The health and safety of Australia's farming community

A report of the National Farm Injury Data Centre for the Farm Safety Joint Research Venture

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May 2000

Funded by the Farm Health and Safety Joint Research Venture and New South Wales Health

ISBN 0 642 58141 X

Publication No: 00/111
Project Number AHU-3A

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Published in May 2000

The suggested citation is:
Fragar LJ, Franklin RC (2000). *The health and safety of Australia's farming community*. ACAHS & RIRDC: Moree

Foreword

The health and safety status of the people engaged in production agriculture is of critical importance to the general well-being and productivity of the industry itself and of the rural communities supporting and supported by the industry.

The Rural Industries Research and Development Corporation has taken the lead in assembling the Farm Health and Safety Joint Research Venture to address the problem. The Joint Venture includes the Rural Industries Research and Development Corporation, the Woolmark Company, the Grains Research and Development Corporation, the Cotton Research and Development Corporation and the Sugar Research and Development Corporation .

The Joint Venture is investing in a program of research in farm occupational health and safety, including funding of the National Farm Injury Data Collection, that is maintained by the National Farm Injury Data Centre at the Australian Centre for Agricultural Health and Safety.

This document, as a summary report, provides a useful overview that complements the growing number of more detailed reports on specific problems, for specific industries and for specific regions. These are serving to inform health improvement and injury prevention programs of the Farmsafe Australia network and industry.

The ongoing funding assistance of NSW Health to the Australian Centre for Agricultural Health and Safety is gratefully acknowledged.

Peter Core
Managing Director
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Acknowledgments

This report is a summary of data that has been collected by a number of other researchers and agencies around Australia. Source data has included government agencies – workers compensation and hospital data collections, the National Occupational Health and Safety Commission and state work health authorities; Divisions of General Practice; research centres and individual researchers.

A number of individual people have made particular contributions to the gathering of information about the health and safety of the population of people engaged in agricultural production in Australia, and should be recognised for that contribution. They include: Kathy Challinor, Keith Ferguson, James Harrison, Tim Driscoll, Lesley Day, Rebecca Mitchell, Andrew Page and Rosie Hewitt. We gratefully acknowledge their contribution.

Abbreviations

ABS	Australian Bureau of Statistics
ACAHS	Australian Centre for Agricultural Health and Safety
EVAO	Estimated value of agricultural outputs
ILO	International Labour Organisation
OHS	Occupational Health and Safety
RIRDC	Rural Industries Research and Development Corporation
ROPS	Roll Over Protective Structure
NIHL	Noise induced hearing loss
NOHSC	National Occupational Health and Safety Commission
OHS	Occupational Health and Safety

Contents

Executive Summary

Title: The health and safety of Australia's farming community
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This is an overview report of the health and safety of the population engaged in agricultural production in Australia.

There is no single database that holds all the information necessary to define the nature and scale of the health and safety problems of the framing population. It has thus been necessary to collate the available data into a 'mosaic', and to pursue the use of the Farm Injury Optimal Dataset to ensure commonality in definitions and information collected by various agencies and researchers.

The continuing re-structuring of agriculture, in the face of cost-price pressure adds complexity to the maintenance of effective occupational health and safety programs on farms.

1. There is evidence of poor health status of male farmers in Australia. Male farmers face about a 40 percent increase in age standardised death rates compared to the male population of Australia, with increased death rates from farm injury, road traffic injury, cardiovascular disease, some cancers and suicide.

2. On farm non-intentional injury results in around 150 deaths, around 6,500 admissions to hospital and close to 6,000 workers compensation claims each year.

   There are between 20 and 70 presentations to hospital Emergency Departments for farm injury per 100 farms, depending on the nature of the agricultural enterprises.

3. It should be noted that the agricultural industry or enterprise type tends to be the greater predictor of injury risk in relation to rate of injury, nature of injury and agents of injury, rather than geographic location per se.

4. Child deaths and injury is an important health and safety problem to be addressed on Australian farms. Drowning in farm dams and bodies of water is the most common cause of death of toddlers on farms, and farm vehicles, motorcycles, horses and other animals are important agents of injury for older children.

   While the issue of at what age children are safe to undertake farm tasks is receiving significant attention in North America, only eight percent of children who died on Australian farms in 1989-1992 were engaged in farm work activity, and for ED presentations for child injury on farms in two zones in NSW, 21 percent were related to farm work.

5. Tractor deaths due to rollover and run-over remain major causes of on-farm death in Australia. This is despite the early moves being made to define preventable factors and to move for the retro-fitment of ROPS on older tractors.

Data being collated by the National Farm Injury Data Centre, and by the newly instituted National Tractor Deaths Register will continue to provide important information to reduce risk.

6. Motorcycle injury on farms is an emerging OHS problem for the agricultural industries. Deaths on farms are associated with both 2- and 4- wheeled motorcycles, and it is estimated that around 400 – 500 admissions to hospitals occur each year due to injury associated with motorcycles on farms.

7. While pesticides would not rank highly as a priority for farm injury prevention on the basis of the number of deaths or actual poisoning events, there is a widespread concern by the industry and by the wider community over safety issues surrounding pesticide usage. Furthermore, individual cases of exposure can result in high cost.

8. The only data that describes the nature and extent of noise damage in agriculture in Australia is New South Wales. South Australian health workers are providing hearing screening services to farmers, however reports are not available to assist in defining the problem for the industry.

   The information that is available indicates a major, disabling problem for farmers and farm workers. The problem is commencing at a young age, and is progressive and permanent.

9. Leptospirosis notifications are increasing in Queensland and New South Wales, and have declined in Victoria. Workers in the dairy, banana, cane and meat works industries are at risk of contracting the disease through contact with infected urine of carrier animals.

   Q fever is a well established hazard for abattoir workers in Australia, and in dairy and beef cattle farmer and farm workers at least in the coastal and tablelands of eastern Australia. It would appear that the disease is prevalent in Australian sheep, and in kangaroos.

10. Hydatid disease is a significant disease in Australia, which is under-reported. It is a hazard to rural workers and others who handle dogs in rural areas.

11. More work is required for a full analysis of available information regarding respiratory disease in the piggeries industry and in the grain and cotton industries in Australia.

12. The true estimates of current cost of farm injury are not immediately available, but could be between $0.5 and $1.29 billion per annum. What information is available indicates:
    - In addition to medical costs, farm injury results in significant direct farm costs such as damage to plant and equipment and labour costs.
    - Costs appear to vary depending on the industry in which injured persons are working at the time of injury
    - The full costs of farm injury are probably not being borne by the industry.
    - Further work to define the costs of farm injury, and the benefits of farm safety programs is required.

1. Background

There has been an increasing interest in the health and safety of the farming population in Australia over the past 5-10 years, as information has emerged that details the nature, scale and costs of work related injury and illness for this sector. In NSW, for example, the workers compensation premiums for agriculture are currently more than ten percent of wages.

For the period 1989 – 1992, there were 20 deaths per 100,000 workers in agriculture, compared to the 'all industries' average of 5.5 deaths per 100,000 workers [1].

Australia is not alone in highlighting this problem, and there has been a concomitant increase in attention to the problem internationally. The United States, Canada, the Scandinavian countries, Germany and New Zealand are among the countries that have invested in farm injury research and prevention.

Agricultural industry, government and other stakeholder organisations that are member agencies of Farmsafe Australia are committed to addressing this problem[2]. Farmsafe Australia has set its goals and targets for farm injury prevention, and is working within a defined strategic approach to achieve these targets.

The collection and analysis of farm related injury for the purposes of injury prevention poses a number of methodological problems. These relate to:

- Small numbers – there are only around 140 000 agricultural enterprises across Australia.
- The geographic spread of agricultural enterprises
- The variety of agricultural enterprise types – (commodities produced)
- The lack of reliable denominator data to define the agricultural workforce – particularly farm family members exposed to injury risk
- The changes and restructuring of agricultural industry occurring in response to input costs and commodity prices, and technology changes.
- No single database is adequate to define and describe the injury/illness problem for agriculture. The Workers Compensation database contains only around 15% of farm injuries that present to hospital Emergency Departments. Emergency Departments do not treat a range of injuries that are treated by doctors in their rooms[3].
- Differing definitions used by different agencies collecting injury relating to agriculture.

The National Farm Injury Data Centre has collated available data to prepare this and other reports of farm injury, and works with industry based Reference Groups to ensure that reports are suitable for use by key stakeholders.

This report provides a broad description of the nature and scale of the farm injury problem in Australia, and is complemented by other more detailed reports for specific agricultural industries.

2. Australian agriculture and factors of importance to health

Number of farm holdings

The 1995/96 agricultural census conducted by the Australian Bureau of Statistics was completed by 143,211 producers, each reporting an estimated value of agricultural output greater than $5,000 (EVAO). This data is broken down by state in Table 2.1.

The scale of Australian agriculture in terms of area, is large with some 469,053,831 hectares being devoted to agricultural production (ABS, Agstats, 1994[4]).

Table 2.1: Numbers of Australian farming (agricultural establishments) units with an EVAO of $5,000

Year	Qld	NSW	Vic	Tas	SA	WA	NT	ACT	Total
1986 No.farms	33,745	51,728	43,931	5,199	18,739	16,004	267	103	169,716
1996 No.farms	31,371	41,578	36,146	4,464	15,562	13,640	221	95	143,211
Number Decrease	2374	10150	7785	735	3177	2364	46	8	26505
Percent reduction	7.0	19.6	17.7	14.1	17.0	14.8	17.2	7.8	15.6

Agricultural establishments range in size from a few hectares to millions of hectares. The number of farms in Australia has steadily declined in the post war period. The number of farms in the early 1950's was estimated at more than 205,000[5].

Commodities produced

Agriculture in Australia produces a wide variety of products that can be categorised by industry. Table 2.2 demonstrates the proportion of farm establishments by major industry group in Australia in March 1993.

The Australian Centre for Agricultural Health and Safety has mapped agricultural zones of importance to health[6].

Table 2.2: Establishments by industry, EVAO $5000 and over, at 31 March 1996 – ABS Statistics

ANZIC Code	Qld	NSW	Vic	Tas	SA	WA	NT	Total	Percent
Plant nurseries	696	679	287	38	125	156	0	1981	1.4
Cut flowers and flower seed	189	215	209	46	125	130	0	914	0.6
Vegetable growing	1376	701	1005	615	561	567	0	4825	3.4
Grape growing	88	788	1733	68	1769	268	0	4714	3.3
Apple and pear growing	109	205	431	167	130	224	0	1266	0.9
Stone fruit growing	89	471	256	23	330	164	0	1333	0.9
Kiwi fruit growing	5	30	9	0	0	9	0	53	0.04
Fruit growing nec	2127	1651	375	35	666	299	134	5287	3.7
Grain growing	1764	3346	3054	22	3732	2729	0	14647	10.2
Grain-sheep/beef cattle farming	1900	7254	2860	102	2753	3688	0	18557	13.0
Sheep-beef cattle farming	1022	4779	3084	443	1084	628	0	11040	7.7
Sheep farming	771	5171	4691	635	1468	1759	0	14495	10.1
Beef cattle farming	11751	10574	8155	1169	1203	1898	221	34971	24.4
Dairy cattle farming	1912	2047	7933	791	825	463	0	13971	9.8
Poultry farming meat	98	331	161	15	71	57	0	733	0.5
Poultry farming eggs	103	145	110	14	43	85	0	500	0.4
Pig farming	428	369	196	35	169	127	0	1324	0.9
Horse farming	524	558	333	44	106	110	0	1675	1.2
Deer farming	55	99	106	38	50	40	0	388	0.3
Livestock farming nec	668	973	805	87	216	162	0	2911	2.0
Sugar cane growing	4603	462	0	0	0	0	0	5065	3.5
Cotton growing	508	465	0	0	0	0	0	973	0.7
Crop and plant growing nec	585	265	353	77	136	77	0	1493	1.0
Total	**31371**	**41578**	**36146**	**4464**	**15562**	**13640**	**221**	**143116**	**100.0**

Farm household residents

The Annual Farm Survey conducted by the Australian Bureau of Agricultural and Resource Economics (ABARE) has included information relating to farm households. For the year 1994/95, ABARE reported the following derived from survey of commercial farms in the broadacre and dairy industries[7]:

Table 2.3: Farming households 1994/95

	Households	People per household Broadacre farms	People per household Dairy farms
Owner manager households			
On-farm	75869	3.08	3.20
Off-farm	8379	2.77	1.35
Total	84248	3.05	3.10
Other households			
On-farm	30800	2.20	2.57
Off-farm	28652	Na	na
Total	59452	Na	na
Total households			
On-farm	106670	2.92	3.12
Off-farm	37031	Na	na
Total	143701	Na	na

Source: Garnaut J et al. 1998 People in farming. ABARE

Table 2.4: The composition of owner manager households 1994/95

	Percent of households
Owner manager only	9
Owner manager and spouse	34
Owner manager, spouse and householder/s under 20 years	33
Owner manager, spouse and other adult/s	13
Other	11

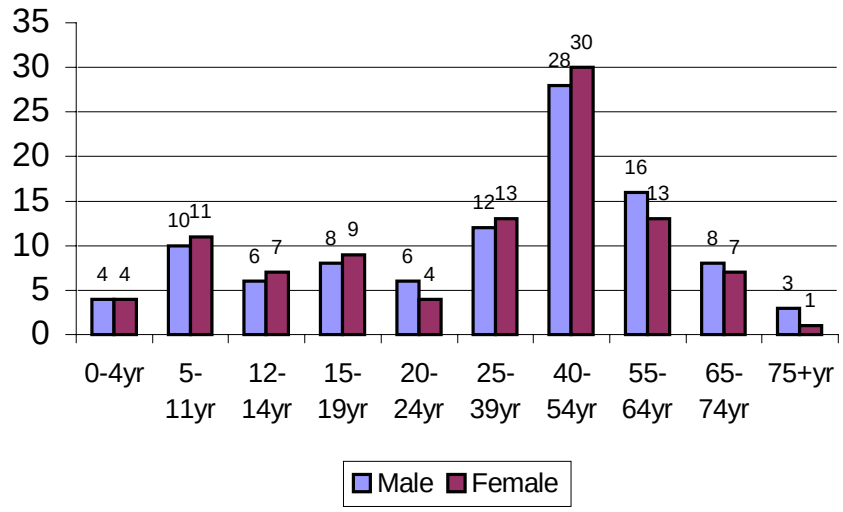
Source: Garnaut J et al. 1998 People in farming. ABARE

The age/gender distribution of households – Owner-manager and other on-farm households is displayed in Figure 2.1.

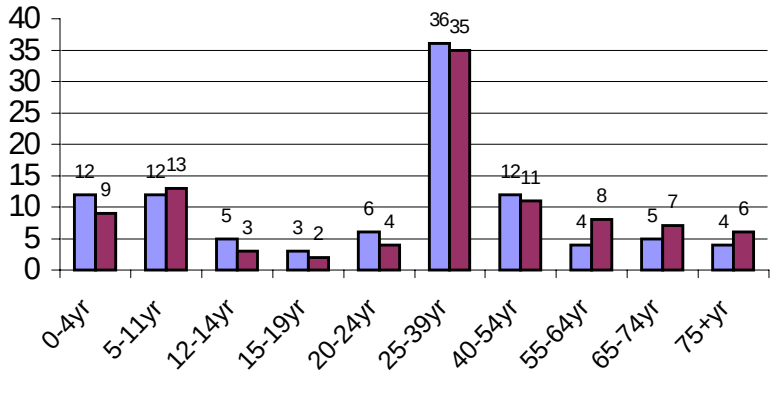
Figure 2.1: The age and gender distribution of people in owner manager households (both on-farm and off-farm) and other on-farm households. 1994/95

Source: Garnaut J et al. 1998 People in farming. ABARE

a. Owner manager households



b. Other on-farm households



The estimated on-farm resident population of children and adolescents for 1990/91 and 1994/95 using this survey data is shown in Table 2.5.

Table 2.5: Estimated on-farm resident population of children and adolescents 1990/91, 1994/95

Age group	1990/91		1994/95	
	Male	Female	Male	Female
0-4	12107	11076	10247	7500
5-14	17038	18569	18543	17046
15-19	8302	8562	10260	9241

Source: Garnaut J et al. 1998, People in farming. ABARE

The farm workforce

A survey conducted by ABARE of farm managers/owner operators of broadacre and dairy farms in Australia in 1993/1994 found that the average of broadacre and dairy farmer is increasing, and was 52 years.

Figure 2.2 demonstrates the age structure of male farmers/farm managers by state in 1991. Data is inadequate to display information about the age structure of female farmers/farm managers.

The proportion of farmer/farm managers over the age of 65 is of significance to health. The increasing age of farmers sees them continuing their agricultural activities, with a concomitant increasing prevalence of chronic degenerative medical conditions. These result in further stress as physical activity is more limited, and risk of injury is increased. It is to be expected that the prevalence of organic brain disorders among farming people will increase.

Figure 2.2: Age distribution of Farm Owners/ Managers 1991

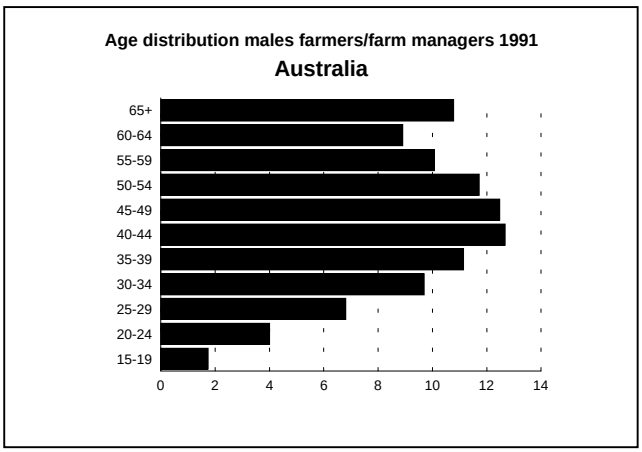


Figure 2.3 demonstrates the age structure of male agricultural labourers in 1991 by state as reported in the Population Census.

Figure 2.3: Age distribution of agricultural workers 1991

Economic realities of Australian agriculture

Australian agriculture has experienced continuing declining terms of trade - the index of farm prices paid continues to outstrip the index of prices received. Economic conditions within the international and domestic spheres plus the technological revolution and 'economies of scale' have brought about the steady decline in the number of farms (Pestana, 1994) – See Table 2.1.

The size of farming operations has seen a corresponding doubling of size in the average individual agricultural enterprise.

The majority of farms in Australia are still family owned and operated. Only five percent of farms are categorised as corporate farms and run as public or private companies. This does not include family farms which operate under a company structure for tax and other business reasons (Pestana, 1994). Sixty percent (60%) of farms are operated under a family partnership arrangement, with 29% of farms having sole operators.

In summary:

Australian agriculture is not homogeneous in terms of:
- Commodities produced, and therefore production systems posing OHS risk
- Changes occurring over time, restructuring of farm systems over time
- Workforce characteristics – with varying age characteristics according to production system needs.

The persons at risk of injury and work-related disease include farm family members, and members of all households physically located on farms. In addition, visitors to farms are at risk, and will include family visitors.

Data presented in this report regarding deaths, injury and illness reflect these characteristics.

3. The health hazards in agriculture

There has long been recognition that agricultural production is associated with significant risk to safety and health. In 1980 the World Health Organisation issued a report of a workshop held in Geneva in November 1979, titled *Workshop on occupational health care in agriculture*.[8]

The hazards to health in that publication were defined in relation to the characteristics of agricultural production processes. This model has been used as the basis for Figure 3.1. While there are more advanced systems of classifications of occupational injury and disease, this early description provides a perspective that takes into account some of the more unique hazards to the industry.

In 1988, Worksafe Australia, the Department of Primary Industry and Energy and the University of New England, convened the first national conference on farm health and safety in Australia – Farmsafe '88. The conference identified a wide range of health and safety issues of importance in Australian agriculture, and served as a springboard from which a more directed program of research and prevention activity has been implemented[9].

A similar major national conference in the United states was convened by the Surgeon General to consider agricultural safety and health, and the report of the proceedings outlined eleven leading work-related diseases and injuries for that country.

More recently, a Working Paper has been prepared by the International Labour Organisation (ILO) to prompt discussion on occupational health and safety for workers in agriculture[10]. This was prepared with a view to determining the interest of member countries in adopting an instrument or instruments concerning safety and health in agriculture, and will be considered at the 88th Session in 2000. The Working Paper draws attention to the following concerns:

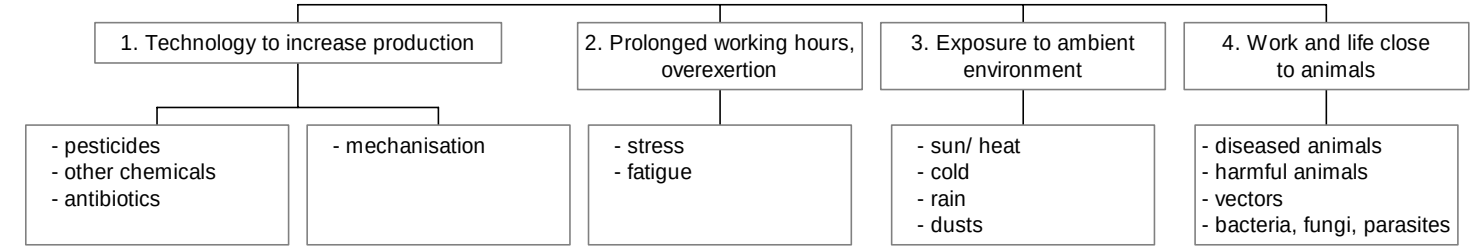
1. Overlapping categories of workers - lack of clear-cut distinctions between different categories of workers and size and types of landholdings.
2. Technical development and agriculture – heterogeneous and multifaceted sector, variable working conditions from industry to industry and country to country.
3. Occupational accidents and injury – machinery, animals.
4. Agrochemical exposure
5. Occupational and work related diseases

- Zoonoses
- Skin disorders
- Respiratory disorders
- Occupational cancer
- Impairment due to noise and vibration
- Relation between general disease and work related disease

6. Under-reporting
7. Access to health services
8. Coverage under national legislation
9. Relevant International Standards

Figure 3.1

Occupational Health Problems in Agriculture



- pesticide poisoning
- resistant strains organisms

- diseases due to noise/ vibration
- ergonomic problems
- psychosocial problems

- injury

- psychoneurotic/ psychosomatic diseases

- diseases due to physical weakness/ injury strain

- heat prostration
- frost bite
- bush fires

- dust - borne diseases

- zoonotic diseases
- snake bite
- animal handling injury

What is significant is the wide *variety* of hazards to health and safety faced by most people in the farm workplace. It could be agued that this is the most significant aspect of OHS on farms that impedes ready adoption of OHS principles and practice in the industry.

There is a growing international literature reporting research findings in a number of areas. These include:

1. Farm injury, particularly work related injury – this literature has focussed on risk factors for tractor and machinery injury, and animal handling injury.
2. Pesticides exposure and health effects
3. Respiratory disease – particularly in the animal confinement industries of the northern hemisphere - ie pig and dairy production
4. Health status and risks of immigrant seasonal workforce in the United States

In Australia, the first record of concern about safety on farms is a paper in the Agricultural Gazette in February 1958 by Nancy Foskett, a Senior Extension Officer (Women's Service) in the NSW Department of Agriculture [11]. This paper focussed on safety in the farm family setting. There has been little attention to reporting the overall health status of the population of people engaged in agricultural production. A preliminary paper was presented at the First Rural Public Health Conference in 1997[12].

This paper describes a number of the key problems described in the WHO workshop report. Not all hazards that exist on farms will be addressed. Rather the major risks, in terms of death, injury, cost and/or prosecution/ litigation, have been identified and will be described as far as is possible with existing data. Other publications of the National Farm Injury Data Centre will address state and industry specific occupational health and safety issues in agriculture.

4. The health and safety of Australian farming populations

There is early evidence from deaths data that Australian male farmers experience higher death rates than the Australian male population. A paper presented at the National Rural Public Health Conference in 1997 reported that the age standardised death rate for male farmers aged 15-65 years in the period 1990-1993 was 39% greater than the age standardised death rate for the working male population[13].

Excessive higher rates of deaths of male farmers are associated with circulatory disease, neoplasms (cancer) and injury (Table 4.1).

Table 4.1 Standardised mortality ratios male farmers/ farm managers by 5 broad disease groups 1990-1993 (Indirect method)

Cause of death	Standardised mortality ratio	95% CI L	95% CI U
Circulatory disease	162	151	173
Neoplasms (Cancer)	120	112	128
Respiratory disease	84	65	103
Injuries and poisonings	224	205	243
Other causes	86	74	98
All causes	**139**	**134**	**144**

Source: HealthWIZ National Social Health Database, reported in Fragar et al, 1997

Death rates were highest in the Northern Territory, New South Wales, Victoria and South Australia for male farmers / farm managers for all causes (Table 4.2).

Table 4.2 Standardised mortality ratios male farmers / farm managers - all causes by state 1990-1993 (Indirect method)

State	Standardised mortality ratio	95% CI L	95% CI U
New South Wales	149	139	159
Victoria	149	138	160
Queensland	118	107	129
South Australia	149	132	166
Western Australia	121	105	137
Tasmania	131	100	162
Northern Territory	158	40	276
Australia	**139**	**134**	**144**

Source: HealthWIZ National Social Health Database, reported in Fragar et al, 1997

Unfortunately, similar data is not immediately available for females or for agricultural workers, and should be the subject of further investigation.

4.1 Deaths on Australian farms

Deaths information is very valuable in describing the nature and scale of injury and illness associated with agricultural production. Deaths and major permanently disabling injury represent the most severe and worrying outcome from injury/illness resulting from exposure to risk on farms and result in major family and community pain, grief, loss, adjustment and cost.

Deaths data that is readily available (eg through the Australian Bureau of Statistics deaths data) is usually only able to provide very general information – age, gender, cause of death and address information. Special studies accessing other databases (eg coroners' records and road fatalities crash records) have been required to obtain more useful information about the circumstances and mechanisms of injury deaths. Current plans to computerise coronial records will provide more information about injury deaths than is currently accessible.

4.1.1 Injury deaths on Australian farms

- In the period 1982-1984 there were 19 deaths per 100 000 workers in agriculture[14].
- In the period 1989-1992 there were 20 deaths per 100 000 workers in agriculture[15].

The National Occupational Health and Safety Commission undertook a study of work related deaths for the period 1989 to 1992, and has made a preliminary report of deaths in the agriculture industry[16]. The study was based on coronial records in all states and territories.

The report identified, that in 1989-1992 there were 373 people employed in the agriculture industry who died in farm-related unintentional work related incidents. A further 72 working persons were killed who were not employed in agriculture and another 142 non-working persons – ie bystanders were killed as a result of farming activities.

A full and detailed report of agricultural industry deaths was published in June 2000[17]. Some of the general findings are presented here.

Table 4.3 indicates the age group of those fatally injured in farm-related activities during the period 1989-1992, according to working status at the time of injury. The detailed report provides further analyses of age and gender factors associated with commodity groups, states, specific agents and specific mechanisms. There is also a section in the report that examines children (0-14 years), young adults (15-29 years) and older adults (55+ years) in detail.

Table 4.4 indicates the industry in which working persons who died in farm-related work activities were employed at the time of the injury. The detailed report provides a full breakdown for key industries of the farm-related fatalities for 1989-1992 (Section 2).

Table 4.3: Age group by work status, farm-related fatalities, Australia, 1989-1992

Age Group	Working	Bystander	Other Farm	Total	%
<5	-	65	7	72	12.3
5 - 9	3	15	7	25	4.3
10 - 14	6	9	3	18	3.1
15 - 19	17	8	6	31	5.3
20 - 24	39	7	7	53	9.0
25 - 29	26	7	5	38	6.5
30 - 34	36	8	6	50	8.5
35 - 39	23	-	2	25	4.3
40 - 44	33	2	2	37	6.3
45 - 49	44	2	3	49	8.3
50 - 54	34	2	4	40	6.8
55 - 59	28	4	7	39	6.6
60 - 64	27	3	4	34	5.8
65 - 69	17	5	3	25	4.3
70 - 74	19	3	1	23	3.9
75+	21	2	5	28	4.8
Total	**373**	**142**	**72**	**587**	**100.0**

Source: Franklin et al, 2000

Table 4.4: Farm enterprise by work status, farm-related fatalities, Australia, 1989-1992

Farm Enterprise	Working	Bystander	Other Farm	Total	%
Agriculture	**358**	**133**	**72**	**563**	**95.9**
Poultry	*1*	*2*	*-*	*3*	*0.5*
Poultry for Meat	*2*	*-*	*-*	*2*	*0.3*
Fruit	*2*	*-*	*-*	*2*	*0.3*
Grapes	*3*	*2*	*1*	*6*	*1.0*
Plantation Fruit	*3*	*2*	*1*	*6*	*1.0*
Orchard and Other Fruit	*10*	*10*	*1*	*21*	*3.6*
Vegetables Including Potatoes	*18*	*4*	*-*	*22*	*3.7*
Cereal Grains, Sheep, Cattle, Pigs	*53*	*18*	*7*	*78*	*13.3*
Cereal Grains	*21*	*1*	*1*	*23*	*3.9*
Sheep, Cereal Grains	*10*	*1*	*-*	*11*	*1.9*
Meat Cattle, Cereal Grains	*12*	*-*	*1*	*13*	*2.2*
Sheep, Meat Cattle	*19*	*3*	*5*	*27*	*4.6*
Sheep	*29*	*12*	*7*	*48*	*8.2*
Meat Cattle	*77*	*13*	*8*	*98*	*16.7*
Dairy	*10*	*9*	*4*	*23*	*3.9*
Pigs	*4*	*2*	*-*	*6*	*1.0*
Other Agriculture	*1*	*-*	*-*	*1*	*0.2*
Sugar Cane	*11*	*1*	*2*	*14*	*2.4*
Cotton	*6*	*1*	*1*	*8*	*1.4*
Nurseries	*3*	*-*	*-*	*3*	*0.5*
Agriculture NEC	*16*	*2*	*5*	*23*	*3.9*
Aerial Agriculture Services	*3*	*-*	*-*	*3*	*0.5*
Services to Agriculture	*4*	*-*	*-*	*4*	*0.7*
Agriculture Not Known	*40*	*50*	*28*	*118*	*20.1*
Other	**14**	**-**	**-**	**14**	**2.4**
Not Known	**1**	**9**	**-**	**10**	**1.7**
Total	**373**	**142**	**72**	**587**	**100.0**

Source: Franklin et al, 2000

Tables 4.5 and 4.6 indicate the number and rates of fatalities that were farm related during 1989-1992 by state and territory. The detailed report provides a full breakdown of farm-related fatalities for each state and the Northern Territory (Section 3).

Table 4.5: Rate of fatalities [a] by state or territory by establishments, farm-related fatalities, Australia, 1991-1992

State or Territory	n	Number of Establishments [b]	Rate per 10,000 Establishments
Queensland	151	33,181	11.4
New South Wales	193	44,443	10.9
Victoria	125	39,170	8.0
Tasmania	30	4,884	15.4
South Australia	41	17,511	5.9
Western Australia	57	14,790	9.6
Northern Territory	10	302	82.8
Australia	607	154,380	9.8

[a] Due to the low number of fatalities in some of the states there may be some problems with the stability of this rate. Includes agricultural workers who were intentionally fatally injured.
[b] Rates based on the 1991 agricultural census.
Source: Franklin et al, 2000

Table 4.6: Rate of fatalities[a] by state or territory for farmers, farm hands and all farm workers, farm-related fatalities, Australia, 1989-1992

State or Territory	Farmer		Farm Hand		All Farm Workers	
	n	Rate per 100,000 workers[b]	n	Rate per 100,000 workers[c]	n	Rate per 100,000 workers[d]
Queensland	59	28.7	23	24.1	95	28.7
New South Wales	68	25.1	26	20.3	105	23.5
Victoria	39	13.9	11	14.4	48	12.1
Tasmania	12	39.8	4	*	16	30.6
South Australia	22	19.5	4	*	30	17.4
Western Australia	16	16.6	5	*	26	16.0
Northern Territory	-	-	1	*	5	35.4
Australia	216	21.6	74	18.1	325	20.6

[a] Due to the low number of fatalities in some of the states there may be some problems with the stability of this rate. Includes agricultural workers who were intentionally fatally injured.
[b] Incidence rates - deaths per 100,000 farmers per year in agriculture industry
[c] Incidence rates - deaths per 100,000 farm hands per year in agriculture industry
[d] Incidence rates - deaths per 100,000 farm workers per year in agriculture industry
* No rate calculated due to the low number of deaths
Source: Franklin et al, 2000

Table 4.7 indicates the activity being undertaken at the time of the fatal incident by work status during 1989-1992.

Around 30 percent of all persons fatally injured on Australian farms between 1989 and 1992 were visitors to the farm.

Table 4.7: Activity at time of fatal incident by work status, farm-related fatalities, Australia, 1989-1992

Activity	Working	Bystander	Other Farm	Total	%
Transport for Work Purposes	98	-	-	98	16.7
Transport for Recreation	-	27	11	38	6.5
Transport NEC	-	11	2	13	2.2
Constructing or Installing	11	-	2	13	2.2
Maintenance	45	-	7	52	8.9
Earthmoving or Digging	11	-	-	11	1.9
Slaughtering, Gutting or Shelling	3	-	1	4	0.7
Milling	1	-	-	1	0.2
Felling Trees or Clearing Land	31	-	2	33	5.6
Firefighting	2	-	-	2	0.3
Hunting	12	-	5	17	2.9
Working with Animals	51	-	3*	54	9.2
Working with Crops	49	-	-	49	8.3
Mining Activities	1	-	-	1	0.3
Monitoring, Observing, Inspecting	16	3	1	20	3.4
Moving Goods	29	-	-	29	4.9
Rescuing	2	-	1	3	0.5
Work Break	2	-	-	2	0.3
Recreation or Playing	-	85	21	106	18.1
Household Domestic Work or Gardening	2	-	5	7	1.2
Assault	-	1	-	1	0.2
Working – Context Unclear	1	-	-	1	0.2
Other	3	12	8	23	3.9
Not Known / Not Stated	3	3	3	9	1.5
Total	**373**	**142**	**72**	**587**	**100.0**

* The three "other farm" fatalities were working with horses at the time of the fatality, but were clearly identified as recreational activities.
Source: Franklin et al, 2000

Table 4.8 indicates the broad agent of injury causing unintentional death on farms during the period 1989-1992. The detailed report provides a breakdown of factors associated with key agents of injury deaths on farms.

Table 4.8: Agent of non-intentional injury death on farms 1989-1992

Agent of injury death	Work related deaths	Bystander deaths	Other on-farm deaths	Total
Farm utility	6	11	3	20
2 wheeled motorcycle	14	9	1	24
Aircraft	46	0	0	46
Other vehicle	50	23	9	82
Tractor	68	19	0	87
Grain auger	6	0	0	6
Other mobile machinery	24	5	0	29
Fixed plant/equipment	9	0	0	9
Workshop equipment	6	0	2	8
Materials	12	0	1	13
Dam	7	44	0	51
River/creek	8	2	9	19
Power lines	11	0	1	12
Other farm structure	20	14	5	39
Horse	21	3	0	24
Other animal	5	1	10	16
Hazardous substances	3	1	2	6
Trees being felled	17	3	2	22
Fire/smoke	4	0	13	17
Other working environment	10	1	4	15
Firearms	18	5	4	27
Other	8	1	6	15
Total	**373**	**142**	**72**	**587**

Source: Franklin et al, 2000

In summary:

Around 150 persons die from non-intentional injury on Australian farms each year. These deaths are of workers, bystanders to work and others and occur in a range of circumstances on farms of different agricultural enterprise types.

Further information regarding farm fatalities is to be found in the major analysis of farm injury deaths in Australia by Franklin et al, 2000[5].

4.1.2 Road traffic deaths of farmers and farm workers.

Rates of death of male farmers by road traffic accident were reported to be higher than that of the male population (age standardised) at the National Rural Public Health Conference in 1997 (Fragar et al, op cit).

Table 4.9 indicates the relative age standardised rates of death by road traffic accident for farmers and farm managers aged 15-64 for 3 periods using the HealthWiz databases for those periods. While the rate for the working aged population has declined over the time periods 1985 to 1995, the rate of decline appears to be much less for male farmers and farm managers in this age group.

Table 4.9: Road traffic deaths male farmers/ farm managers aged 15-64 in 3 time periods 1985-1989, 1990-1993, 1992-1995 Number, age standardised rates per 100000 population.

Time period	Number deaths male farmers	Direct age-standardised death rate male farmers	95% Confidence Interval	Death rate male working age population	95% Confidence Interval
1985-1989	263	42.1	36.6 - 47.5	32.7	32 – 33.4
1990-1993	132	37.7	46.3 - 29.1	22	21.3 - 22.6
1992-1995	127	38	29.1 - 46.9	20	19.4 - 20.6

Source: HealthWIZ National Social Health Database

Rates of death of farm managers due to road traffic accident for the period 1992-1995 by state are indicated in Table 4.10

Table 4.10: Road traffic deaths male farmers/ farm managers aged 15-64 1992-1995 by state. Number, age standardised rates per 100,000 population.

State	Number deaths male farmers	Direct age-standardised death rate male farmers	95% Confidence Interval	Death rate male working age population	95% Confidence Interval
New South Wales	32	35.2	17.8 - 52.6	17.8	16.8 - 18.7
Victoria	31	45.5	24 - 67.1	16.8	15.7 - 17.9
Queensland	23	24.3	11.4 - 37.3	24.5	22.9 - 26.1
South Australia	14	40.7	11.1 - 70.3	20.4	18.4 - 22.5
Western Australia	23	56.6	27.9 - 85.4	23.7	21.6 - 25.7
Tasmania		6	-5.7 - 17.7	21.5	17.8 - 25.3
Northern Territory	2	75.5	-33.9 - 184.9	51.6	42.1 - 61
ACT	1	158.2	-151.9 - 468.2	11.9	8.6 - 15.3
Total	**127**	**38**	**29.1 - 46.9**	**20**	**19.4 - 20.6**

Rates for Western Australia and Victoria have significantly higher rates than the national age standardised rate of death for road traffic deaths.

A study undertaken by the Australian Centre for Agricultural Health and Safety in association with the Australian Transport Safety Bureau (ATSB) has reported key factors associated with road fatalities in the farming community[18]. That study will be reported in full, later in 2000. The study examined road traffic deaths of male farm managers and agricultural workers for the years 1988, 1990, 1992, 1994 and 1996. The data source was established by matching ATSB and Australian Bureau of Statistics files. Female deaths records inadequately defined female farm managers and farm workers and were excluded from the analysis. The following information was derived from the study.

Figure 4.1 displays the age distribution of farmers and farm workers who died on roads for the study period.

Figure 4.1: Age of farmer and farm worker road deaths. 1888, 1990,1992,1994 1996.

Source: Australian Centre for Agricultural Health and Safety.1999.

Crash circumstances

Crash circumstances were reported in relation to the number of vehicles involved in the crash and the distance from home to the site of the road accident resulting in death. Table 4.11 indicates that more than 80 percent of accidents involved single vehicles.

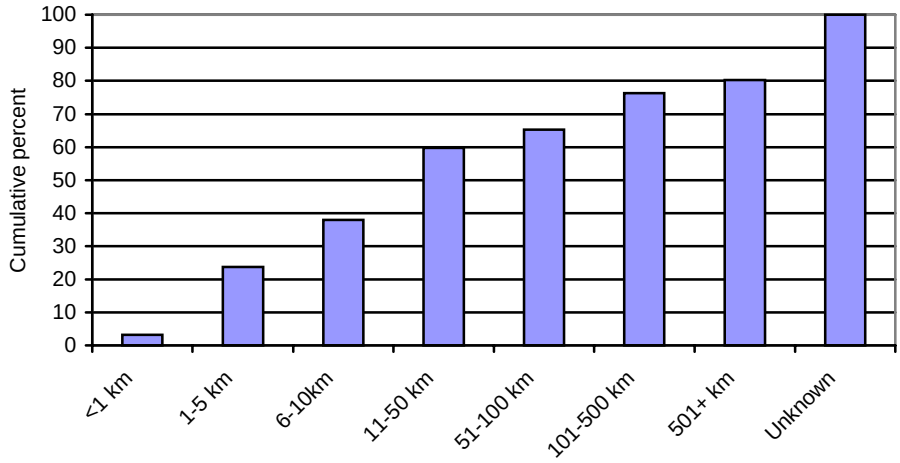
Table 4.11: Number of vehicles involved in road deaths of farmers and farm workers. 1988, 1990, 1992, 1994, 1996.

Number vehicles involved	Farm manager	Farm worker	Total	Percent
1	155	98	253	82
2	32	21	53	17
3	2	0	2	1
Total	**189**	**119**	**308**	**100**

Source: Australian Centre for Agricultural Health and Safety.1999.

Figure 4.2 indicates that around 60% of road deaths of farmers and farm workers occurred within 50 kilometres from home.

Figure 4.2: Distance from home to site of road death of farmers and farm workers 1988, 1990, 1992, 1994, 1996.



Source: Australian Centre for Agricultural Health and Safety.1999.

Personal factors

Use of seat belts was reported in the study.

For both groups, managers and farm workers, 64.6% of vehicles had seat belts fitted to the vehicles. However, 34.3% of farm managers who had a seat belt fitted were not wearing it at the time of accident. For farm workers, 44.8% of those who had a seat belt fitted were not wearing them.

Of the 142 farm managers who died and who had blood alcohol tests, 33.8% had a blood alcohol reading greater than 0.05 g/100ml. For farm workers, 49.6% of the 59 who had a blood alcohol test had a level greater than 0.05 g/100ml.

Other factors will be reported in the full report, and will be the subject of consideration by farmers' and farm workers associations within the Farmsafe Australia framework.

In summary:

Deaths of farmers and farm workers on roads appear to be an important cause of premature loss of life for this population. The search for preventable factors has begun with reporting of behavioural factors such as seat belt wearing and alcohol use being identified as significant contributors to road traffic deaths.

4.1.3 Cardiovascular disease deaths of farmers

Death rates (age standardised) of male farmers/farm managers due to cardiovascular disease were noted to be 62% higher than for the Australian male population for the period 1990-1993 in the report presented at the First National Rural Public Health Conference[19].

Background

Table 4.12 indicates the relative age standardised rates of death due to cardiovascular disease for farmers and farm managers in the age group 15-64 for 3 periods using the HealthWiz databases for those periods. Deaths from cardiovascular disease in this working age group appear to be declining in line with the national trend.

Table 4.12: Deaths due to cardiovascular disease of male farmers/ farm managers aged 15-64 in 3 time periods 1985-1989, 1990-1993, 1992-1995 Number, age standardised rates per 100000 population.

Time period	Number deaths male farmers	Direct age-standardised death rate male farmers	95% Confidence Interval	Death rate male working age population	95% Confidence Interval
1985-1989	1361	117	110.7 - 123.3	127.3	125.9 - 128.7
1990-1993	700	84	77.7 - 90.3	79.1	77.9 - 80.3
1992-1995	598	71.8	65.9 - 77.6	71.1	70 - 72.2

Source: HealthWIZ National Social Health Database

Rates of death of farm managers in the age group 15-64 due to specific cardiovascular diseases for the period 1992-1995 by state are indicated in Table 4.13.

Table 4.13: Age standardised death rates of farmers/farm managers aged 15-64 due to specific cardiovascular diseases 1992-1995

	Number deaths farmers/farm managers	Death rate farmers/farm managers per 100,000 direct age standardised	95% Confidence Interval	Death rate male working population AGED 15-64 direct age standardised	95% Confidence Interval
Heart disease - acute myocardial infarction	337	40.5	36.1 – 44.9	36.4	35.6 - 37.2
Heart disease - other ischaemic heart disease	168	19.7	16.7 – 22.7	23	22.4 - 23.6
Cerebrovascular disease – stroke	85	10.4	8.2 - 12.7	10.4	10 - 10.9
Cardiovascular disease	598	71.8	65.9 – 77.6	71.1	70 - 72.2

Source: HealthWIZ National Social Health Database

In summary

Further investigation of the previously reported increased rate of death from cardiovascular disease in the male farmer/farm manager population needs to be undertaken.

4.1.4 Cancer deaths of farmers

Farmers are reported in the international literature as having higher risk of certain cancers. These are often reported in the context of attempts to demonstrate association with chemical or other environmental exposures (see Chapter 8).

Age standardised death rates for certain cancers were noted to be higher for male farmers/ farm managers than for the male population of Australia, in the paper presented to the First National Rural Public Health Conference in 1997. Those cancers noted to be associated with higher death rates were:

- Cancer of the colon
- Cancer of the rectum
- Cancer of the skin – melanoma
- Other skin cancer
- Cancer of the prostate
- Cancer of the brain

Death rates for cancer of the lymphatic and haemopoietic tissues, while higher, were not statistically significantly different.

Table 4.14 indicates death rates for male farmers/farm managers' aged 15-64 for the period 1992-1995 in relation to rates for the working age population.

Table 4.14: Direct age standardised death rates for specified cancer, male farmers/farm managers aged 15-64. 1992-1995

	Death rate farmers/ farm managers, direct age standardised	95% Confidence Interval	Death rate working age population, direct age standardised	95% Confidence Interval
Cancer of the trachea, bronchus & lung	18.4	15.5 - 21.3	24.1	23.4 - 24.7
Cancer of the colon	12	9.7 - 14.3	9.4	9 - 9.8
Cancer of the rectum	5.5	3.9 - 7.1	4	3.7 - 4.2
Cancer of the skin - melanoma	7.2	5.1 - 9.2	4.8	4.5 - 5
Other cancer of the skin	1.5	0.7 – 2.4	1.4	1.3 - 1.6
Cancer of the prostate	7.9	5.9 - 10	3.8	3.5 - 4
Cancer of the brain	8.2	6.1 - 10.4	5.2	4.9 - 5.5
Leukaemia	5.8	3.8 - 7.8	3.9	3.6 - 4.2
Cancer of lymphatic & haemopoietic tissue	8.1	6 - 10.2	6.9	6.5 - 7.2
All cancers	105.0	97.6-112.4	98.3	97.0 – 99.6

Source: HealthWIZ National Social Health Database

In summary:

Cancer incidence and death rates for the farming population of Australia needs further investigation and research to determine relative risk and causal factors.

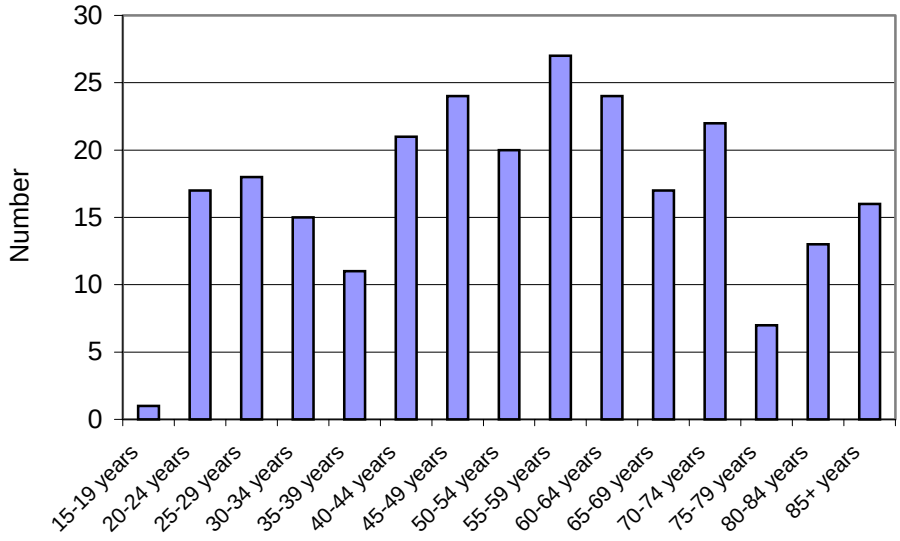
A major prospective study of the health of farmers in two states in the United States that aims to recruit 75,000 participants will be an important study as it attempts to relate environmental and occupational exposures to health status[20].

4.1.5 Suicide deaths of farmers

Rates of suicide deaths of male farmers were reported to be around double that of the male population (age standardised) at the National Rural Public Health Conference in 1997 (Fragar et al[21]).

For the period 1992-1995 there were 253 suicide deaths of male farmer/farm managers. Figure 4.3 indicates the age distribution of these suicide deaths.

Figure 4.3: Number of suicide deaths of farmers/farm managers by age 1992-1995.



Source: HealthWIZ National Social Health Database

Table 4.15 indicates the relative age standardised rates of suicide deaths for farmers and farm managers aged 15-64 year for three periods using the HealthWiz databases. While the rate for the working aged population has remained fairly steady, over the time periods 1985 to 1995, the rate of suicide death appears to have increased for male farmers and farm managers, although not at a statistically significant degree.

Table 4.15: Suicide deaths male farmers/ farm managers aged 15-64 in 3 time periods 1985-1989, 1990-1993, 1992-1995 Number, age standardised rates per 100000 population.

Time period	Number deaths male farmers	Direct age-standardised death rate male farmers	95% Confidence Interval	Death rate male working age population	95% Confidence Interval
1985-1989	212	27.6	23.5 - 31.7	26.8	26.1 - 27.4
1990-1993	185	34.5	28.6 - 40.5	27.3	26.6 - 28
1992-1995	178	33.2	27.5 - 38.9	27.9	27.2 - 28.6

Source: HealthWIZ National Social Health Database

Rates of suicide death of farm managers for the period 1992-1995 by state are indicated in Table 4.16.

Table 4.16: Suicide deaths male farmers/ farm managers aged 15-64 1992-1995 by state. Number, age standardised rates per 100000 population.

State	Number deaths male farmers	Direct age-standardised death rate male farmers	95% Confidence Interval	Death rate male working age population	95% Confidence Interval
New South Wales	66	44	31.6 - 56.4	26.6	25.4 - 27.7
Victoria	54	38.7	26.9 - 50.5	25.7	24.4 - 27
Queensland	26	22.2	12.9 - 31.5	31.5	29.7 - 33.3
South Australia	10	16.2	5.1 - 27.3	28.2	25.7 - 30.6
Western Australia	17	27.8	13.4 - 42.2	30.4	28 - 32.7
Tasmania	4	19.3	-0.7 - 39.3	37.6	32.6 - 42.5
Northern Territory	1	65.3	-62.7 - 193.4	30.9	23.5 - 38.4
ACT	0	0	0	25.6	20.5 - 30.6
Total	178	33.2	27.5 - 38.9	27.9	27.2 - 28.6

Source: HealthWIZ National Social Health Database

Suicide rates for New South Wales male farmers/managers in the age group 15-64 were significantly higher than the national male population of working age.

The Health Reference group of Farmsafe Australia has been examining the issue of Mental Health and Suicide in the farming population. An issues paper prepared for the Reference Group has examined mental health and suicide in the social and economic contexts within which agricultural production and farm life occurs[22].

That paper has reported preliminary data relating to occupation and method specific to the farming population. obtained from the Victorian State Coroner for the period January 1994 – July 1997. Table 4.17 indicates the occupation of the person who died of suicide, and the method used in Victoria from 1994 to mid 1997. Gunshot was the method of suicide for 15 of the 31 suicides recorded for the period 1994-1997.

Table 4.17: Suicides on Victorian farms by occupation and method, Jan 1994-Jul 1997

Occupation	Method	1994	1995	1996	1997
Farmer	Gunshot	2	5	6	2
	Hanging	1	1	1	
	CO poisoning		1		
	Asphyxiation			1	1
	Unknown		1		1
Farm hand/labourer	Gunshot	1		1	
	Hanging	1			
Farm resident*	Gunshot	1	1		
	Hanging	1		1	
	Fire		1		
Total		**7**	**10**	**10**	**4**

(Source: Victorian State Coroner)

*Those who temporally reside or live on a farm, but do not work as a farmer or farm hand. Some case have been excluded, due to insufficient information on the cause of death.

Further research into the major problem of farm suicide is being undertaken in association with the Health Reference Group and a Working Group of specialists in the field.

In summary:

Suicide deaths are a major problem for the farming population of Australia. Further examination of the available information about the circumstances of suicide death and the identification of preventable factors is a priority activity.

4.2 Workers compensation and farm injury

Workers compensation information is valuable in describing outcomes in terms of work days lost and compensation costs associated with work-related injury and illness occurring in specified industries. In addition to demographic information about the injured person, some information is also reported relating to the agent of injury.

However, for agricultural industries in Australia, where most farms are family enterprises and farmers are not within the state workers' compensation schemes. Between 15 and 19 percent of farm injuries that require medical attention or result in at least one working day lost are the subject of a workers compensation claim[23,24]. Extrapolation of such data to estimate risk and cost for the whole agricultural workforce should take into account the inherent biases in the source of agricultural industries workers compensation data.

The National Occupational Health and Safety Commission has published workers compensation statistics for all industries for the year 1996-97[25].

In the year 1996-97, fatalities in Agriculture, Forestry and Fishing made up 9.7 percent of all compensated fatalities in the workers' compensation system.

For the same year there were 4,977 new workers' compensation cases for Agriculture, Forestry and Fishing for Australia, excluding Victoria and the Australian Capital Territory. Workers' compensation claims cover period of working days lost of more than five days, except in Victoria, where claims are made for more than ten working days lost.

Table 4.18 indicates the incidence rate of new cases in Agriculture, Forestry and Fishing compared to other industries.

Table 4.19 indicates the incidence of new injury/poisoning cases reported of eleven or more days duration of work days lost for Agriculture, Forestry and Fishing by state.

The age/sex profile of reported new workers compensation cases in Agriculture, Forestry and Fishing is indicated in Figure 4.4.

Table 4.18: Incidence rates of new cases per 1,000 wage and salary earners by industry 1996-97 (Excluding Victoria and the ACT)

Industry	Incidence rate per 1,000 wage and salary earners
Agriculture, Forestry and Fishing	37.25
Mining	42.66
Manufacturing	39.81
Electricity, gas and water supply	25.92
Construction	37.42
Wholesale trade	18.40
Retail trade	14.18
Accommodation, cafes and restaurants	20.48
Transport and storage	37.58
Communication services	22.45
Finance and insurance	4.38
Property and business services	12.86
Government administration and Defence	23.18
Education	8.69
Health and community services	22.09
Cultural and recreational services	18.75
Personal and other services	23.61
Total	**22.86**

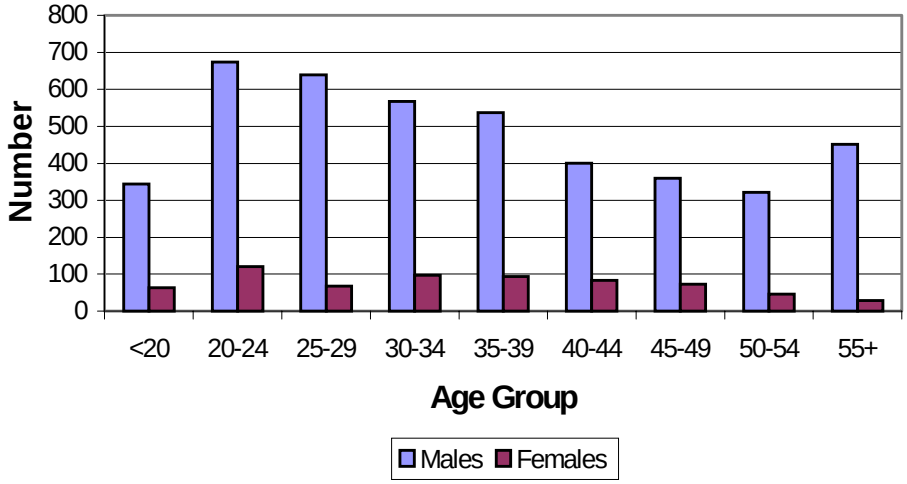
Source: National Occupational Health and Safety Commission 1998. Compendium of workers' compensation statistics, Australia 1996-97

Table 4.19: Incidence of new injury/poisoning cases reported of 11 or more days duration of work days lost for Agriculture, Forestry and Fishing by state (per 1,000 salary and wage earners)

State	Incidence rate per 1,000 salary and wage earners
Queensland	14.86
New South Wales	35.16
Victoria	14.41
Tasmania	17.39
South Australia	18.51
Western Australia	20.59
Northern Territory	45.24

Source: National Occupational Health and Safety Commission 1998. Compendium of workers' compensation statistics, Australia 1996-97

Figure 4.4: Age/sex profile of reported new workers compensation cases in Agriculture, Forestry and Fishing 1996-97 (Excluding Vic and ACT)

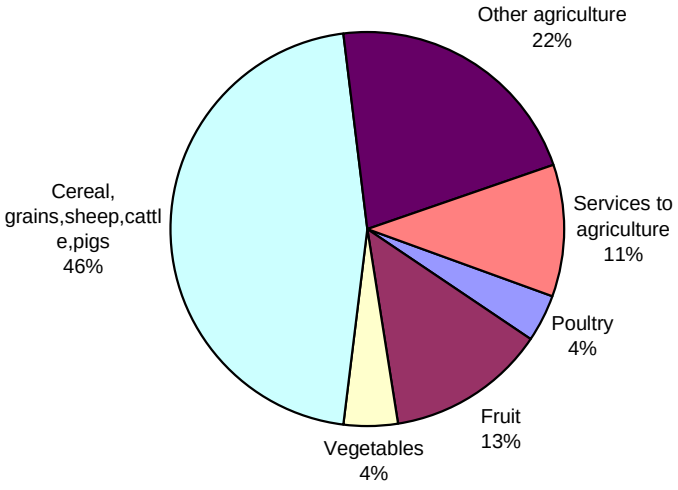


Source: National Occupational Health and Safety Commission 1998. Compendium of workers' compensation statistics, Australia 1996-97

In 1995 the National Occupational Health and Safety Commission published Australia-wide workers compensation data specifically relating to Agriculture and Services to Agriculture industries for the year 1992-93[26]. There were 5,885 compensated injury/disease occurrences reported for 1992-1993. This represented 1 in every 20 salary and wage earners in the industry for that year.

Figure 4.5 indicates the proportion of injury/disease occurrences by broad industry group. *Other agriculture* includes sugar cane, cotton, and nurseries.

Figure 4.5: Proportion of injury/disease occurrences by industry group 1992-1993



Source: Cole and Foley, 1995

Figure 4.6 shows the incidence rates for selected occupations for Agriculture and Services to Agriculture. Sheep shearing had a very high rate of workers compensation claims.

Figure 4.6: Injury/disease incidence rates for selected occupations per 1,000 wage and salary earners 1992-1993

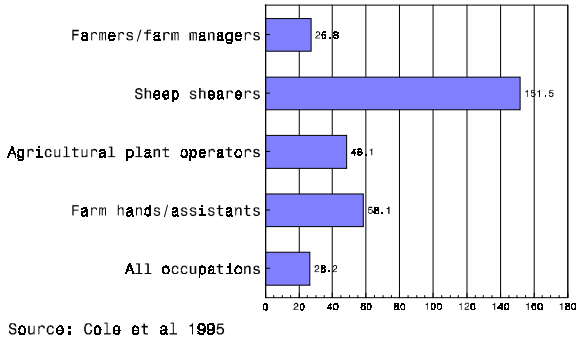
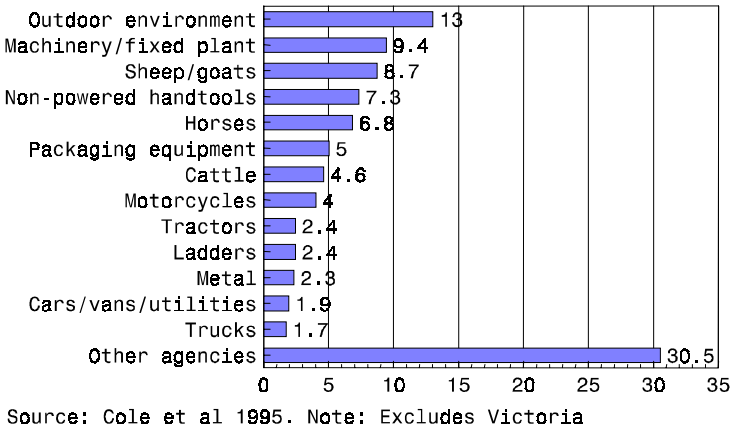


Figure 4.7 shows the agency of injury resulting in workers' compensation claims in Agriculture and Services to Agriculture for 1992-93.

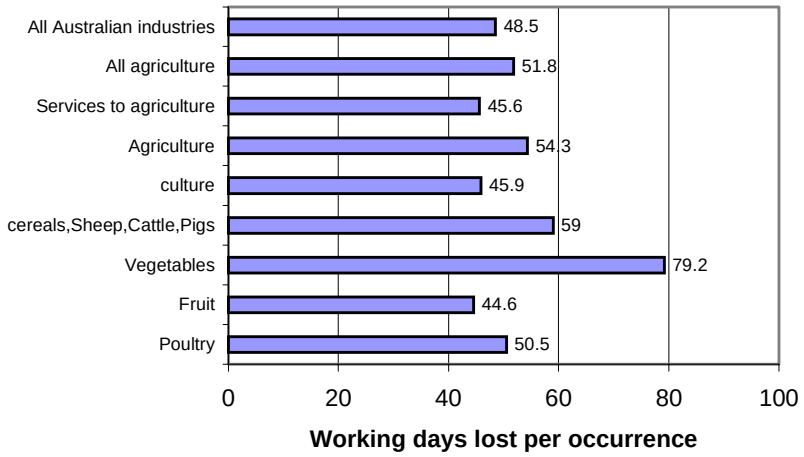
Figure 4.7: Agency of injury, Agriculture and Services to Agriculture: 1992-1993



Back injuries made up 17.8 percent of Agriculture and Services to Agriculture injuries, hand and fingers 17.5 percent and lower limb 17.1 percent.

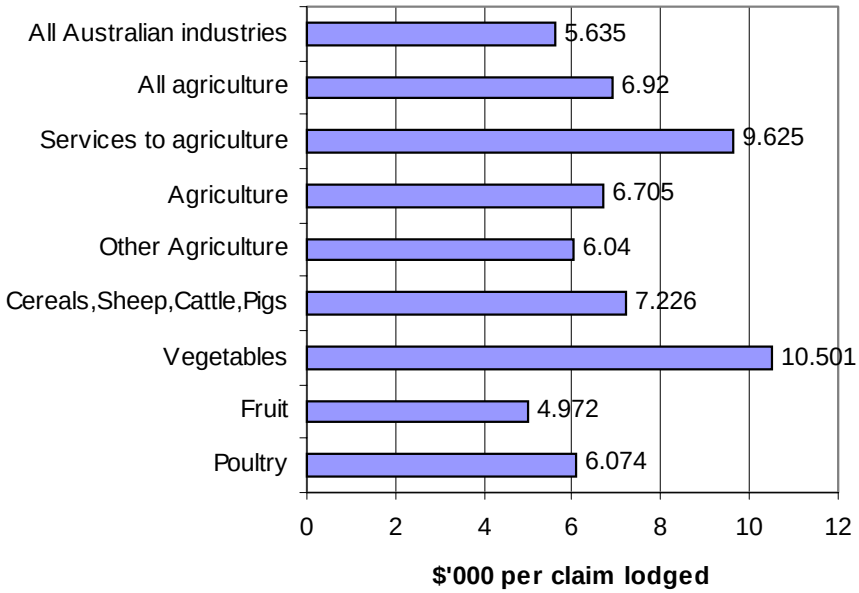
The average duration of absence from work for Agriculture and Services to Agriculture for 1992-93 is displayed in Figure 4.8 and the average cost per occurrence in Figure 4.9. In total approximately 308,000 working days were lost in the agriculture sector during that year as recorded in the workers' compensation claims.

Figure 4.8: Average working days lost per occurrence, Agriculture and Services to Agriculture, 1992-93



Source: Cole and Foley, 1995

Figure 4.9: Average cost per occurrence, Agriculture and services to Agriculture 1992-93.



Source: Cole and Foley, 1995

The average cost per claim for the Agriculture sector ($6,920) was 23 percent higher than the All Industries average cost per claim ($5,635).

In summary:

There are close to 6,000 workers compensation claims each year for on-farm injury/illness. Claims rates for Agriculture and Services to Agriculture are amongst the highest of any industry. The sheep shearing industries are associated with very high rates of claims and costs.

4.3 Injuries on farms resulting in hospital admission

Serious acute injury generally results in admission to hospital, and thus hospital statistics are a potentially important source of information to define the nature and scale of the injury problem for Australian agriculture.

However, there are major limitations in the use of hospital admissions and separations data that relate to:

1. The purpose for generating data about persons admitted to hospital has primarily been for the purposes of recording details of care provided outcome of treatments and the cost of that care.
2. While there is a separate coding framework established for describing injury - called the E-Code, the coding framework is limited in its capacity to identify and describe injury occurring on farms, from a prevention perspective. eg the coding system does not discriminate between animal injury causes by sheep and cattle.
3. There have been identified significant coding irregularities relating to interpretation by coding staff of the E-Code eg road traffic injury has been frequently incorrectly coded as vehicle injury occurring on farms.

These issues are subjects of a current study[27].

Hospital data describing on-farm injury admissions and separations has been examined in three states. Tables 4.20 to 4.22 display the number of people leaving ('separating' from) hospitals with a diagnosis of injury sustained on farms in New South Wales, Victoria and South Australia.

It should be noted that the tables display a *selection* of on-farm injury. A number of other injuries, including *falls*, are not included in light of identified coding irregularities.

Table 4.20: New South Wales Hospitals – hospital separations, selected on-farm injury – all ages

E-Code	Description	NSW Separations all ages						
		89/90	90/91	91/92	92/93	93/94	94/95	95/96
E820-E829	Motor vehicle non traffic accidents & Other road vehicle accidents							
	Motor cycle	205	206	236	266	236	254	270
	Other vehicle	100	115	122	116	94	144	111
	Animal ridden	224	249	277	269	240	231	196
E862	Poisoning by petroleum products	*	*	5	*		*	*
E863	Poisoning by agricultural chemicals	13	10	17	18	22	20	11
E864	Poisoning by corrosives & caustics	*		*	*	*		
E866	Poisoning by gases and vapours		*	*	*	*	5	*
E890-899	Fire and flames	19	26	29	22	18	21	15
E905	Venomous animals and plants	17	32	75	43	41	46	50
E906.0	Dog bite	*	5	10	7	6	*	*
E906.8	Injury by other animal	147	130	150	140	137	133	122
E919.0	Agricultural machinery	123	120	121	114	129	96	134
E919.1-9	Other machinery	58	27	43	48	25	43	32
E920	Cutting and piercing	104	96	144	119	102	88	106
E922	Firearms	10	13	18	18	15	11	10
	TOTAL SUBSET	**1025**	**1030**	**1251**	**1186**	**1069**	**1096**	**1062**

Source: HOIST dataset. NSW Health. * Small number

Figure 4.10: NSW hospital separations, selected on-farm injury – all ages

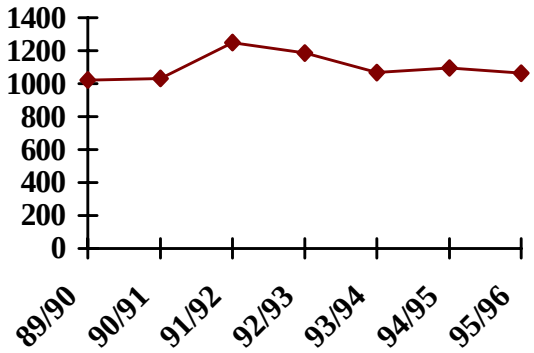


Table 4.21: Victoria hospital separations, selected on-farm injury – all ages

E-code	Description	Separations – all ages				
		93/94	94/95	95/96	96/97	97/98
E820-E829	Motor vehicle non traffic accidents & Other road vehicle accidents					
	Motor cycle	84	79	76	65	81
	Other vehicle	79	64	59	62	59
	Animal ridden	47	40	20	18	14
E862	Poisoning by petroleum products	0	0	0	0	0
E863	Poisoning by agricultural chemicals	5	2	5	5	3
E864	Poisoning by corrosives & caustics	*	*	*	0	0
E866	Poisoning by gases and vapours	0	0	0	0	*
E890-899	Fire and flames	12	3	3	3	9
E905	Venomous animals and plants	14	10	16	9	16
E906.0	Dog bite	3	*	*	*	3
E906.8	Injury by other animal	73	48	39	53	51
E919.0	Agricultural machinery	62	60	50	47	53
E919.1-9	Other machinery	10	6	12	7	11
E920	Cutting and piercing	45	32	44	28	29
E922	Firearms	5	3	*	*	*
	TOTAL SUBSET	**440**	**351**	**328**	**301**	**332**

Source: VIMD – Victorian Injury Surveillance System

Figure 4.11: Annual separations Victoria hospitals, selected on-farm injury

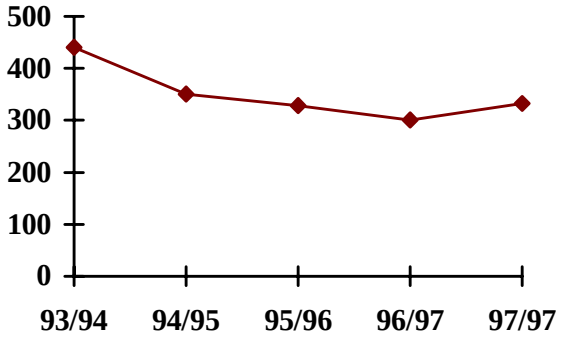


Table 4.22: South Australia hospital on-farm injury separations 1996 – all ages

E-code	Description	Separations – all ages		
		Male	Female	Total
E820-E829	Motor vehicle non traffic accidents & Other road vehicle accidents			
	Motor cycle	53	3	56
	Other vehicle	45	8	53
	Animal ridden	16	15	31
E862	Poisoning by petroleum products	4	2	6
E863	Poisoning by agricultural chemicals	7	2	9
E864	Poisoning by corrosives & caustics	3	*	4
E866	Poisoning by gases and vapours	*	*	4
E890-899	Fire and flames	*	*	3
E905	Venomous animals and plants	31	10	41
E906.0	Dog bite	9	4	13
E906.8	Injury by other animal	28	17	45
E919.0	Agricultural machinery	45	*	46
E919.1-9	Other machinery	15	4	19
E920	Cutting and piercing	90	25	115
E922	Firearms	*	0	*
	TOTAL SUBSET	**352**	**95**	**447**

Source: SA Health Commission

Similar hospitals-based data is being collated for Queensland and Western Australia.

Hospital admissions/separations due to falls injury on farms

Irregularities with coding on-farm injuries by health services has led the National Farm Injury Data Centre to use the above selection of injuries for monitoring on-farm injury admissions to hospitals. The one other large number of injury separations reported as occurring on farms is *falls.* In 1991/92 there were 448 on-farm falls separations reported in NSW. In 1996/97 there were 77 falls admissions reported for people aged less than 80 years.

Further examination of falls admissions is required.

General

One early study has reported more detail derived from retrospective analysis of information held within hospital records of on-farm injury, and a summary of results are displayed in Figure 4.12[28].

This information is presented to display the further detail that is included within medical records of farm injury, that could be available for future study.

Figure 4.12: Causes of farm injury admission to three hospitals in North West NSW 1981-1985

Cause of injury	Number	Percent
Tractors	22	5.4
Headers	6	1.5
Augers	3	0.7
Cotton machinery	8	2.0
Other machinery	21	5.1
Truck, other vehicles	19	4.6
Chainsaws	15	3.7
Welding	7	1.7
Fencing	8	2.0
Animal shooting	17	4.2
Horse related	193	47.1
Other animals	21	5.1
Venomous bites	35	8.5
Agricultural chemicals	16	3.9
Explosions	1	0.2
Trench accidents	6	1.5
Falling object	2	0.5
Falls from structures	8	2.0
Tree falling	2	0.5
Total	**410**	**100**

Source: Australian Agricultural Health Unit

In summary:

Examination of hospitals data indicates the importance of motorcycle, other vehicles, horses, farm machinery and animals as agents of farm injury.

Hospitals data has been used to profile specific farm injury problems – causes of child farm injury admissions to hospitals, age/sex characteristics of persons admitted with farm injury associated with specific agents of injury – farm machinery, “animals ridden” (horses), motorcycles.

4.4 Farm injury reported by other sources

Since 1988 there has been an increasing attention by individual researchers and government and academic agencies to define the nature and scale of farm injuries. In addition to providing useful information at a local or state level, these studies are providing a valuable contribution to the production of Australia-wide and specific industry-wide profiles of farm injury. Those more recent studies that have adopted the definitions and criteria laid down in the National Farm Injury Optimal Dataset[29] are increasingly valuable for the specific industry profiles.

4.4.1 Emergency Department based data

Many people with acute injury present initially to the Emergency Department (ED) of the local hospital. Some of these will be admitted, and details of their injury will be recorded and coded as part of the hospitals inpatient databases. Hospital ED records should thus 'capture' a higher proportion of farm injury cases than other databases, and thence provide information about the frequency, or risk, of farm injury in relation to severity of injury and outcome.

However, hospitals across Australia do not routinely collect detailed information about the causes of injury from patients who present at their ED's. Moves are being made to establish uniform injury data collection systems in hospital ED records, and good progress has been made in the state of Victoria.

ED records can also be used to obtain more detailed information about the context, circumstances and mechanisms of injury associated with specified 'flagged' cases. Such a process would be useful for, for example, farm motorcycles and horse related injury, and is being planned.

In 1990-1992, six hospitals in north west NSW, and three in the mid north coast of NSW undertook a 2-year survey of injury administering the injury reporting system established by the National Injury Surveillance Unit for all persons who presented with injury to the ED's for that period. Results were reported by Wolfenden[30] and Clarke and Payne[31].

Results from the study showed an overall rate of more than 70 injury presentations at ED's per 100 farms in the catchment area of the participating hospitals. Higher rates were observed for the coastal areas – beef and dairy production, and the grain and cotton areas, compared with lower rates (30 and 40 per 100 farms) in areas of sheep and grain production only.

A number of differences between coastal (beef, dairy) and inland (grain, cotton, sheep and beef cattle) farm injury profiles were defined by that study – in relation to agents of injury, farm activity and context of injury, and a number of preliminary profiles of injury for specified agricultural industries were able to be produced, using this data.

A study at the Tamworth Base Hospital found that during a 14 month study period there were 422 people who sustained an injury on farms, three quarters were males and 2/5 were aged 24 years or less[32]. The majority were Australian (97.4%) who lived in the study area (94.3%). Of people who were admitted to the emergency department, only 28.5% were then admitted to hospital the majority were discharged (68.9%). Just over half (55.1%) of the people were working for an income at the time of the fatality. The most common agents were horses and

motorcycles. Recommendations from the study were that additional work needs to be conducted to examine injuries with horses, motorcycles and children and appropriate material provided to farmers to reduce their risk of injury.

4.4.2 Rural doctor surgery based data

Patients with injury and illness relating to farm exposure to risk may also present to their general practitioner either for initial care for an acute or more chronic injury/illness, or for continuing care of an injury previously treated at a hospital.

A combination of farm injury data from the local hospital ED and from all general practitioners in an area should provide the most complete 'capture' of relevant cases to define farm related injury and illness. Unfortunately, such data is not available except by special arrangements and at some cost.

Two significant studies that include both hospital and general practice injury data collection have been reported:

A study in the Latrobe Valley in Victoria found that of the injuries occurring on farms, three-quarters (77%) were males and there was a rate of 339 injuries per 1000 farms[33]. Over a third (38%) of the farm injuries were work related. Animals contributed significantly to all farm injuries (horses, cattle and sheep), as were motorcycles (13%). Recommendations were made that:
"…The farmhouse and garden should be fenced, thus separating children from hazards such as irrigation ditches, dams, farm machinery and farm animals. Animal handling, equipment design and protective clothing would seem to be worthwhile areas on which to focus other preventative efforts…" p4.

A study in central Queensland found that farm injuries contributed the most severe injuries and comprised 9% of all injuries[34]. Of these 30% were animal related (57% horse and 20% cattle) and 18% were transport related. Machinery was involved in 7% of injuries, where 48% were to eye. Fifty eight percent were work related and 31% occurred in the home. Recommendations were to "…increase awareness of horse habits and riding skills, and that programs aimed at decreasing the number of metal fragments in the eye are required…" p3

A number of other studies of farm injury presentations to rural doctors surgeries have been undertaken by general practitioners and Divisions of General Practice.

In the Eyre Peninsula of South Australia, for farm injuries reported to the Eyre Peninsula Division of general practice, the majority (95.9%) were males, 65.5% were farmers and the owner was often (58.6%) involved in the injury[35]. The most common location for farm injuries was in a paddock (31%) and occurred all year round with a decline in September. The majority (90.3%) of farmers, worked more than 40 hours per week, some (4%) working more than 100 hours.

A major combined General Practice and associated hospital study in Central Queensland has been reported by the National Farm Injury Data Centre[36].

Of people who received an injury on a farm, only 49 (9.6%) claimed workers compensation for their injuries. Of those people working on farms who were *permanent employee's* 43.4% (85) claimed workers compensation, yet only 21.4% (14) of *casual employees* and 19.4% (36) of *contractors* claimed workers compensation for their injuries. The group of people who made the least number of workers compensation claims was the *owner / family member* group 1.3% (2).

4.4.3 Farm survey based data

Well designed farm enterprise based surveys are useful for:

1. Defining the level of injury risk, risk factors and outcomes at the enterprise level, and
2. Undertaking more detailed investigation of specific injury/illness problems - eg farm motorcycle injury

Such studies are costly but valuable if their objectives and methods are clearly and carefully defined and definitions are consistent with the Farm Injury Optimal Dataset.

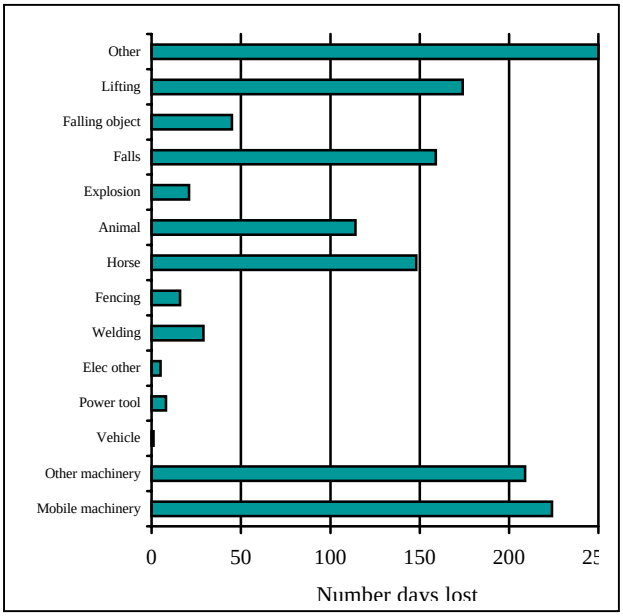
In 1988 the then Australian Agricultural Health Unit undertook a recall survey of farmer members of the Moree branch of the NSW Farmers Association[37].

There were 70 respondents to the survey, representing about 35% of branch members.

The 70 farmers could recall 13 on-farm injuries that required admission to hospital during the previous five years - seven to the farmer, four to other family members, and two to employees. There were a total of 98 injuries where there was at least one work day lost due to the injury in the five years.

Figure 4.11 indicates the total number of work days lost for 5 years by 70 farms due to farm injury.

Figure 4.11: Working days lost due to farm injury, by cause of injury 70 farms, Moree, NSW 1988.



During 1991-1993, Griffith and Low of the NSW Department of Agriculture, undertook a survey of farms[38]. The study collected 18 months of injury data from a proportionate stratified random sample of farms in three shires in NSW. The study was a combined six month recall survey followed by a twelve months prospective survey of injury on the 919 participating farms.

One in five properties in the study reported at least one injury every year. The purpose of the study was to determine the costs of farm injury, and further information from the study is reported in Chapter 12.

Two separate mail-out surveys of farms in Queensland have been reported in major farm health and safety studies by Keith Ferguson, and a third is to be reported. The 1996 survey[39] was collected by a mail-out questionnaire for the twelve months, from February 1994 to January 1995. A total of 302 injuries/illnesses were reported from 204 properties. Illnesses that were included were hearing impairment, chronic back pain, allergic or adverse reactions to agricultural produce, by-products of chemicals.

The average annual injury/illness rate was 20.2 per 100 farms and 2.99 per 100,000 worked hours, with significant variation between agricultural production type in which the injured person was working at time of injury.

Detailed analyses of the agent of injury, agricultural activity, and costs of injury are included in the report. Some further cost information is reported in Chapter 12.

5. Child injury on farms

It is well established that agriculture is amongst the highest risk industries for work-related injury. The family business base of the majority of Australian farms places children in close proximity to the agricultural workplace. Chapter 2 indicates that there are around 20,000 children aged less than 5 years and around 25,000 children aged 5-14 years resident on farms across Australia. These and child visitors to farms are at particular risk as the boundary between the farm household and the farm workplace is often blurred, as is farm work and farm family life.

It is not surprising, then, that injury and traumatic deaths of children on Australian farms are a key problem. The problem of injuries to children on farms is also the subject of attention in other countries[4041].

Child deaths on farms

The most comprehensive study of on-farm traumatic fatalities of children is that of Franklin et al, for the period 1989-1992[42]. This study reported 117 deaths of children aged less than 15 years of age on Australian farms during the 4 study years.

Of the children who died, 75% were male, 25% were female. Seventy seven percent were 'bystanders' to work (ie they were in the immediate vicinity of work being undertaken), eight percent died while working, and the other 15% died in other circumstances.

Table 5.1 indicates the agent of injury associated with the injury. Drowning in farm dams is by far the most common cause of deaths of children aged 0-4 years, while deaths from vehicles and tractors (mostly run-over) are important across all age groups.

Table 5.1: Child deaths on farms 1989-1992

Broad Agent of Injury Death	**Age Group**			
	0-4 years	**5-9 years**	**10-14 years**	**Total**
Vehicle	12	7	12	31
Tractor	7	2	2	11
Other machinery	4	1	1	6
Body of water	43	5	1	49
Horse	1	3	1	5
Other animal	1	0	0	1
Other	6	7	1	14
Total	**74**	**25**	**18**	**117**

Source: Franklin et al, 2000

Table 5.2 indicates numbers of child deaths on farms by state reported in the same study. Differences in rates between states are probably not significant.

Table 5.2: Number of child fatalities on farms by state. 1989-1992.

State	Number child deaths	Child deaths per 10000 farms per annum	95% Confidence Interval
Queensland	29	2.1	0.58-3.66
New South Wales	32	1.9	0.57-3.16
Victoria	34	2.3	0.75-3.81
Tasmania	3	1.6	-2.03-5.25
South Australia	5	0.8	-0.58-2.11
Western Australia	16	2.2	-.019-4.66
Northern Territory	1	7.9	-23.09-38.91
Australia	117	1.9	1.24-2.65

Source: Franklin et al, 2000

Injury to children on farms

Children admitted to hospital with on-farm injury

Children represent a significant proportion of persons admitted to hospitals as a result of on-farm injury. In 1995/96 children represented 18 percent of NSW, 22 percent of Victorian and 26 percent of South Australian hospital separations for selected on-farm injuries.

Details of these are presented in Tables 5.3-5.5.

Table 5.3: NSW – hospital separations, selected on-farm injury, children aged 0-14 yrs

E-Code	Description	NSW separations 0-14 yrs		
		93/94	94/95	95/96
E820-E829	Motor vehicle non traffic accidents & Other road vehicle accidents			
	Motor cycle	61	62	68
	Other vehicle	33	36	28
	Animal ridden	60	67	56
E862	Poisoning by petroleum products		*	*
E863	Poisoning by agricultural chemicals	7		*
E864	Poisoning by corrosives & caustics	*		
E866	Poisoning by gases and vapours	*		
E890-899	Fire and flames	8	*	*
E905	Venomous animals and plants	6	12	*
E906.0	Dog bite	*		*
E906.8	Injury by other animal	12	17	8
E919.0	Agricultural machinery	12	11	10
E919.1-9	Other machinery	*	5	*
E920	Cutting and piercing	5	11	9
E922	Firearms	*		*

TOTAL SUBSET	**216**	**224**	**193**

Source: HOIST dataset. NSW Health * Small number

Table 5.4: Victoria – hospital separations, selected on-farm injury children aged 0-14 yrs

E-code	Description	Separations – 0-14 years				
		93/94	94/95	95/96	96/97	97/98
E820-E829	Motor vehicle non traffic accidents & Other road vehicle accidents					
	Motor cycle	30	24	22	18	29
	Other vehicle	25	19	22	18	13
	Animal ridden	7	6	8	3	7
E862	Poisoning by petroleum products	0	0	0	0	0
E863	Poisoning by agricultural chemicals	0	0	0	0	*
E864	Poisoning by corrosives & caustics	*	0	*	0	0
E866	Poisoning by gases and vapours	0	0	0	0	*
E890-899	Fire and flames	3	*	*	*	4
E905	Venomous animals and plants	*	*	*	3	*
E906.0	Dog bite	*	*	*	*	*
E906.8	Injury by other animal	7	6	4	3	7
E919.0	Agricultural machinery	9	8	12	7	5
E919.1-9	Other machinery	0	0	0	*	*
E920	Cutting and piercing	4	*	4	3	5
E922	Firearms	*	0	0	0	*
	TOTAL SUBSET	**91**	**69**	**78**	**58**	**71**

Source: VIMD, Victorian Injury Surveillance System * Small number

Table 5.5: South Australia hospital on-farm injury separations 1996 – ages 0-14 yrs

E-code	Description	Separations – all ages		
		Male	Female	Total
E820-E829	Motor vehicle non traffic accidents & Other road vehicle accidents			
	Motor cycle	22	*	24
	Other vehicle	14	4	18
	Animal ridden	*	4	6
E862	Poisoning by petroleum products	3	*	5
E863	Poisoning by agricultural chemicals	*	*	4
E864	Poisoning by corrosives & caustics	*	*	3
E866	Poisoning by gases and vapours	*	*	3
E890-899	Fire and flames	0	0	0
E905	Venomous animals and plants	6	4	10
E906.0	Dog bite	7	3	10
E906.8	Injury by other animal	4	3	7
E919.0	Agricultural machinery	*	0	*
E919.1-9	Other machinery	*	0	*
E920	Cutting and piercing	16	9	25
E922	Firearms	0	0	0
	TOTAL SUBSET	**82**	**36**	**118**

Source: SA Health Commission

Child presentations to hospital Emergency Departments for on-farm injury

In 1990-1992 six hospitals in north west NSW, and three in the mid north coast of NSW undertook a 2-year survey of injury administering the injury reporting system established by the National Injury Surveillance Unit for all persons who presented with injury to the Emergency Departments (ED's) for that period. Results were reported by Wolfenden[43] and Clarke and Payne[44].

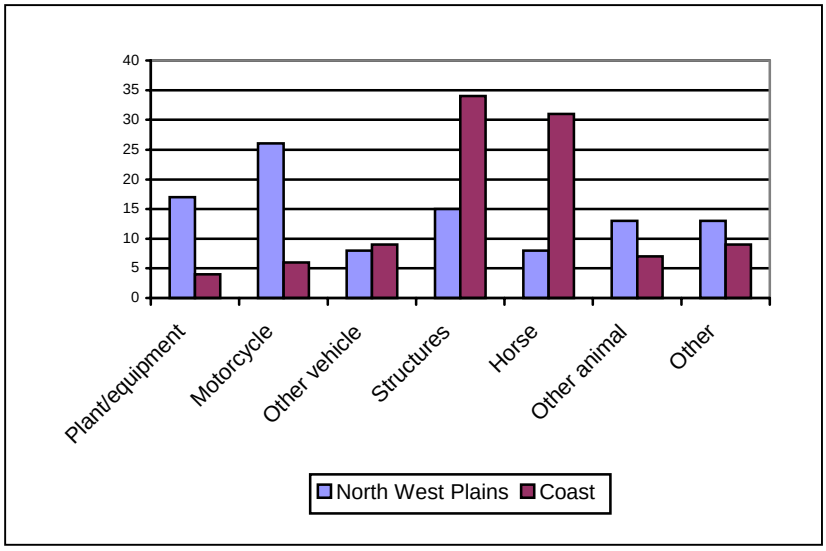
Results from the study provided information about 180 presentations of children to ED's. Table 5.6 indicates the common agents of on-farm child injury. However, Figure 5.1 indicates the differences in the proportion of agents of child injury for each of the two zones – the north-west plains and the coastal zones.

Table 5.6:Number of injuries per age group by agent, 1990-1992 (N=180).

Agent of Farm Injury	Less than 1 year	1-4 years	5-9 years	10-14 years	Total
Farm Vehicle	1		6	13	**20**
Farm Machinery		1		3	**4**
Plant / Equipment		1		1	**2**
Workshop Equipment		1			**1**
Farm Structure	1	5	5	4	**15**
Animal	1	5	16	12	**34**
Farm Chemical		3	2	1	**6**
Working Environment	3	10	19	48	**80**
Person		1		1	**2**
Other / Unknown			6	10	**16**
Total	**6**	**27**	**54**	**93**	**180**

Source: RIPP. 1990-1992

Figure 5.1 Agent of child on-farm injury presenting to ED's in two zones of NSW 1990-1992



Source: RIPP. 1990-1992

Differences can be explained in terms of the differing production systems in operation in the two zones, and thence the differing exposure to risk of children on farms in the two zones.

Such differences are important in planning prevention programs relevant to the needs in any one area, or farm enterprise type.

Table 5.7 presents data from the same study and demonstrates the location on the farm where children were injured according to the general activity being undertaken by the injured child.

Table 5.7: Activity involved in accident by location, two agricultural zones, NSW, 1990-1992

	Activity			
Location	**Work**	**Transport**	**Leisure**	**Total**
Farm	10	15	34	**59**
Paddock	16	19	28	**63**
Grain / Wheat Paddock	1	2		**3**
Shed	3		7	**10**
Yards	2		3	**5**
Dairy	1		2	**3**
House			6	**6**
Garden / House Yard	1	1	7	**9**
River / Creek / Dam			3	**3**
Other *	3	1	5	**9**
Not Specified	1	4	5	**10**
Total	**38**	**42**	**100**	**180**

*Other includes *stock route*, *cotton field, bush / forest*, *woolshed*, *horse paddock* and *other*.

In summary

Child deaths and injury is an important health and safety problem to be addressed on Australian farms.

Drowning in farm dams and bodies of water is the most common cause of death of toddlers on farms, and farm vehicles, motorcycles, horses and other animals are important agents of injury for older children.

While the issue of at what age children are safe to undertake farm tasks is receiving significant attention in North America, only eight percent of children who died on Australian farms in 1989-1992 were engaged in farm work activity, and for ED presentations for child injury on farms in two zones in NSW, 21 percent were related to farm work.

References Chapter 5

6. Tractor and farm machinery injury

Modern agricultural production is associated with a high degree of mechanisation, with a number of special characteristics from an occupational health and safety perspective.

There is a high reliance on mobile machines that move over the land. These include tractors that provide pull and power for trailed agricultural implements and agricultural machines that are designed to undertake specialised agricultural functions such as harvesting and spraying. Such machines are designed to push, pull, lift, grab, cut, thresh, crush, grind and/or blast, using mechanical, hydraulic and air power.

The type of farm enterprise will influence the machinery-related hazards found on farms and exposure to risk. However, they have some common features. They may be grouped as hazards arising from:

1. Mechanical energy
2. Noise
3. Electrical energy
4. Heat hazards
5. Vibration
6. Chemical exposure – fumes and fuels
7. Ergonomic problems

The most acute and serious injuries and deaths occur from the mechanical and electrical hazards. Chemical hazards may result in death or chronic illness. Noise, heat, vibration and ergonomic hazards can result in less severe injury but such injury may be permanently disabling.

The hazard of ***mechanical energy*** gives rise to the most acute and serious injury. Entanglement in exposed, moving machinery parts is the risk related to mechanical energy. Another frequently encountered mechanical hazard is that of hydraulic pressure or stored energy. Crushing injury or death can result from release of hydraulic energy when used as a means of jacking up a machine or powering attachments. Failure of hydraulic energy used to elevate machinery attachments can also result in crushing injuries that usually lead to death. Fluid or air that escapes under pressure from hydraulic hoses may also result in the air or water being injected under the skin or deeper into the body.

Farmsafe Australia has established a Farm Machinery Safety Reference Group that has examined available data defining the nature and scale of the farm machinery injury problem for the industry[45]. That analysis estimated that approximately 36 deaths occur each year in Australia due to farm machinery injury – this includes deaths attributable to tractors, attachments, mobile farm machinery and other machinery. It was estimated that there would be approximately 500 hospital admissions, and 6,700 presentations to hospital emergency departments each year due to farm machinery injury.

The *Farm related fatalities 1989-1992* report indicates that 22.3 percent of traumatic deaths on farms during 1989-1992 were associated with tractors and mobile plant and fixed plant.

6.1 Tractor related deaths in Australia

Deaths associated with tractor operation pose a major risk to workers in agriculture worldwide. Indeed, the report of the papers and proceedings of the Surgeon General's Conference on Agricultural Safety and Health in the United States of America in 1992, the following comment was made[46]:

" Amidst expressions of anguish and pleas for reason, there was an overwhelming interest in a particular issue, namely the need to reduce the risk of fatalities related to tractor roll-overs.

*Deaths from tractor roll-overs are the leading cause of traumatic fatalities on the farm. There is no acceptable excuse for the persistence of this problem as deaths from tractor roll-overs are fully preventable. The problem justifies the term '**occupational obscenity**'. Twenty seven speakers at the Conference addressed the problem."*

Tractor deaths remain the single most common cause of death on Australian farms. These deaths are most commonly due to tractor run-over and tractor roll-over[47].

In 1991 a national tractor safety conference was convened by the then Farmsafe network[48]. The conference recommended a national approach to reducing tractor related deaths on Australian farms. The Commonwealth Department of Primary Industry and Energy proceeded to fund a one-year National Tractor Safety Project that was the springboard for a number of programs that are addressing the problem[49].

The National Farm Injury Data Centre has established a National Tractor Deaths Register, with a view to improving information regarding each tractor-related death in Australia. This will provide the basis for ongoing monitoring of the number of tractor related deaths, as well as information for prevention.

Figure 6.1 demonstrates the trend in tractor related deaths reported by state work health authorities Australia wide.

Figure 6.1: Moving 3-year average of number of tractor deaths. All states.

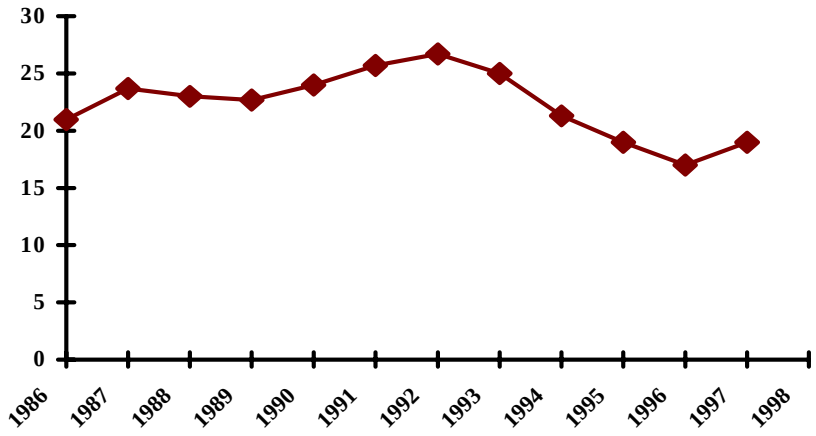


Table 6.1 indicates tractor death numbers provided by each states' work health authority.

Table 6.1: Tractor Deaths reported by states' OHS authorities

YEAR	QLD	NSW	VIC	TAS	SA	WA	NT	TOTAL
1985	11	na	3	1	na	2	na	17+
1986	9	na	12	1	na	0	na	22+
1987	10	2	7	2	na	3	na	24+
1988	3	8	9	1	3	1	-	25
1989	11	1	4	0	3	1	-	20
1990	5	4	9	2	0	3	-	23
1991	7	11	7	2	1	1	-	29
1992	8	7	6	2	1	1	-	25
1993	9	5	7	1	1	3	-	26+
1994	7	5	8	-	2*	2	-	24+
1995	4	2	8	-	-	-	-	14+
1996	9	3	5	-	2*	-	-	19+
1997	7	4	4	-	2	1	-	18+
1998	10	5	4	-	1	-	-	20+

* = incomplete data
na = not available

The *Farm related fatalities 1989-1992* report provides a more detailed analysis of tractor deaths on farms for the period 1989-1992[50]. Between 1989 and 1992 there were 87 fatal incidents on Australian farms involving tractors. Table 6.2 indicates the number of tractor deaths for the period according to work status and year.

Table 6.2: Number of fatalities per year by work status, tractors, farm-related fatalities, Australia, 1989-1992

Year	*Working*	Bystander	Total	%
1989	15	6	21	24.1
1990	17	4	21	24.1
1991	18	7	25	28.7
1992	18	2	20	23.0
Total	**68**	**19**	**87**	**100.0**

Source: Franklin et al. Farm-Related Fatalities, 1989 - 1992

Table 6.3 indicates the proportion of tractor deaths that were roll-overs and run-overs. Of the 87 tractor related deaths, 55 percent were due to tractor rollover, and 30 percent were due to tractor run-over.

Table 6.3 Broad mechanism of tractor death by work status, Australia 1989-1992.

Mechanism	Working	Bystander	Total	%
Run-over by tractor	17	9	26	29.9
Rollover of tractor	38	10	48	55.2
Other	12	-	12	13.8
Mechanism Not Known	1	-	1	1.1
Total	**68**	**19**	**87**	**100.0**

Source: Franklin et al. Farm-Related Fatalities, 1989 - 1992

Table 6.4 indicates tractor deaths in 1989-1992 by state and territory.

Table 6.4: State or Territory of incident by work status, tractors, farm-related fatalities, Australia, 1989-1992

State or Territory	Working	Bystander	Total	%
Queensland	24	6	30	34.5
New South Wales	20	5	25	28.7
Victoria	11	5	16	18.4
Tasmania	9	-	9	10.3
South Australia	1	1	2	2.3
Western Australia	3	2	5	5.7
Total	**68**	**19**	**87**	**100.0**

Source: Franklin et al. Farm-Related Fatalities, 1989 - 1992

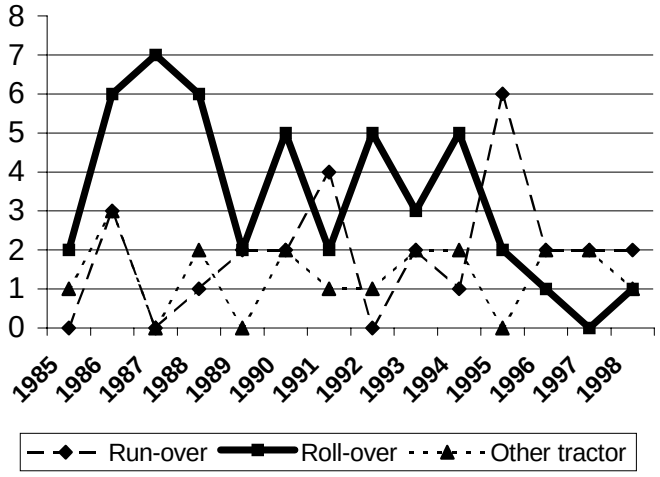
6.2 Tractor rollover deaths

The National Tractor Safety Project, in its review of deaths by tractor rollover, and of the effectiveness of roll-over protective structure (ROPS) fitment as an almost absolute protection from rollover death, made recommendations to states for a staged program of retro-fitment of ROPS to reduce roll-over death. Such an approach would include a period of promotion and education of farmers about the effectiveness of ROPS, with a clear signal that a program of enforcement of legislation requiring fitment would begin after an agreed period.

Farmsafe Victoria took up the recommendations for ROPS retro-fitment campaign, with a joint program between the Victorian Farmers Federation and Workcover Victoria of subsidisation for farmers who fitted a ROPS, followed by adoption of regulations requiring ROPS fitment to all tractors.

Figure 6.2 indicates the encouraging reduction in tractor deaths since introduction of the project in 1995.

Figure 6.2: Annual number of tractors deaths, by mechanism, Victoria.



Source: Workcover Victoria.

An evaluation of the campaign in Victoria was undertaken by the Monash University Accident Research Centre and this indicated a favourable benefit to cost ratio[51].

In 2000, the New South Wales government announced plans for a similar program in that state.

6.3 Tractor run-over and safe tractor access

The 1991 National Tractor Safety Conference had representation of key Australian and international agricultural safety engineers with experience in examination of the circumstances of deaths from tractor run-over. Figure 6.2 indicates the factors considered to be of importance for tractor run-over.

Figure 6.2: 1991 Tractor Safety Conference statement on tractor run-over deaths

Tractor run-overs and access

1. Statement of Problem:
A significant number of people are injured or killed by being driven over or crushed by a tractor while alighting, mounting or working with it (a tractor ed)

2. The problem is/has been caused by:

- Crushing when operator attaches implements
- People thrown from moving tractors
- Tractors moving when operator opens gates, etc
- People slipping as they mount or alight
- People running beside to regain control
- Standing alongside such as when jump starting
- Passengers

3. Other contributing factors are:

- Age of farmer: there is mounting evidence that older (and even experienced) farmers lose co-ordination skills with age
- Age of machines: the majority of accidents occur on older machines
- Condition of machinery: there is a direct correlation between tractors accidents and the amount of maintenance afforded the machine.

- Fatigue
- Climatic conditions

4. We recommend the following actions:

- Modification of early model machinery to current safety standards by industry manufacturers
- National support and funding be given to local Farm Safety Action Groups for safety programs to be directed to farm families

Source: Mitchell I (1991). *Proceedings of the first national conference on tractor safety held at University of New England (Orange Campus) 17-18 September 1991*. Rural Training Council of Australia, p62

The National Tractor Safety Project, in its review of deaths by tractor runover, commissioned the design of a safe tractor access platform that farmers or engineering firms could manufacture and fit to existing tractors to take the path of access to the tractor outside of the path of the rear wheel[52].

A number of other design features for tractors to reduce risk of run-over by the rear wheel have been examined. These include systems that prevent starting the tractor with the tractor in gear.

The National Farm Injury Data Centre is moving to establish the National Tractor Deaths Register in association with state work health authorities and those responsible for the investigation of tractor deaths on farms. Such a register will attempt to record as much information about the circumstances of each death as is possible, for the purpose of defining preventable factors and thence to reduce risk.

In summary

Tractor deaths due to rollover and run-over remain major causes of on-farm death in Australia. This is despite the early moves being made to define preventable factors and to move for the retro-fitment of ROPS on older tractors.

Data being collated by the National Farm Injury Data Centre, and by the newly instituted National Tractor Deaths Register will continue to provide important information to reduce risk.

6.4 Farm machinery injury

Table 6.5 lists the machinery associated with deaths reported in the *Farm-related fatalities 1989-1992* report.

Table 6.5 Plant and machinery agents of death 1989-1992, by working status.

Agent	Working	Bystander	Total	Percent of deaths
Mobile farm machinery and plant				
Tractor	68	19	87	14.8
Linkage		1	1	0.2
Tillage/seeder	2	1	3	0.5
Fertiliser spreader	2		2	0.3
Earth moving equipment	3		3	0.5
Harvesting machine	2		2	0.3
Grain auger	6		6	1.0
Slasher	2	1	3	0.5
Hay baler	1		1	0.2
Posthole digger	4		4	0.7
Other mobile farm machinery nec	8	2	8	1.4
Total mobile farm machinery and plant	**98**	**24**	**122**	**20.8**
Fixed plant and equipment				
Pump	3		3	0.5
Generator	1		1	0.2
Feed mixer	1		1	0.2
Other fixed plant equipment nec	4		4	0.7
Total fixed plant and equipment	**9**		**9**	**1.5**

Source: Franklin et al: 2000 Farm related fatalities in Australia, 1989-1992

There is a wide range of farm machines associated with deaths on farms (other than tractors) and in light of this, the Farm Machinery Safety Reference Group has agreed to pilot and institute an approach to examine machinery associated with serious injury and deaths, beginning with:

- Tractor runover
- Grain augers
- Power-take-off (PTO) guarding
- Posthole diggers.

That will involve collation of available information regarding as many cases involving the specific machinery item as are available and consideration of human factors, design factors and working environment factors contributing to the injury event. This approach is laid down in the Farmsafe Australia National Farm Machinery Strategy[53], and will result in guidelines for safe operation and recommendations for research into improved design.

In summary:

There are numerous farm machinery hazards causing injury on Australian farms. The type of agricultural enterprise and the production system will determine the exposure to different machinery risk.

The National Farm Machinery Safety Strategy of Farmsafe Australia will institute a uniform process for examination of different machinery hazards and risk factors associated with injury. The National Farm Injury Data Centre will collate information and participate in the planned Farm Machinery Safety Project to implement the Strategy.

References Chapter 6

7. Farm Motorcycle Injury

Motorcycles, both 2- and 4-wheeled are important causes of injury on Australian farms.

The National Occupational Health and Safety Commission has funded a study into the problem of farm motorcycle injury and the research report will be published later in 2000[54]. The following summary information has drawn on information gathered within that project, and from a previous report prepared by Muiswinkel[55].

In Australian agriculture, farm motorcycles are used for a variety of operations, in both light and dark conditions. Both 2-wheeled motorcycles and ATVs are commonly used in activities such as:

- personal transport around the farm
- mustering of livestock (Figure 7)
- supervision of working field crews
- inspection of crops, pastures, fences and livestock
- timber marking
- inspection of irrigation fields, pipes and channels
- recreation

ATVs, in addition, may be associated with the following activities:

- substitute for the farm utility (ute) and tractor
- towing and/or carrying of goods (Figure 5 and 8)
- spraying of crops and pastures
- seeding, fertilising and applying chemicals
- mowing grass
- small scale earthmoving
- shifting irrigation pipes
- markers for aerial operators
- recreation

The majority of Australian farms have at least one farm motorcycle in operation. Table 7.1 demonstrates that 2-wheeled farm motorcycles were the most popular irrespective of farm size in NSW in 1994. A trend appears showing that, in general, the larger farms have a greater proportion of 4-wheeled motorcycles (ATVs).

Table 7.1: Number of Farm Motorcycles Used on Farms by Farm Size NSW, 1994 and Field Day Attenders at Major Field Days in New South Wales, 1994

Farm Size (ha)	Number of Respondents	Average No. of Farm Motorcycles on Farm			
		2 Wheeled	3 Wheeled	4 Wheeled	Total
0 - 99	155	0.49	0.03	0.10	0.62
100 - 499	143	1.20	0.07	0.43	1.70
500 - 999	97	1.38	0.03	0.57	1.98
1 000 - 1 999	102	1.36	0.05	0.55	1.96
2 000 - 2 999	38	1.87	0.11	0.53	2.51
3 000 - 3 999	12	2.25	0	1.25	3.50
4 000 - 4 999	12	1.83	0.08	1.33	3.24
5 000 - 9 999	18	2.17	0	0.94	3.11
10 000 - 25 000	7	2.43	0	1.14	3.57
Total	**584**	**14.98**	**0.37**	**6.84**	**22.19**

Source: NSW Farm Safety Project 1994.

The National Sales Figures from Honda, Yamaha, Kawasaki and Suzuki (Table 7.2) suggest an increase in the sales of both 2-wheeled motorcycles and ATVs. It is difficult to estimate the number of motorcycles that are used on Australian Farms as there is no registration or licensing system which enables an accurate record to be kept. National sales figures give an approximate count of the new 2-wheeled 'agbikes' and ATVs entering agriculture, but do not give any indication of the number of trail bikes that are sold into agricultural establishments or the number of older motorcycles that are still in use.

Table 7.2: Number of 2-Wheeled Motorcycles and ATVs Sold into Agriculture

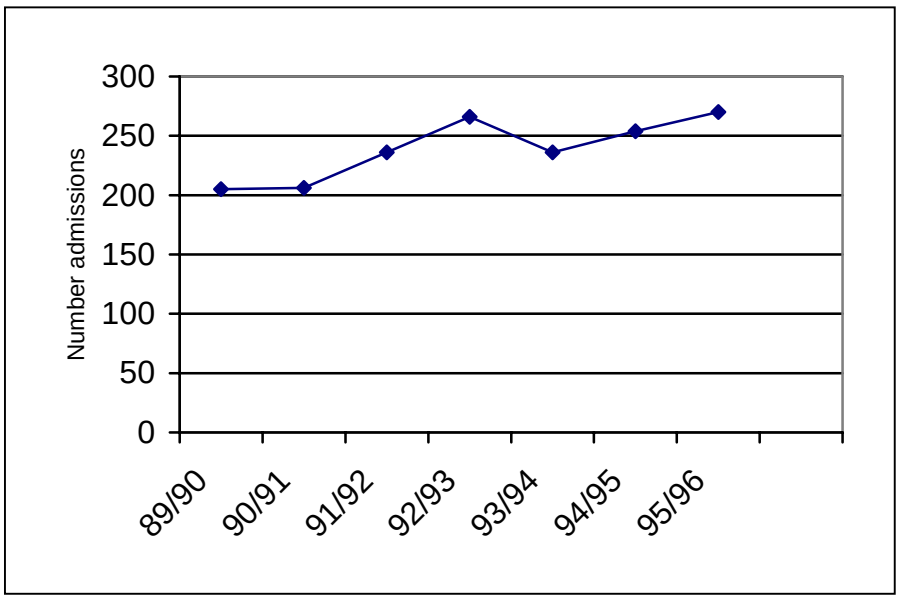
Motorcycle Type	1995	1996
2-wheeled motorcycles	3 241	3 249
ATVs	8 226	9 546

Source: Newland (1997)[56], reported in Schalk and Fragar 2000.

Farm motorcycles, including ATVs, were associated with 8-11% of on-farm injuries presenting to rural hospital Emergency Departments in Australia (Muiswinkel 1994)[2].

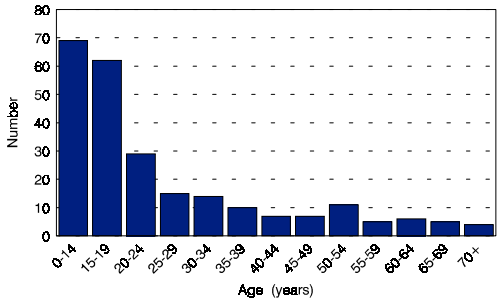
Figure 7.1 indicates the number of motorcycle injury admissions to NSW hospitals for the years 1989/90 to 1995/96.

Figure 7.1: Number of admissions to NSW hospitals due to farm motorcycle injury from 1989/90 to 1995/96



The number of farm motorcycle injuries appeared to be associated with the age of the motorcycle rider. Figure 7.2 shows that farm motorcycle riders in the age group less than 24 years more frequently sustained an injury and were admitted to hospital than any other age group. Once over 24 years of age it appeared that older riders are less frequently injured and admitted to hospital with a motorcycle injury. Whether this represents a difference in exposure or risk was not known.

Figure 7.2: Age Profile of Injured Farm Motorcycle Riders – NSW Hospital Admissions

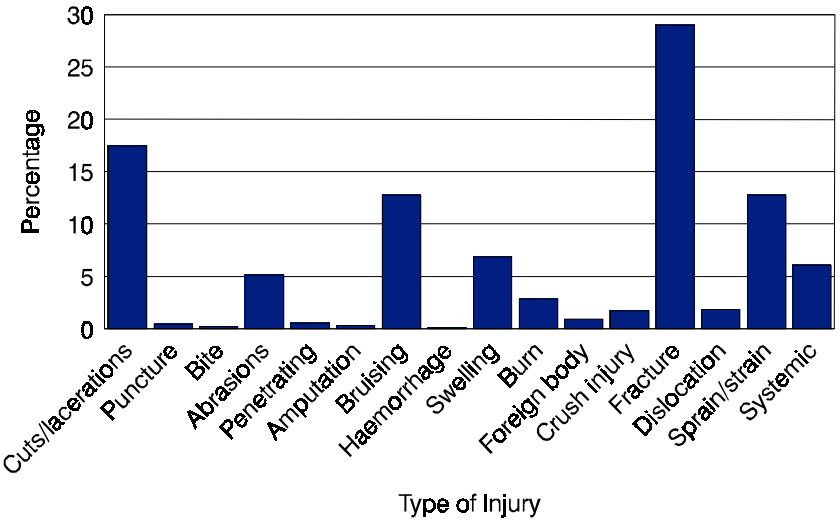


Source: New South Hospitals Separations 1991-92, reported in Schalk and Fragar, 2000.

A series of 1,492 persons presenting with on-farm motorcycle injuries to Emergency Departments in a selection of hospitals in eight states during 1988-92 showed that 46.9% of injured farm motorcycle riders required significant treatment, 25.5% required minor treatment and 20.7% were admitted to a ward[57].

The injured farm motorcycle riders were commonly treated for fractures, cuts/lacerations, bruising and sprain/strains.

Figure 7.2: Types of Injuries Sustained by Farm Motorcycle Riders - Emergency Department Presentations



Source NISU (1992), reported in Schalk and Fragar, 2000

The body parts which were most commonly injured in farm motorcycle accidents are the lower and upper extremities. Head injuries were also common, although the prevalence and severity will be determined by the use of a motorcycle helmet.

The NOHSC funded project report by Schalk and Fragar (Ibid) will report on risk factors associated with farm motorcycle injury in relation to rider age, weight, height, training, motorcycle maintenance, industry and riding speed.

In summary

Motorcycle injury on farms is an emerging OHS problem for the agricultural industries. Deaths on farms are associated with both 2- and 4- wheeled motorcycles, and it is estimated that around 400 – 500 admissions to hospitals occur each year due to injury associated with motorcycles on farms.

References Chapter 7

8. Pesticides and human health

8.1 Pesticides use in agriculture in Australia

A pesticide is defined as a substance used to destroy, prevent, attract or repel pests, or to regulate plant growth. It can be in the form of a liquid, powder, dust, granules, baits or a gas.

There are hundreds of pesticides registered for use in agriculture in Australia and pesticides are commonly used in *most* agricultural industries. This is in the background of extensive domestic and other commercial use of pesticides, and of agricultural use of other chemicals such as fuels.

Most people would be aware of high pesticide usage in industries such as the cotton industry, and in orchards and vegetable industries, but may not be aware of the dependency on certain pesticides in grain and wool production.

Pesticides are applied in a variety of manners, including:

- Hand sprayer/application
- Hand dressing, jetting, dipping, back-lining and drenching of stock
- Boom spray application mounted either behind or in front of a tractor or vehicle
- Mister application in orchards
- Insecticide bomb/fumigation in confined spaces such as silos, as well as of soil and rabbit burrows
- Aerial application

Pesticides may represent expensive inputs into commodity production and use is largely based on economic considerations of pest control and production system options.

The community at large is becoming aware of pressure on producers to meet consumer demand for unblemished fruit and vegetables, and the consequent use of insecticides. However, there is also increased herbicide usage associated with conservation tillage in wheat and grain production. These new processes result in reduction in soil degradation through direct drilling of the crop.

Producers as a group are paying increased attention to safety issues of pesticide usage. Such interest is being generated as a result of pressure from a number of directions, including:

- Consumer demand for residue free food and fibre products
- A general increase in community interest in health, fitness and safety
- Regulation of use under state “control of use” legislation, and under states’ occupational health and safety legislation
- Pressure to improve safe use by environmental agencies
- Programs of other agencies - Farmsafe Committees, and Public Health Units

Moves are being made within the industry to self regulate agricultural chemical use. A national Farm Chemical User Training (Farmcare) program has been developed and is being implemented throughout the rural network of TAFE and other training providers. More recent moves to require purchasers and users to hold such certification before being able to purchase the more toxic chemicals will fast-track this training program. A similar program for aerial operators is in place and for resellers of pesticides.

8.2 Pesticide toxicity

Pesticides, by definition, exert adverse effects on living organisms, including humans. The properties which determine the nature and degree of toxicity include:

- Chemical properties
- Physical properties
- Interaction with other chemicals
- Environmental transformation
- Specificity of the pesticide

Pesticides are usually grouped according to purpose and chemical characteristics. Table 8.1 provides a general classification of commonly used pesticides.

The dose-response relationship is a fundamental principle in toxicology. It is the relationship between the degree of response of a biological system and the amount of a substance received by the system, and implies that a change in the dose results in a concurrent change in the response of the organism.

The **LD_{50}** (lethal dose 50) is the dose at which half the given test population (mostly rodents) will be killed. LD_{50} data are used to provide a comparison of relative acute toxicities of pesticides.

The **NOEL** (no-observable-effect-level) is the exposure level at which no adverse health effects occur, and is often used to establish acceptable contaminant or exposure levels of substances in the environment. These levels are determined by applying a safety factor to account for possible differences between test animals and humans, and to provide protection for sensitive human subgroups.

This relationship is used extensively to quantify the toxicity of substances and to determine the **ADI** (Acceptable Daily Intake) and the **MRL** (Maximum Residue Level).

Toxic effects of pesticides may be:

- Acute effects, having a rapid onset, and relatively rapid recovery. These include skin and respiratory tract irritation, gastrointestinal effects, neurological symptoms and death.
- Chronic and delayed effects may occur after a lapse of time or following multiple exposures. They may include:
  - Behavioural changes
  - Peripheral neuropathy
  - Cancer
  - Reproductive effects
- Subclinical effects may not be revealed as signs or symptoms, but may be detected by biological tests - eg cholinesterase inhibition due to chronic exposure to organophosphate exposure. Other effects may only be defined by behavioural and psychomotor testing.

Health effects which may not be so clearly dose-related are those where allergic type responses cause symptoms. In some cases, symptoms become so severe that workers must avoid handling particular products.

Routes of human exposure are:

- Dermal - the common route associated with work related toxicity

- Inhalation - where pesticides are applied as mists, sprays or gases, and especially important in confined spaces
- Ingestion - through either contamination of hands, food, drinking water and, more commonly, through accidental or intentional poisoning.

Exposure to the odours associated with pesticides application may be a significant problem to some hypersensitive people. Some pesticides release a range of volatile mercaptans with strong, and sometimes offensive odours.

A number of agricultural industries have been identified as associating significant numbers of workers or others in the community to risk of pesticide exposure[58].

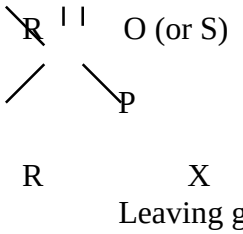
These include:

Cotton
Orchards and viticulture
Vegetable production
Sheep
Banana production
Greenhouse crop production

The people at risk of exposure, in general order of degree of risk, include:

- Mixers, loaders and handlers of concentrated forms of pesticides
- Pesticide applicators
- In-field markers, for directing application (less commonly used)
- Workers who enter sprayed crops - eg bug checkers, cotton chippers
- Family of workers who handle pesticides - by pesticides residues on surfaces and clothes[59]
- Families whose homes are adjacent to paddocks or crops being sprayed - by pesticides residues on outdoor surfaces, and spray drift
- Other bystanders who may be exposed by spray drift
- Communities may be exposed by occasional spray drift or drift of odours.

Table 8.1: Classification of pesticides

PESTICIDE GROUP	CHEMICAL GROUP	COMMENT
INSECTICIDES	ORGANOCHLORINES 1. Cyclodienes (aldrin, dieldrin, chlordane, heptachlor, endosulfan) 2. Halogenated aromatics (DDT) 3. Cycloparaffins (benzene hexachloride, lindane) 4. Chlorinated terpenes	• Almost all are insoluble in water, soluble in organic solvents, and stable to air, light, heat and carbon dioxide • All are now banned except endosulfan and dicofol, in the light of evidence of bioaccumulation of DDT in birds and humans, but may be reported in tissue • Endosulfan is used in agriculture and does not accumulate in fatty tissue
	CHOLINESTERASE INHIBITING INSECTICIDES 1. Organophosphates General formula  R X Leaving group S-containing (-thion) compounds readily converted to O-containing oxons, much more toxic than their corresponding thions 2. Carbamates	• Act by inhibiting acetylcholinesterase • Usage increased as replaced chlorinated hydrocarbons • Include some of the most toxic and potentially lethal pesticides • Specific antidotes available • AchE inhibition by carbamates is transient and tends to reverse itself
	PYRETHRUM, PYRETHRINS, PYRETHROIDS Pyrethrin the active ingredient of pyrethrum. Pyrethroids are synthetic compounds.	• Highly toxic for insects, common use in agriculture and in home gardens and ectoparasite controls. • Neurotoxicity in laboratory animals, few systemic poisonings in humans • Rapid biodegradation by mammalian liver enzymes
	OTHERS -Chitin Inhibitors - Biological control	

HERBICIDES	BIPYRIDYLS -paraquat, diquat	• Non-specific contact herbicides. Paraquat particularly in concentrate, very toxic to humans, both dermally and orally
	CHLOROPHENOXY ACIDS - 2,4-D, MCPA, MCPB	• Plant growth regulators, selective for broadleaf weeds. • Conflicting reports in literature associating group with non-Hodgkin's lymphoma
	OTHER HERBICIDES Nitrophenols and nitrocresolic herbicides Triazine herbicides - Atrazine, Substituted urea -Diuron Glyphosate Others	Variable toxicity
DESICCANT/ DEFOLIANT	Organophosphates Sodium chlorate Bipyridols Substituted urea	
PLANT GROWTH REGULATOR		
FUNGICIDES	Inorganic - sulphur, copper, mercury Organic - dithiocarbamates - thiazoles - substituted aromatics - dicaroximides - systemics- oxathiins,benzimidazoles And others	• Usually applied to prevent growth of fungi on crops and stored grains and products
BACTERICIDES		
RODENTICIDE	Anticoagulants - coumarins - pindone - brodifacoum - bromadialone Metal phosphides Sodium fluoroacetate - 1080 Strychnine Phosphorous	

8.3 Long term effects of pesticides

In 1993, Maroni and Fait published a review of the 1975-1991 literature describing the long-term health effects of prolonged exposure to pesticides[60]. The authors note that despite the increasing use of agricultural pesticides the adverse effects on human health have not been exhaustively evaluated, and that the role of pesticides in disease development remains controversial. "Of particular concern in the eyes of the public are allergic diseases and long-term health effects..." p9.

Further, while animal studies provide valuable information on absorption, biotransformation and elimination of chemicals, on mechanisms of toxicity, "epidemiological studies on humans exposed to pesticides provide more direct information, and cannot be replaced by other methods of investigation to confirm the existence of adverse health effects".

While there have been population studies based on geographic area, any association remains "vague and difficult to prove". Hence the increasing attention being focused on humans with occupational exposure, who experience higher doses than the general population. "Therefore studies on occupationally exposed subjects are likely to contribute the most valuable information to investigate associations between pesticide exposure and long-term health effects." p10.

Of the 440 published papers, 97 were review articles, 108 were case-control design, and the remainder reported results from proportionate mortality, cohort studies and cross-sectional studies, and case reports. Studies were mostly carried out on pesticide applicators, agricultural workers or people employed in the pesticide manufacturing industry.

When compared with the general population, total mortality, and non-cancer causes of deaths (with the exception of deaths by accidental causes) were found to be consistently lower among pesticide manufacturers or users. This finding has mostly been attributed to the "healthy worker" effect.

There was also a very consistent reporting of low overall cancer incidence among agricultural workers. However, an increased risk of myelolymphoproliferative disorders (especially multiple myeloma) has been reported in farmers, although further studies are required to control for confounding variables to make the evidence for association with pesticides (mainly phenoxyacid type compounds) more compelling.

Several studies point to an association between brain cancer and pesticide exposure, although no firm conclusions can be drawn at the moment and further studies are recommended.

An association between arsenicals and lung cancer has been reported, but the possible influence of smoking as a confounder has given rise to difficulties in other studies examining links between lung cancer and pesticides use.

A relationship between prostate cancer and pesticide related occupations, has been consistently reported, especially among farmers.

Cytogenetic studies on subjects exposed to pesticides suffer from insufficient documentation of exposure for Maroni and Fair to assess risk.

Numerous studies have been reported addressing reproductive effects, with "clear and substantial" evidence showing suppression of spermatogenesis and increased FSH and LH levels resulting from exposure to dibromochloropropane (DBCP).

In summary the authors state:
" In conclusion, in spite of a relative abundance of scientific literature on health effects related to pesticide exposure, very few papers present requisites which allow firm demonstrations of causal inferences to be made. Thus, firm conclusions on the adverse effects of chronic exposure to pesticides on human health are difficult to draw. The main limitations concern assessment of exposure, study design and insufficient control of important confounders."

More recent reports in the literature have tended to confirm the association of agricultural activity and possible pesticide exposure to higher risk of lymphopoietic neoplasms[61 62 63 64].

There has, in addition, been a growing literature addressing endocrine disruption, chemical sensitivity, neurotoxicity and the development of biomarkers.

Reports of neurotoxicity associated with organophosphate use have been based on use on the sheep dipping in the United Kingdom [65 66]. These reports are currently under consideration by the National Registration Authority to determine the implications for Australian use.

8.4 Deaths associated with agricultural chemicals in Australia

During the period 1989 to 1992 there were 2 on-farm deaths due to acute pesticides poisoning, and another 4 due to other hazardous substances [67]. One of the pesticides deaths was of a child aged less than 5, the other of an adult.

These acute deaths do not take into account the potential long term adverse affects of pesticides. A number of pesticides have been withdrawn from use due to concerns about long term effects, including cancer. One such pesticide was chlordimiform, an insecticide used in the cotton industry, now known to be associated with bladder cancer[68]. Workers who were registered to handle the pesticide have been offered a monitoring service by NSW WorkCover to detect bladder cancer early.

8.5 Workers compensation claims relating to agricultural pesticides

Published reports of workers compensation claims for agriculture do not specify claims for pesticides, in light of the overall low proportion of such claims.

However, the following tables are derived from available state-specific workers compensation data. It should be noted that cases of 'poisoning' are not necessarily due to pesticides, but could be associated with other hazardous substances.

The number of cases is small by comparison in relation to the total number of workers compensation claims in Agriculture – between one and two percent of claims are due to poisoning by all chemicals. However, the cost of any one claim may be significant. A case in Wagga Wagga in New South Wales saw three shearers successfully claim a total more than $600,000, when they were exposed to organophosphates applied to sheep.

1. Queensland

Table 8.2: Workers compensation claims due to "Poisoning"

Industry	1990/91		1991/92		1992/93	
	No claims	Cost of claims $	No claims	Cost of claims $	No claims	Cost of claims $
Agricultural farms & harvesting contractors	2	350	2	100 168	0	0
Fruit growers, driers & packers	0	0	1	92	2	927
Peanut threshing & selling	0	0	0	0	1	202
Poultry farms	3	596	1	54	1	273
Pastoralists (cattle & horses)	0	0	0	0	3	570
Total agricultural industries	**5**	**$946**	**4**	**$100 314**	**7**	**$1972**

2. New South Wales

Table 8.3: Number of workers compensation claims in agricultural industries new South Wales due to contact with chemicals or substances 1991/92

Occupation	Long term contact with chemicals or substances	Single contact with chemical or substance
Sheep shearers	1	0
Farmers/farm managers	0	0
Farm hands and assistants	3	5

3. South Australia

Table 8.4: Workers compensation claims in agricultural industries South Australia due to contact with chemicals or substances 1995/96 to 1997/98

Accident type	Males		Females	
	Number of claims	Cost of claims $	Number of claims	Cost of claims $
Long term contact with chemicals or substances	3	39419	0	0
Single contact with chemicals or substances	4	15044	4	45270
Total	**7**	**$54463**	**4**	**$45270**

4. Western Australia

Table 8.5: Workers compensation claims in agricultural industries in Western Australia due to chemicals/ chemical products 1993/94 to 1995/96

Industry	Number of claims		
	1993/94	1994/95	1995/96
Plant nursery	1	3	2
Vegetable growing	3	1	1
Grape growing	0	2	1
Apple and pear growing	0	0	1
Fruit growing nec	4	2	0
Grain growing	1	0	0
Grain-sheep $ Grain-beef-sheep	6	7	3
Sheep-beef cattle	1	0	0
Sheep	2	0	0
Beef cattle	1	1	0
Dairy cattle	1	0	0
Poultry – meat	0	2	1
Livestock farming nec	0	0	1
Crop and Plant growing nec	3	0	0
Sheep shearing	2	0	1
Services to agriculture nec	1	3	0
Total claims due to chemicals	**26**	**21**	**11**

A review of health effects of occupational exposure to hazardous substances in all industries in Australia was undertaken for the National Occupational Health and Safety Commission in 1996[69]. This report included reported chronic effects of agricultural chemicals in the estimates.

8.6 Hospital admissions

Numbers of hospital admissions for treatment of on-farm poisoning by agricultural pesticides are available for a range of years for NSW, Victoria and South Australia. (Tables 8.6 – 8.8)

The number of admissions is small. It is estimated that Australia-wide there are around 30-40 admissions for poisoning by agricultural chemicals occurring each year. Information regarding the circumstances of these is not available, but would include accidental ingestion by children, intentional ingestion by adults, and some worker exposure resulting in toxicity.

Table 8.6: New South Wales Hospitals – hospital separations, selected on-farm injury – all ages

E-Code	Description	NSW Separations all ages						
		89/90	90/91	91/92	92/93	93/94	94/95	95/96
E862	Poisoning by petroleum products	*	*	5	*		*	*

E863	Poisoning by agricultural chemicals	13	10	17	18	22	20	11
E864	Poisoning by corrosives & caustics	*		*	*	*		
E866	Poisoning by gases and vapours		*	*	*	*	5	*

Source: HIOST dataset. NSW Health. * Small number

Table 8.7: Victoria hospital separations, selected on-farm injury – all ages

E-code	Description	Separations – all ages				
		93/94	94/95	95/96	96/97	97/98
E862	Poisoning by petroleum products	0	0	0	0	0
E863	Poisoning by agricultural chemicals	5	2	5	5	3
E864	Poisoning by corrosives & caustics	*	*	*	0	0
E866	Poisoning by gases and vapours	0	0	0	0	*

Source: VIMD – Victorian Injury Surveillance System

Table 8.8: South Australia hospital on-farm injury separations 1996 – all ages

E-code	Description	Separations – all ages		
		Male	Female	Total
E862	Poisoning by petroleum products	4	2	6
E863	Poisoning by agricultural chemicals	7	2	9
E864	Poisoning by corrosives & caustics	3	*	4
E866	Poisoning by gases and vapours	*	*	4

Source: SA Health Commission

8.7 Worker exposure studies

A small number of worker exposure studies have been undertaken in specific agricultural industry settings - cotton chippers[70], horticultural industries [71] [72], vineyard workers[73], market gardeners[74] [75] [76] and sheep handlers [77].

Some of the studies have examined practice, others have attempted to measure exposure - measuring chemical residue on various body parts (patches) and a few have collected blood samples for cholinesterase testing as an indicator of acute exposure to organophosphate insecticides.

While each study has revealed either evidence of exposure or breakdown of appropriate preventive strategies – use of personal protective equipment, or safe practice, most of these studies have faced extreme difficulty in achieving a representative sample of subjects, and each therefore must be considered to have inbuilt bias. That bias is likely to be towards the most informed and concerned section of each industry.

8.8 Other studies

Other studies describing farm injury in defined localities in Australia have defined poisoning on farms in a range of different ways.

Ferguson, in a survey of 2,188 producers in four regions of Queensland for 12 months in 1994/95, found that there were 12 reports of pesticide poisoning[78]. This was 2.7% of farm injuries reported for the period. The average cost of each poisoning was estimated to be $477.

In Victoria, 13 adults and four children presented to Emergency Departments as a result of poisoning on farms for the year 1996/1997[79]. This represented 1.1 percent of presentations with farm injury.

A number of General Practice based farm injury surveys have been carried out that indicate cases of pesticide poisoning. There were 4 cases of chemical poisoning on farms reported in the Yorke Peninsula between 1 September 1996 and 30 April 1998[80]. This was 6.9% of injury cases reported.

Chemicals made up 2 percent of farm injuries reported in a 12 month General Practice survey (1997-98) on the Eyre Peninsula[81], and made up 1.7 percent of cases in a general practice and Emergency Department study in Central Queensland between July 1995 and June 1996[82] .

8.9 Community exposure to pesticides

Communities have an increasing concern about the use and safety of pesticides. The past 20 years or so has seen a number of communities express concern over potential and/or perceived adverse health effects of pesticides in use in adjoining or previous agricultural production. Table 7.9 briefly summarises a number of these events.

Table 8.9: Reported Community Concerns

Time period	Region	Commodity Crop	Health concern	Public Health Response
Late 70's	Wee Waa, NSW	Cotton	Mainly agricultural concerns	North West Pesticide Committee - ongoing interagency committee
Early to late 80's	Moree NSW	Cotton	General Later cluster of neuroblastoma	Community Liaison Committee NAIHO study of the health problems of Aboriginal Cotton Workers [83] Survey of doctors in cotton area [84] [85] Plan for Adverse Impact Register pilot[86]

				Review cancer rates in cotton area Review birth defects in cotton area
1980 – 1985	Emerald, Qld	Cotton	Childhood leukaemia	Cabinet Enquiry into epidemiology of childhood leukaemia [87] [88] Air and water sampling [89]
Early 1990's	North Coast NSW	Old Cattle Tick Dip sites	Various	
1992-1993	Coff's Harbour, NSW	Bananas	Cluster of cleft palate	Community consultation 3x case control studies Air sampling [90]
1994	Central NSW	Horticulture	Cluster of cases of aplastic anaemia	Case control study [91]
1995	Gunnedah, NSW	Cotton	Various symptoms	Consultation with specialists physicians/ immunologists [92] Water sampling [93] Limited air sampling Asthma surveillance Local Chemical Liaison Committee formed, Development of Spray Guidelines
1996	Narromine, NSW	Cotton	Cancer Various other concerns	Public meeting Adoption of Gunnedah Spray Guidelines Investigation of suspected cancer cluster [94]
1996	Far North Queensland	Treatment of tropical fruit for papaya fruit fly	Various	Surveillance during treatment Plan to establish Register of Adverse Health Effects

In summary:

While pesticides would not rank highly as a priority for farm injury prevention on the basis of the number of deaths or actual poisoning events, there is widespread concern by the industry and the wider community over safety issues surrounding pesticide usage. Furthermore, individual cases of exposure can result in high cost.

References Chapter 8

9. Noise damage

In the early 1980's, nurse audiometrists working in rural communities in New South Wales recognised that farmers, due to the nature of their work were likely to have significant hearing loss. It was also evident from Community Health Records, that this client group did not access hearing health services for testing, prevention, education and support services. As the majority of farmers are self-employed, the true incidence of Noise Induced Hearing Loss (NIHL) is not reflected in compensation claims made through the various state compensation bodies.

Noise induced hearing loss is not the only damage caused by noise on farms. Tinnitus, ringing or noises in the ears, is another type of damage.

Noise induced hearing loss

To the end of 1998 there were 5,148 farmers and farm workers screened for noise injury at the major farm field days around NSW. These were undertaken by trained nurse audiometrists and audiologists, accompanied by individual counselling regarding hearing conservation and using standardised methods[95].

Of the 5,148 farmers / farm workers screened, 83.2 % were male, 16.6 % were female.

The three largest commodity enterprises represented were:

Meat cattle	16.0%
Meat cattle/cereal grains	15.0%
Sheep/cereal grains	14.9%

Figure 9. 1 indicates the location of field days where screening was undertaken.

Figure 9.1 Locations of New South Wales field days where hearing screenings have been conducted, 1993 -June 1999

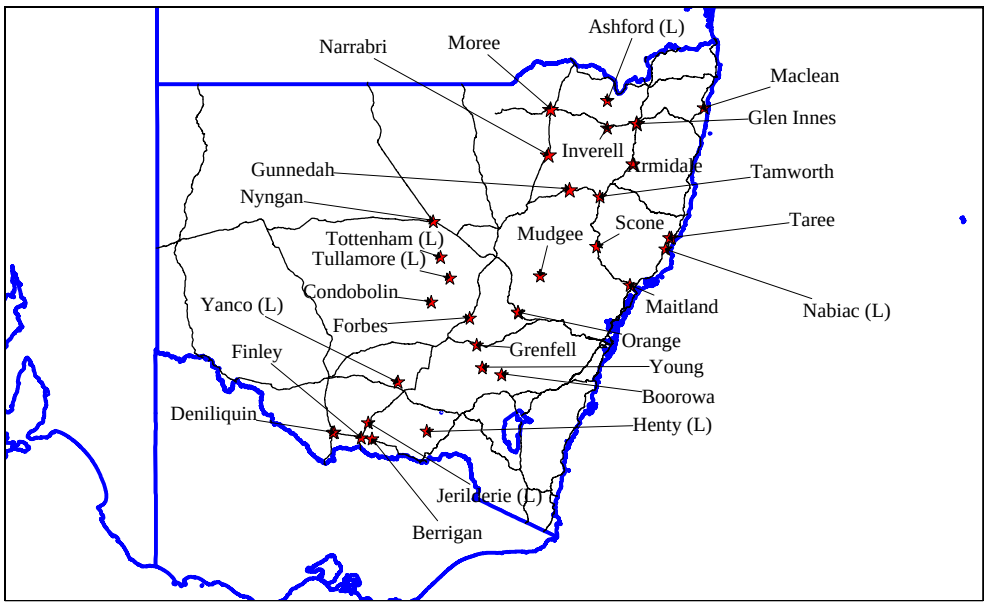
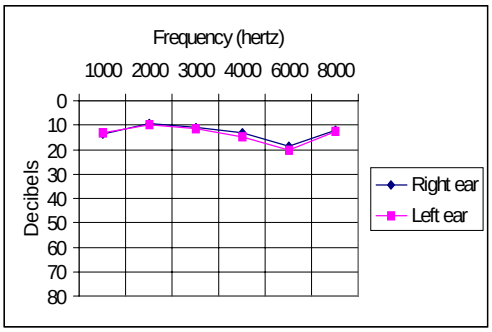


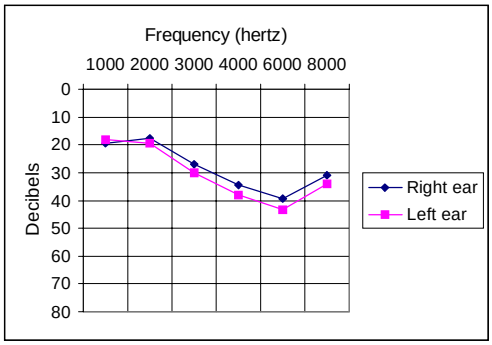
Figure 9.2. Mean values for hearing thresholds - male farmers/ farm workers at NSW Field Days in 2 time series.

Time series 1: April 94 – Sept 97

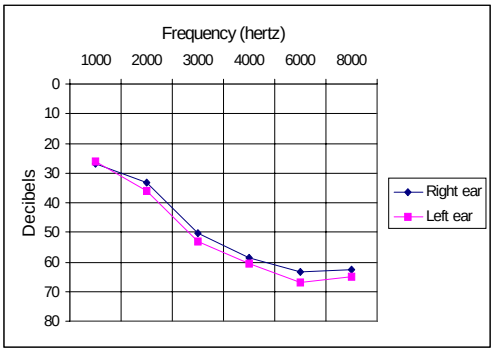
Age group 15-24 years (n=276)



Age group 45-54 years (n=631)

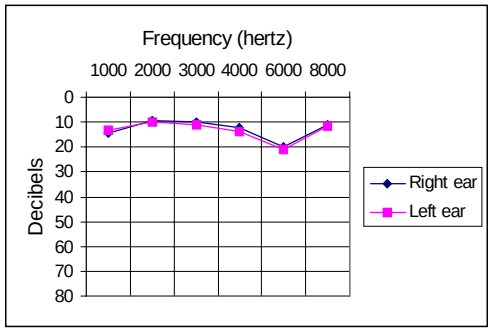


Age group 65+ (n=323)

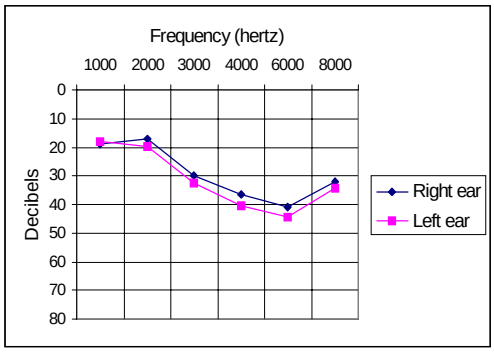


Time series 2: Sept 97 – Nov98

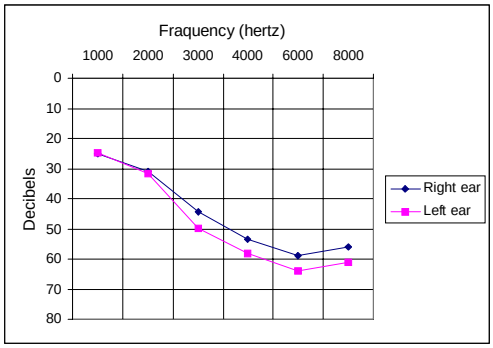
Age group 15-24 years (n=165)



Age group 45-54 (n=225)



Age group 65+ (n=100)



Source: Fragar LJ, Franklin R. 1999[96].

Figure 9.2 describes the mean values for hearing thresholds for three age groups in two time periods for male farmers and farm workers in the NSW program to end 1998. Normal hearing

thresholds are considered to be less than 20-25 dB for all frequencies. The 'dip' in the graphs around the 4000 to 6000 Hertz is characteristic of noise induced hearing loss. Time Series 1 is for the period April 1994 to September 1997. Time Series 2 is for the period September 1997 to November 1998.

There is a notable increase in hearing thresholds across all frequencies screened in the left ear. From observation this is the result of the postures adopted during noisy agricultural work. Driving tractors and checking towed implements by looking over the right shoulder, operating workshop equipment and discharging firearms with the right hand all contribute to left ear / right ear differences by exposing the left ear to the largest noise dose.

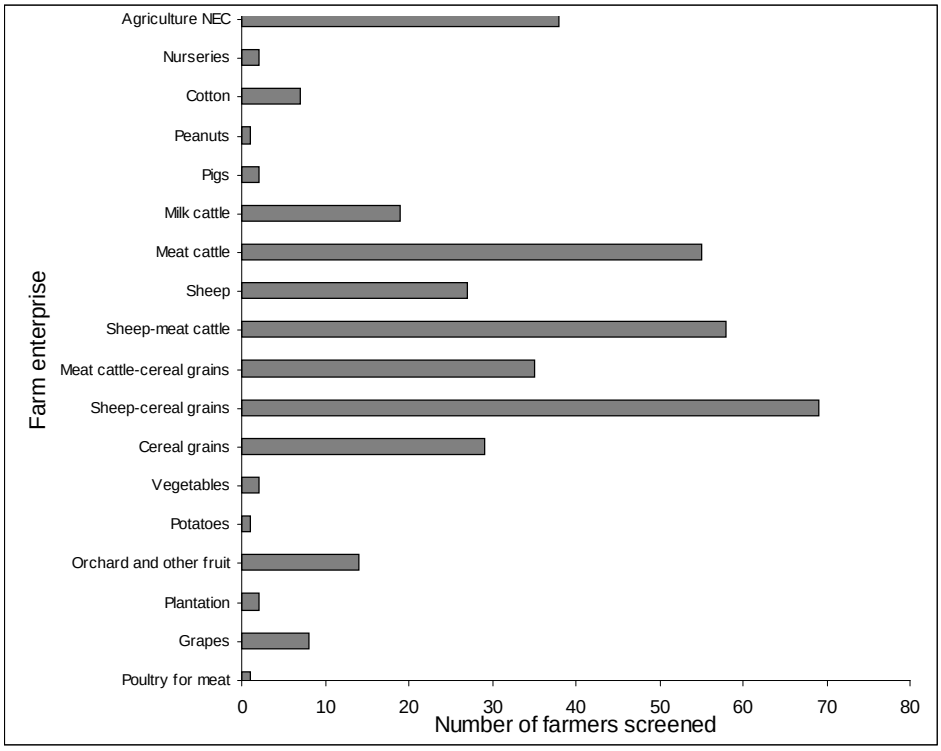
Tinnitus

Tinnitus is a ringing or sensation of noise in the ears or head when no external sound is present and is a commonly reported symptom of a noise injury.

Of 813 screenings carried out for farm workers since the hearing screening form was changed in July 1998, there were 371 people who had tinnitus. Of these 318 (85.7%) were males and 53 (14.3%) were females.

Of those with tinnitus, 233 were full-time farmers, 108 part-time farmers, 29 full time students and three part-time students. There is some overlap between full-time / part-time farmers and full-time / part-time students. Figure 9.3 indicates the farm enterprise type of those in this sample of screened persons.

Figure 9.3: Farming enterprise of screened farmers (N=370)



Of those who had tinnitus 40 (10.8%) had it in the right ear only, 57 (15.4%) had it in the left ear only and the rest 274 (73.9%) had it in both ears. There were 86 (23.2%) who had continuous tinnitus and the rest 285 (76.8%) had intermittent tinnitus. The effect of the tinnitus was nil on 202 (54.4%) of the group but 168 (45.3%) found it an annoyance.

Table 9.1 indicates the current hearing difficulties farm workers with tinnitus experience. Seventy one percent experienced hearing difficulties with background noise present, 44% had difficulties hearing the television and 31% had hearing difficulties in their working environment.

Table 9.1: Current Hearing difficulties experienced by those with tinnitus

	Yes	No	Total
Television	163	208	371
Telephone	105	266	371
Meetings / conversations	201	170	371
Working environment	116	255	371
Background	263	108	371
Classroom	16	355	371

Over 70% of those with tinnitus had exposure to the major noise producing items on a farm as seen in Table 9.2. It is interesting to note that only 167 (45.0%) had a tractor with a cabin.

Table 9.2: Current Noise Exposure for those with tinnitus

	Yes	No	Total
Tractor (no cabin)	293	78	371
Firearms	254	117	371
Chainsaw	323	48	371
Workshop tools	317	54	371
Heavy machinery	210	161	371
Tractor	167	204	371

Use of hearing protection on farms

While hearing conservation on farms should not rely on use of personal hearing protection by workers alone, there are many activities where noise cannot be removed at the source and use of ear muffs or plugs remains the only practical intervention.

Routine use of hearing protection during some noisy activities can be used as a measure of adoption of hearing conservation measures.

Table 9.3 reports general use of hearing protection on farms by male farmers and farm workers in the three age groups, in the two time series described above.

Table 9.3: Use of hearing protection by male farmers/farm workers on NSW farms

a. Time series 1: April 94- Sept 97

	15-24 years		44-54 years		65+years	
Protection used	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Ear plugs	36	13.0	62	9.8	26	8.1
Ear muffs	107	39.8	338	53.6	120	37.1
Either	47	17.0	60	9.5	17	5.3
Both	15	5.4	22	3.5	9	2.8
None	71	26.7	149	23.6	151	46.8
Total	276	100	631	100	323	100

b. Time series 2: Sept 97 – Nov 98

	15-24 years		44-54 years		65+years	
Protection used	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Ear plugs	19	11.5	21	9.3	7	7.0
Ear muffs	72	43.6	121	53.8	37	37.0
Either	25	15.2	42	18.7	5	5.0
Both	6	3.6	5	2.2	2	2.0
None	43	26.1	36	16.0	49	49.0
Total	165	100	225	100	100	100

Examination of this data would suggest that farmers in the age range 45-54, who are the largest group participating in the program in both time series, are also changing their behaviour in relation to the use of hearing protection on farms. The proportion of these farmers not using any protection has dropped from 23.6% in the first time period, to 16.0% in the second.

Close to 50% of older farmers use no protection, and more than 25% of younger farmers and farm workers also use no protection.

Use of hearing protection for specific noisy activities has also been reported (Table 9.4). The following describes the use of hearing protection by the three age groups when driving uncabined tractors and using chainsaws. The results tend to reflect the general hearing protection use described above.

Table 9.4: Use of hearing protection during specified activity by male farmers/farm workers in 1998

a. Use of hearing protection when driving a tractor without a cabin

Protection Used	**15-24 years**		**44-54 years**		**64+ years**	
	Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Always	23	16.7	56	28.7	17	18.5
Sometimes	37	26.8	64	32.8	19	20.6
Never	78	56.5	75	38.5	56	60.9
Total	**138**	**100**	**195**	**100**	**92**	**100**

b. Use of hearing protection when operating a chainsaw

Protection Used	**15-24 years**		**44-54 years**		**64+ years**	
	Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Always	39	27.7	91	41.9	12	14.1
Sometimes	41	29.1	52	24.0	20	23.5
Never	61	43.3	74	34.1	53	62.4

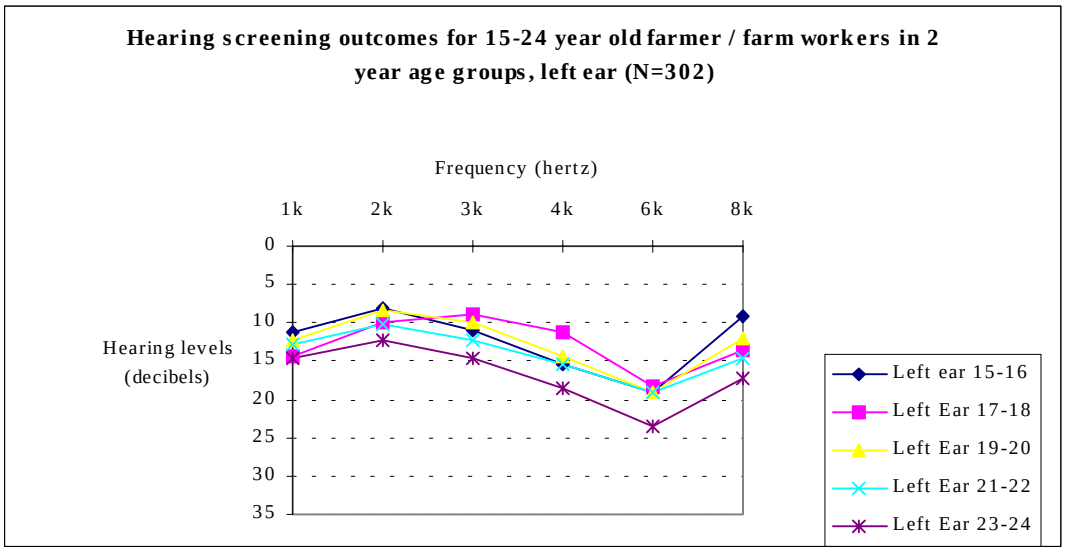
Total	**141**	**100**	**217**	**100**	**85**	**100**

General

Farmsafe Australia has established a five-year target to reduce the proportion of young men on farms aged 15-24 who have early noise induced hearing loss by 15 percent. The Australian Centre for Agricultural Health and Safety has prepared a paper to establish the baseline information for this program[97].

Analysis of data in the farmer hearing screening program of the hearing thresholds of this age group demonstrates a progressive deficit being experienced at this early age. Figure 9.3 indicates this progression.

Figure 9.3:



In summary

The only data that describes the nature and extent of noise damage in agriculture in Australia is gathered in New South Wales. South Australia health workers are providing hearing screening services to farmers, however reports are not available to assist in defining the problem for the industry.

The information that is available indicates a major, disabling problem for farmers and farm workers. The problem is commencing at a young age, and is progressive and permanent.

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