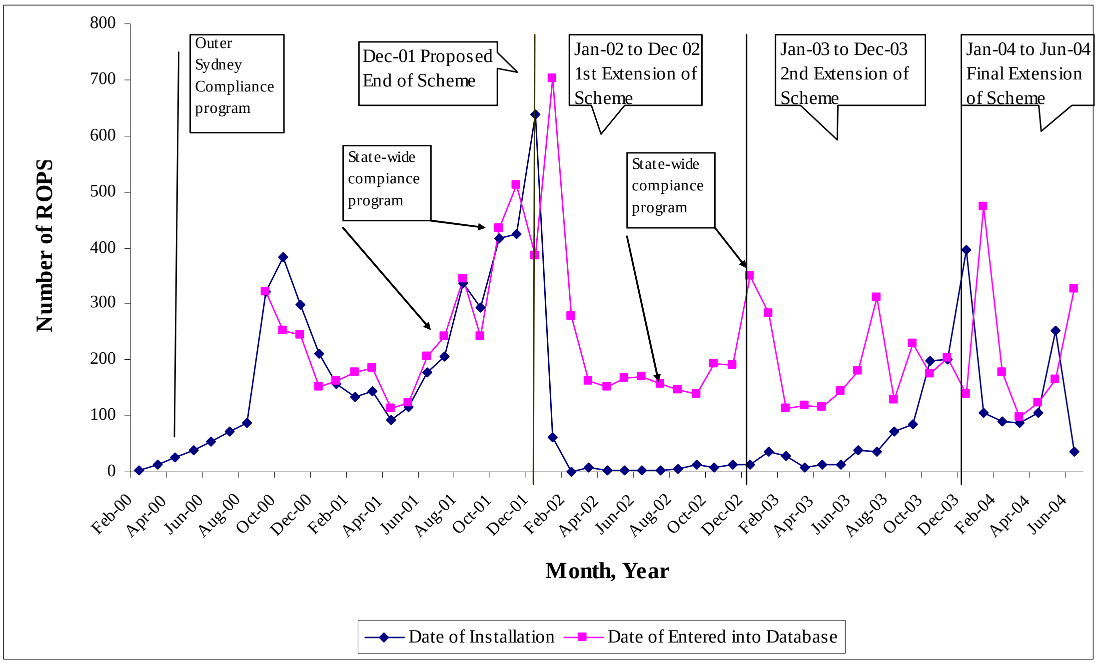
On the whole the ROPS Committee focused on the logistics of the program. Funding was available for the promotion of the scheme which was predominantly undertaken by WorkCover NSW with input from the ROPS Committee and was distributed to Committee member organisations. Due to the limited amount of funds available for the promotion of the ROPS Rebate scheme, it appears the promotion was ad hoc with small periods of intensive promotion. The small periods of promotion were designed by WorkCover NSW to coincide with the compliance program that was to be run.

The Committee on the whole felt that the compliance program was an effective promotion method to increase ROPS fitment and the only issue raised was that the scope of the compliance program was not large enough. The compliance program was funded partially from monies allocated to the ROPS Rebate Scheme, however the activity often had to be incorporated into the current work of WorkCover NSW employees. Compliance programs occurred approximately in the following timeframes:

- April 2001 Outer Sydney

- August 2001 – October 2001 across the state
- July 2002 to December 2002 across the state (Figure 94)

Figure 94 ROPS installed and ROPS rebates entered into database by Month and Year, with identification of Key ROPS Scheme Dates including compliance programs



From the information presented in the minutes, there was a definite increase in the number of ROPS fitted following the introduction of the compliance programs. The compliance programs were also accompanied by advertising. The increase in ROPS fitments may have also been influenced by the scheduled completion of the scheme.

The variable nature of the buying of ROPS did present some problems for suppliers managing their workforce.

While the ROPS Committee was on the whole a partnership, there was very little activity that occurred in partnership. The ACAHS undertook the administration of the scheme and WorkCover undertook the promotion and compliance programs. Farmsafe, Tractors and Machinery Association and NSW Farmers promoted the schemes to their members and were available for some media opportunities, such as when the Minister handed over the cheque to farmers who had fitted a ROPS. There was a lot of mention about attending field days; however there was very little information on what was planned for the field days, who was attending and how these could be improved.

The monitoring of the program was reasonably well undertaken with the committee receiving regular updates on the number of ROPS fitted and towards the end of the Compliance programs the number of farms visited and tractors issued with notices.

9.5 Discussion

The ROPS rebate scheme set out to do two things: firstly, increase the proportion of tractors on farms in NSW that are fitted with an approved ROPS and, secondly, reduce the number of deaths from tractors rollovers. The evaluation set out to answer seven questions:

1. Was the ROPS rebate scheme successful in reducing the number of tractors in NSW without a ROPS?
2. Has the number of tractor rollover deaths decreased as a result of the ROPS scheme?
3. What was the uptake of the ROPS scheme over time?
4. Did different commodities groups or regions utilise the scheme more than others?
5. Was the scheme administered effectively and did the ROPS committee work?
6. What was the cost of the ROPS scheme?
7. If the ROPS scheme was to be undertaken again what issues should be considered?

To answer these questions a number of methods were used, these were:

- An examination of the information collected as part of the scheme,
- Focus groups (this information was used to develop the questions used as part of the survey),
- A survey of a sample of the people who fitted a ROPS,
- A community survey, and
- Examination of the ROPS Committee minutes.

The following information is provided by examination of process (‘Was the ROPS rebate scheme successful in reducing the number of tractors in NSW without a ROPS?’ and ‘Was the scheme administered effectively and did the ROPS committee work?’), impact (‘What was the uptake of the ROPS scheme over time?’, ‘Did different commodity groups or regions utilise the scheme more than other?’, and ‘What was the cost of the ROPS scheme?’) and outcome (‘Has the number of tractor rollover deaths decreased as a result of the ROPS scheme?’).

9.5.1 Process

9.5.1.1 Was the ROPS rebate scheme successful in reducing the number of tractors in NSW without a ROPS?

The scheme was successful, with 10,449 tractors in NSW now fitted with a ROPS that did not have a ROPS in April 2000. It is hard to know how many tractors there were without a ROPS prior to the commencement of the scheme. One estimate from a survey conducted at AgQuip in 1994 estimated there were 88,000 tractors of which between 22,386 and 25,146 did not have a ROPS [319].

With 10,449 ROPS fitted it would be expected that the number of tractors without ROPS to be between approximately 12,000 and 16,000. The survey conducted as part of this study found that there were approximately 18,430 (16,951-19,909) tractors without ROPS in NSW as of April 2004. The previous survey was conducted in the Northern Region, which was found in the current survey to have fewer tractors without a ROPS. The Northern Region also had a lower uptake of the scheme per 100 establishments, thus the previous study would probably have underestimated the total number of tractors without a ROPS. [319]

While the scheme managed to increase the number of tractors with a ROPS there are still a large number of tractors in NSW that do not have a ROPS.

9.5.1.2. Was the scheme administered effectively and did the ROPS committee work?

On the whole the scheme was administered effectively with an average of 4.5 days for a rebate to be sent out and 95% of farmers having their cheque sent within 28 days. When the people who fitted a ROPS were surveyed, 89% said they had received a cheque within four weeks. People who were unhappy with the scheme were more likely to have not received the rebate within the four week period. This may well have been due to the farmer having not provided all the information in the initial application and needing to send in more information, thus increasing the time to receiving the rebate.

Advertising and promotion of the scheme are also important to the uptake of the rebate scheme. Of the people who fitted a ROPS and were followed up, 75% said there was enough publicity about the scheme and 76% of respondents to the community survey said they had heard about the scheme. It appears that while the promotion of the scheme was good it could have been undertaken better. Specific skills in advertising and public relations would have been useful on the committee. Money specifically allocated to the undertaking of compliance programs would also have been useful; employing someone for the first two years of the program to undertake compliance activity may have resulted in a faster uptake of the ROPS rebate. Development of a specific promotion plan in the first few months of the scheme may have also been useful and seen a greater coordinated promotion activity from all members of the committee.

With very little television advertising, it was interesting that 16% of those surveyed who fitted a ROPS and 20% of the community survey respondents had heard about the scheme this way, higher than would have been expected. The most common ways people heard about the scheme (follow-up survey, community survey) were The Land newspaper (39%, 54%), farming organisation (18%, 21%), local newspaper (14%, 23%) and radio (12%, 24%).

Most of the people who fitted a ROPS felt there was enough publicity about the scheme: only those who heard about the scheme from a magazine or a field day did not. It should be noted, however, that hearing about the scheme did not mean all of their tractors would have ROPS fitted.

9.5.2 Impact

9.5.2.1 What was the uptake of the ROPS scheme over time?

Objectives of the evaluation were to report on the uptake of the program by month, commodity group and WorkCover location and to describe the characteristics of the program. Figure 59 provides a graph of the fitment of ROPS over time and the rebates entered into the database over time. While there is a minor lag between fitment and entering information into the database, there are some noticeable trends. In particular, utilisation of the program was highest in periods closest to the proposed end dates of the scheme. These dates also coincided with the compliance programs; thus, it is hard to determine if the end date or the compliance program had the biggest effect (it is probably a combination of both). It is unknown whether running the scheme for longer initially would have led to a better uptake in the early months of 2002.

The multiple finishing dates of the scheme may have actually been a benefit to the fitment of ROPS, as there was an increase in the number of ROPS every time the scheme was scheduled to close. One of the reasons farmers gave as to why they did not fit a ROPS was “that they had not got round to it”. Having a closing date for receiving a rebate was perhaps enough of a push to have farmers fit a ROPS.

Different WorkCover regions had different rates of ROPS fitment per 100 establishments. While it is hard to speculate why this may have been the case, an examination of the advertising and ROPS compliance program might provide an indication of the impact of advertising and compliance program on the uptake of the ROPS rebate. Other factors that would affect the number of ROPS fitted are the number of tractors prior to the program without a ROPS in that area, the season the area had (i.e. good or bad), and commodity groups present.

There was a large difference in the number of ROPS fitted per 100 establishments by commodity grouping, with crop and plant growing and horticulture having the highest rate. This, however, needs to be interpreted with caution as there were a large number of mixed farms where if more information was known would have been classified into a specific commodity group. There were also a large number of people who identified their farms as 'hobby farm', which would be unlikely to have work related tractor rollover deaths, as these farms are not working farms.

9.5.2.1. Did different commodity groups or regions utilise the scheme more than other?

The number of ROPS fitted to tractors per 100 establishments varied by region, with Sydney having the highest number and the Far West having the lowest number. The number of potential tractors without a ROPS also varied. Some regions, such as the Illawarra and the Hunter, have potentially very low numbers of tractors without ROPS.

The fitment of ROPS by commodity groups also varied significantly, with the livestock industries seeing more ROPS fitted per 100 farms. With mixed farming and hobby farming having approximately a third (37.5%) of all ROPS fitted, crop and plant growing NEC and horticulture and fruit group had fitment rates per 100 establishments of 37.9 and 29.7 respectively.

9.5.2.1. What was the cost of the ROPS scheme?

The average cost of a ROPS was $576, with a total of $6,519,406 dollars spent on ROPS. A further $157,203 was spent on fitment of the ROPS. A total of $2,082,200 was provided by the scheme for ROPS (10,411 ROPS x $200), thus farmers spent more than $4,594,409 on ROPS.

On average the cost of ROPS rose by $51 over the period of the ROPS scheme or an increase of 8.5%. The change in CPI during this period was 9.7%. Thus, cost of ROPS increased approximately in line with CPI [330]. Although another interpretation could be that the less expensive ROPS were fitted first and the more expensive ROPS were fitted later in the scheme.

The data suggest that the number of tractors without a ROPS has decreased by approximately 1/3 (34%) over the period May 2000 to June 2004. As there were six deaths in the five years (1995-

1999) prior to the scheme, a reduction of deaths by a third would equate to two lives saved every five years from ROPS fitment. A natural attrition of tractors out of the workplace due to age is also expected. Between the period 1990-1994 (13 deaths) and 1995-1999 (6 deaths), the number of deaths from tractor rollovers halved. In the next period (2000-2004) there were four deaths - a reduction of a third. It is expected that there would be only two deaths in NSW from tractor rollover in the period 2005-2009.

There are some issues with the estimation of the number of lives saved as it does not take into account exposure and in the survey many people identified that it was not their main tractor that did not have a ROPS but the secondary tractors that were used occasionally, thus the effect of the scheme may be much greater.

Another cost that needs to be included is the cost of fitting the ROPS by the farmer, which took an average of 3.7 hours. Thus there were 10,449 x 3.7 hour = 3,866.13 hours used to fit a ROPS. Assuming the minimum wage is approximately $12.30 then this would equate to a minimum of $475,500 in indirect costs in fitting a ROPS.

Day and Rechnitzer in their evaluation of the Victoria ROPS rebate scheme estimated the average lifetime cost per tractor rollover deaths to be $522,210. If there are approximately two lives every five years saved, this scheme will pay for itself within 10 years [155]. Each tractor that had a ROPS fitted on average had another 14.2 years of estimated life left. This equates to a total of 14,838 years of work in which the drivers of the tractors will be protected if the tractor rolls over.

Some unanticipated benefits from the scheme included that people were more aware of safety on the farm more generally. Examples of how this was acted upon during the scheme were the introduction of a rebate for hand pieces on shearing equipment, an increase in the number of Managing Farm Safety courses, and a Wool Shed design program.

9.5.3 Outcome

9.5.3.1. Has the number of tractor rollover deaths decreased as a result of the ROPS scheme?

This question is not as easy to answer, as an examination of rollover deaths over an extended period needs to be undertaken. A reliable outcome evaluation was not available due to lack of routinely available data and funds were not provided to undertake a more rigorous analysis of tractor rollover deaths. However, information provided by WorkCover (Table 111) shows that there has been a decrease in the number of tractor deaths since the mid 1990s. Part of this decrease is probably from the natural attrition of tractors out of the workforce (due to old age). The natural attrition of tractors out of the workforce would be slow with the average working life of a tractor being 25.9 years.

An examination of tractor rollover deaths in three five year periods, 1990-1994 (13 deaths), 1995-1999 (6 deaths), 2000-2004 (4 deaths), shows there has been a decrease in the number of tractor deaths since the introduction of the ROPS scheme. However, this information should be interpreted with caution as Franklin et al found that only two thirds (67.7%) of agricultural tractor related deaths were collected by OHS authorities and Workers' Compensation information [14].

9.5.7 Possible biases in the evaluation

It is not possible to gain an understanding of why people did not respond to the mail surveys. However, analysis of the returned information did not find any significant biases. In the survey sent to farmers who fitted a ROPS, there may have been some recall bias as some of the people surveyed would have fitted their ROPS more than 12 months prior to receiving the survey.

In the General Farming Community Survey there were a low number of returned forms from the number sent; however, this was to be expected as not all RMB represent farms in the area and this survey was a one off with no reminders or notice of intent. There was no way to follow-up people who had not returned a form. The response rate increased when the number of farms for the area was used as the denominator. However, there is no way of knowing exactly how many farms there are in any given area and so this method may under or over estimate the true number of farms. In addition, not all farms have an RMB. There was also a need to separate employees from contractors and casual labour, who may not use the tractor.

While the questions in the survey were piloted with farmers some interpretation of questions may vary, changing the underlying assumptions of the survey. For example, having a ROPS on all tractors may not be an indication of attitude or intent to act (as assumed in this Thesis), it may mean that the farmer bought all his tractors after 1982 or that the farmer is a better manager who is more financially secure and has the resources to ensure all his tractors have a ROPS.

9.5.8 Directions for future farm injury prevention programs based on information obtained from the ROPS evaluation

There were two main reasons people fitted a ROPS: the rebate and the law. Increased awareness was also a factor that prompted people to fit a ROPS. This means that future campaigns in farm injury where people are required to purchase, replace, improve or build a safety device should ensure that people are aware of the safety device (i.e. what is it, how well it works, and what it prevents), that there is a form of reward for fitting it (rebate) and that it is required by law.

The four most common reasons for not fitting a ROPS were that there was a cabin present, they do not use the tractor or it is not working, the cost of the ROPS and could not find a ROPS. These can be interpreted as barriers. That is, presence of a cabin represents other similar devices that people think does the same job thus no need to change or people are unwilling to replace the cabin with a two-post ROPS due to weather or other reasons. If equipment is not used often, then the owner is less likely to improve its safety. Cost is usually a barrier and in this case providing the rebate reduced the impact of the cost. If it is difficult to find a safety device or a person does not know about it, then it is less likely that it will be found and used. Addressing these barriers as part of a farm injury prevention campaign should increase the uptake of the safety device.

People who knew of a serious injury or death in their region were more likely to ensure all their tractors were fitted with a ROPS. Thus if wanting to increase the uptake of safety measures, when there is a death or serious injury, the local media and/or other methods of raising peoples awareness of the issues should be undertaken to ensure people in that locality know about the death or serous injury. To ensure that the safety device is implemented, farmers will also require information about how the safety device would have saved the person’s life or reduced the severity of the injury [331].

Increased awareness of ROPS and the consequences of tractor rollovers may help increase the fitment of ROPS, however as the number of deaths from tractor rollovers decreases, the ability to use this as an impetus for fitment of a ROPS will become more difficult.

Legal action (inspection and enforcement) appears to be the best method to increase the number of tractors in NSW fitted with a ROPS. This is similar to other safety initiatives, such as drink driving, speeding on roads, wearing of seatbelts and pool fencing, where legal action has been found to be effective in making people undertake safer behaviour [64 332-337]. In this study the number of ROPS fitted increased when compliance programs were being implemented. Where possible, linking a rebate scheme with enforcement of legal activities should help increase the uptake of the safety initiative.

The appropriate amount of the rebate is always difficult to determine. It may be a fixed amount or a percentage of the total costs. In the ROPS example if a rebate of greater value had been provided it may have been counter-productive, as those who had not fitted a ROPS may continue to wait in the belief the rebate will increase further. The provision of a set timeframe in which the rebate is available appears to motivate people to take advantage of the scheme. In this study there was an increase in the number of rebates as the closing date (note this was revised three times) for the scheme approached. Thus those schemes with no closing date may not be as successful as those with a specified period.

There were a number of difficulties that farmers encountered when they were fitting a ROPS. These difficulties included having to make modifications, removing existing components, aligning of attachment holes, acquiring a ROPS, poor quality of the ROPS and poor fitment instructions. To help alleviate these problems a solutions database accessible on the web (that could also be printed out) could be made available. For ROPS this could include things such as how to avoid hitting overhanging objects, fitment instructions from manufacturers, tips for removing old bolts, and tips for aligning the ROPS with the tractor's frame. The ability for farmers to provide feedback about problems and their solutions that can be accessed by others should also help to improve the uptake of other safety devices.

Administration of the scheme is an important aspect in ensuring the success of the scheme. Providing the rebate in a timely manner was found to be linked to the happiness of the participants. Thus, the administration of a scheme needs to be addressed early in a program. It was found that those who did not (or perceived that they did not) receive their rebate within four weeks were significantly more likely to be unhappy with the scheme. Another aspect of the administration of the scheme which caused people to be unhappy was the amount of paper work. Reducing the amount of paperwork and increasing speed of processing may have helped keep people happy, which in turn should help with promotion of the scheme by word-of-mouth.

Ensuring people understand the effectiveness of a safety device and the risk of being injured or killed if the safety device is not present is important for the success of the program. In this study, there were misconceptions about the risk of a tractor rollover. Many farmers in this study believed that they were not at risk of a tractor rollover because their land was flat; they were experienced; had common sense; were aware of safety; or carried out risk assessments. While these may (although there is no evidence this is the case) reduce the risk of a tractor rollover they do not eliminate the risk.

It is interesting to note that while people said they would have fitted a ROPS even without the rebate they did not do so before the scheme became available. The scheme therefore either prompted them to fit a ROPS through the rebate or reminded them to do something they had been planning to do for a while.

9.5.9 Utility of existing data to provide performance measure for ROPS

Chapter 4 to Chapter 7 provide a wealth of data about the overall status of people who are injured on farms, during farm activity, or are employed in agricultural industries. However, there is no one data source which provides information about tractor deaths and whether these deaths resulted from a tractor rollover.

Examination of a specific prevention activity and its effectiveness is often difficult where that activity is a subset of other occurrences, such as a death from a tractor rollover. While Workers' Compensation included information on tractors deaths, it had been found previously that this information was incomplete and that the information provided was not detailed enough to capture tractor rollover deaths [14]. In the ABS Deaths data there was no specific category for tractors. This situation is currently being rectified by the National Coroners Information System (NCIS), which provide information about all non-natural deaths in Australia.

The use of the other data sources to provide information about specific farm injury prevention initiatives will be limited unless these initiatives are specific to the dataset. For example, the prevention of eye injuries to agricultural workers could be monitored via Workers' Compensation information.

The development of performance indicators that can be measured using different information sources will continue to be needed for the monitoring of farm injury prevention initiatives. There are some opportunities for this information to be collected via other methods, such as the ABS agricultural survey and census.

9.6 Conclusion

Death from tractor rollover is a problem in Australia and ensuring a ROPS is fitted is a simple and effective solution. In May of 2000 the NSW State Government announced funding for a ROPS retro-fitment campaign, where the first 10,000 farmers to fit a ROPS would receive a $200 rebate. The objective of the ROPS rebate scheme was "To increase the proportion of tractors on farms in NSW that are fitted with an approved ROPS in order to reduce the number of deaths from tractor rollovers". The NSW ROPS rebate scheme was successful in fitting 10,449 ROPS onto tractors, thus achieving the first part of the objective.

According to figures from NSW WorkCover, the number of tractor deaths in the period 2000-2004 decreased to four deaths from six deaths in the previous five year period (1995-1999). While it is difficult to know if this reduction is a direct result of the scheme, it is likely that that the 10,449 ROPS that were fitted and the awareness of the issues created by the scheme would have contributed.

The ROPS rebate scheme was well run and had a number of lessons for future farm safety campaigns, such as:

- when providing a rebate, the administration (i.e. sending the cheque) needs to be done well;
- advertising is important and should be co-ordinated;
- increasing awareness of the risk(s) involved that are being prevented and subsequent solution (s);
- increasing awareness of the outcome the intervention is aiming to prevent;

- undertaking compliance; and
- addressing barriers to uptake.

9.7 Summary ROPS Evaluation

1. Death from tractor rollover has been a continuing problem in Australia. However, a simple but effective solution exists to prevent people from being killed when the tractor rolls over. A rollover protective structure (ROPS) is a frame fitted to a tractor to protect the operator by providing a zone of protection. The ROPS must comply with either Australian Standards AS1636 Tractor Roll-Over Protective Structures – Criteria or AS2294 Earth-Moving Protective Structures.
2. In NSW in 1982 legislation was enacted requiring all tractors weighing between 560 and 15,000kg to be fitted with a ROPS that conforms to AS1636. While some farmers fitted ROPS to their tractors when the legislation first came in, many did not.
3. Following a national tractor conference in 1991 held by Farmsafe Australia a project was undertaken to improve Australia's understanding of tractor safety. As part of this project a survey of farmers who attended the agricultural field day 'AgQuip' in NSW was used to estimate that the number of tractors in NSW without a ROPS. This estimate was 23,766 tractors.
4. Since 1990 there have been 23 tractor rollover deaths and the number of rollover deaths per annum decreased during this period. Between 1990 and 1994 there were 13 deaths, between 1995 and 1999 there were 6 deaths and between 2000 and 2004 there were four deaths.
5. In May of 2000 the NSW State Government announced funding for a ROPS retro-fitment campaign where the first 10,000 farmers to fit a ROPS would receive a $200 rebate. This historic announcement followed the very successful campaign in Victoria where 12,129 ROPS were fitted to tractors.
6. The objective of the ROPS rebate scheme was "To increase the proportion of tractors on farms in NSW that are fitted with an approved ROPS in order to reduce the number of deaths from tractor rollovers".
7. The evaluation set out to answer seven questions:
    a. Was the ROPS rebate scheme successful in reducing the number of tractors in NSW without a ROPS?
    b. Has the number of tractors rollover deaths decreased as a result of the ROPS scheme?
    c. What was the uptake of the ROPS scheme over time?
    d. Did different commodities groups or regions utilise the scheme more than others?

e. Was the scheme administered effectively and did the ROPS committee work well?
f. What was the cost of the ROPS scheme?
g. If the ROPS scheme was to be undertaken again what issues should be considered?

8. To answer these questions a number of methods were used. These were:
   a. Focus groups (this information was then used to develop the survey),
   b. An examination of the information collected as part of the scheme,
   c. A survey of a sample of the people who fitted a ROPS,
   d. A community survey, and
   e. Examination of the ROPS Committee minutes.
9. The evaluation found the following answers to the seven questions:
   a. The ROPS rebate scheme was successful in reducing the number of tractors in NSW without a ROPS by 10,449.
   b. The number of tractor rollover deaths may have decreased as a result of the ROPS scheme.
   c. The scheme ebbed and flowed around closing dates and the compliance program. While the closing dates may have seen a drop off in the number of ROPS rebates afterwards, the multiple closing dates may have prompted farmers to fit a ROPS as one of the barriers identified was that "they had not got round to it".
   d. Different commodities groups or regions utilised the scheme more than others. Livestock industries fitted more ROPS under the scheme per 100 establishments.
   e. The scheme was administered effectively and the ROPS Committee worked. Rebates were sent out on average within 4.5 days and 89% of those survey said that they received their rebate with in four weeks. Three quarters of the people survey said that they had heard about the scheme. The compliance program increased the uptake of ROPS.
   f. Farmers spent over $6,519,406 on ROPS of which the NSW Government contributed $2,082,200.
   g. Issues that should be considered if a new ROPS rebate scheme was to be undertaken include: administration; improved coordination of advertising program; increased awareness of rollover deaths; more compliance; addressing the difficulties that were encountered as part of fitting the ROPS; and increasing awareness about risk of rollover.

10. The NSW ROPS rebate scheme was successful in fitting a large number of ROPS onto tractors that would not have otherwise been fitted. It was on the whole well run and had a number of spin offs for improved safety in other areas.
11. None of the available data from on-going collections was able to provide any information about the impact of the placement of ROPS on farm tractors in NSW (i.e. injuries or fatalities related to tractor rollovers were not able to be identified). The National Coroners Information System which started in 2002 may be able to provide information for future studies.

Chapter 10. Bringing the Mosaic of Information Together - Conclusion and Summary

> What we think, or what we know, or what we believe is, in the end, of little consequence. The only consequence is what we do.
>
> **John Ruskin (1819 - 1900)**

10.1 Bringing it all together

Public health broadly speaking is the process of preventing diseases and injuries through a process of problem identification (surveillance), cause identification, solution development, and solution implementation. This Thesis has primarily focused on surveillance, with the evaluation of a farm safety initiative program providing a real world example of public health action.

This Thesis has five studies: the first four use various datasets to examine injuries sustained by people on farms or during the course of agricultural production and the final study is an evaluation of a farm safety strategy.

The first aim of this Thesis was to undertake the surveillance of injuries occurring to people on farms or during agricultural production using Emergency Department, NSW Hospital data, NSW Workers' Compensation Claims, and ABS Deaths data. Chapters 4-7 provide information about people injured on farms or during agricultural production. Each chapter examines the data for its utility and Chapter 8 compares the information from all of the Chapters.

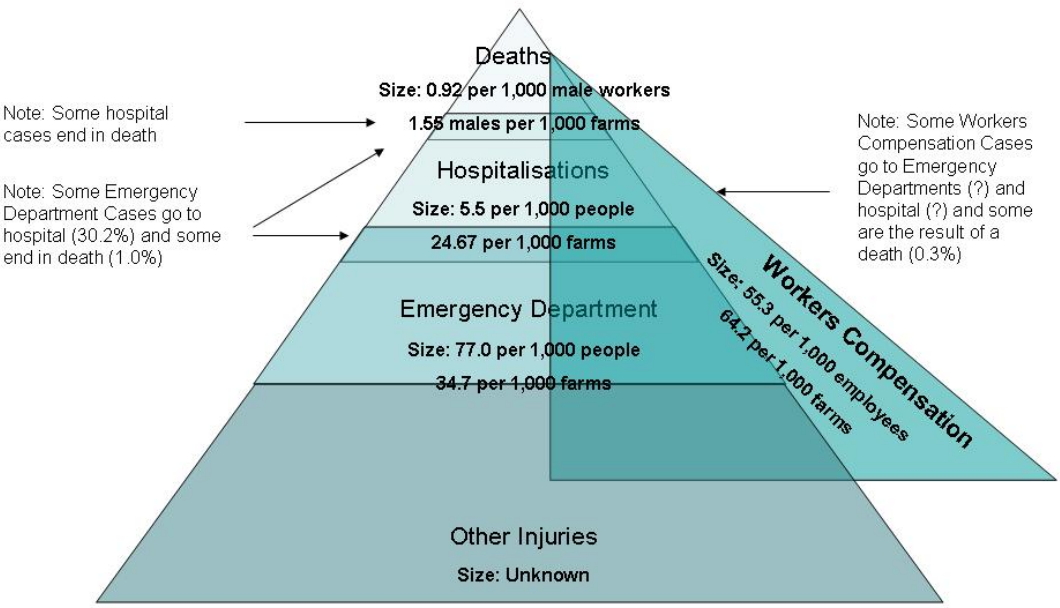
Each of the surveillance studies had strengths and weaknesses (Table 138), and provided different perspectives on farm injury related to severity of injury and level of detail collected about the circumstances surrounding the injuries. The Tamworth Emergency Department data was the only surveillance study in this Thesis set up to specifically examine farm injuries and as such provides a comprehensive picture. However, it was limited to one year of data, whereas the other data sources provided time series information.

Table 138 Summary of the strengths and weaknesses of each dataset used in this Thesis

Data Collection	Strengths	Weaknesses
Emergency Department	• Detailed • Designed specifically to examine farm injuries • Accurate information • Complete for all farm cases at Emergency Department	• One year of information • Not able to be generalised to the whole of NSW • No appropriate denominator
Hospital	• Time series data • Includes all people who sustained an injury on farm and required hospitalisation • Uses international classification system	• Misses cases where person was injured while working in agriculture but not on a farm • Data collected for other purposes • Lack of detail about circumstances • Coding is limited for farm cases • No appropriate denominator
Workers' Compensation	• Times series data • Includes a wide range of severity of injuries • Good detail about the circumstances surrounding the injury • Good denominator information	• Misses people injured on farm who are not covered by scheme (e.g. children, family members, bystanders, visitors) • Does not include self employed (approximately 45% of workforce) • Data collected for other purpose
ABS Deaths Data	• Time series Data • Includes all deaths • Uses international classification system • Denominator information available	• Lacks detail • Misses people injured on farm or during agriculture work where their occupation was not 'farmers and farm managers' or 'agricultural labourer and related worker' • Unable to differentiate work cases from non work cases

Chapter 8 brings together the information from each of the surveillance studies to provide an overview of the current status of farm injuries in NSW (Figure 95) and defines areas where prevention activities need to be undertaken. There were a large number of risks identified and further work needs to be undertaken in finding prevention solutions.

Figure 95 Farm Injury Pyramid for NSW



Note: Deaths rates are the average number of deaths registered by year of death to male 'Farmer and Farm Managers' and 'Agricultural Labourers and Related Workers' between 1 January 1991 and 31 December 2000 , hospital rates are the average of hospital separation that were coded as occurring on farm between 1 July 1990 and 30 June 2000, Emergency Department rates are for NSW based on information collected at the Tamworth Base Hospital between 1 September 1997 and 31 August 1998, Workers' Compensation rates are based on NSW Workers' Compensation claims lodged during the period 1 July 1992 and 30 June 2001 and the number of cases presenting to Emergency Departments or Hospitals is unknown.

Farmsafe Australia's use of Haddon's 'Hierarchy of Control' as a tool to teach farmers how to manage risk and as a process for identifying the most effective strategies is overall an appropriate strategy [60 122]. This strategy is particularly valuable as there appears to be a lack of information in the literature on the effectiveness of many of the proposed prevention activities.

One of the strategies with extensive information about its effectiveness is Rollover Protective Structures (ROPS). This strategy has been used for a long period of time in Australia and overseas. The penultimate chapter provides an evaluation of the NSW ROPS Rebate Scheme. This chapter moves the Thesis from purely a theoretical basis to the last stage of public health (implementation).

The NSW ROPS Rebate Scheme was found to be successful; however, this could not be determined from any of the data sources used in this Thesis. With the development of the National Coroners Information System (NCIS) the reduction in deaths from a similar scheme in the future could be evaluated. The evaluation of ROPS in this Thesis used a range of methods to examine its effectiveness and developed a number of questions and codes. This information should now be stored somewhere for future studies to use.

10.2 What has this study contributed to farm injury prevention?

There have been very few studies in Australia and internationally that have examined the utility of different datasets and the classification systems used. In particular, the information gathered in this study has helped to improve the Farm Injury Optimal Dataset (FIOD) and International Classification of Diseases Version 10. It has provided a comprehensive examination of farm injury issues in NSW, as well identifying where prevention activities need to be targeted. The evaluation of the NSW ROPS Rebate Scheme has provided an insight into those elements which can help to improve the success of other programs.

10.3 Conclusion

The information provided in this Thesis highlights the substantial burden farm injury places on the agricultural and rural sectors of NSW. While there is no one data source in Australia which describes the circumstances and the burden of farm injuries, the currently available data does provide an insight into the circumstances of farm injuries and the burden these injuries place on health, Workers' Compensation, agricultural industries and farming families. Each dataset has limitations with the FIOD providing the best classification of farm injuries.

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