THE INCIDENCE OF FARM INJURY: RESULTS FROM A PILOT SURVEY

J.M. LOW, G.R. GRIFFITH, K.A. PARTON and L.J. CLARKE.
Economist, NSW Agriculture, McCarthy Building, PO Box 991 Armidale, NSW 2350; Senior Research Scientist, NSW Agriculture, Regional Veterinary Laboratory, PMB (UNE), Armidale, NSW 2351; Senior Lecturer, Department of Agricultural Economics and Business Management, University of New England, Armidale, NSW 2351; and Director, Agricultural Health Unit, Moree District Hospital, PO Box 138 Moree, NSW 2400.

1 Introduction to the Farm Injury Problem

A study of work-related deaths in Australia from 1982 to 1984 (Harrison, Frommer, Ruck and Blythe 1989) revealed the occupational category "farming, fishing, hunting and timbergetting", as having the third highest incidence of work-related fatalities after "mining and quarrying" and "transport and communication". Community concern about the number and severity of farm work-related injuries in Australia was manifest in 1988 at the University of New England, Armidale, when the first national farm safety conference, Farmsafe '88, was held.

From this conference, a broad-based Ministerial Advisory Group on Farm Safety was assembled. The Group's aim was to see the development of "a national framework which will enable community driven OHS programs for the farm population to be established and to promote farm safety" (Clarke 1991, p10).

These Occupational Health & Safety (OH&S) programs were to be delivered by local community-based Farm Safety Action Groups (FSAGs). Four principal functions were suggested for the FSAGs:

1. to identify local hazards and farm health and safety problems.
2. to determine how these issues can be best addressed within the local farming community.
3. to arrange education and training programs, information dissemination and other relevant activities.
4. to identify and make best use of available resources.

In undertaking these functions the FSAGs sought information on farm occupational safety in the Australian context, to guide their activities. Of the studies then available, none presented a comprehensive profile of occupational injury for rural Australia (McCulloch 1991).

Having identified this information gap, injuries have become the focus of a three-year project, "The Economics of Farm Safety in Australian Agriculture" (EFSAA), being carried out by NSW Agriculture with funding from the Rural Industries Research and Development Corporation.

2 The EFSAA Project

2.1 Background

The EFSAA project plans to develop a comprehensive profile of injuries in the cereal and oilseed cropping, sheep/wool and beef production industries. Activities and work practices undertaken in these industries should also have parallels in other agricultural industries. An estimate of the cost of injuries, the rate of occurrence or incidence and the severity will be made. Possible risk factors of injury occurrence are also being analysed as a part of the project.

Results of the EFSAA project should assist FSAGs to focus their efforts more effectively by providing information on risk factors in accident occurrence, and to facilitate resource support seeking efforts by presenting a clearer picture of the risk/incidence of different types of accidents and the range (and some magnitudes) of associated costs to society.

A farm-based injury survey is the primary data collection component of the EFSAA project.

2.2 The Survey Objectives

1. To estimate the incidence of work-related accidents associated with selected agricultural industries (cereal and oilseed cropping, sheep/wool and beef cattle production).

2. To identify correlations between industry, demographic or socio-economic factors and accident occurrence.

3. To provide an indication of the type and magnitude of costs at the farm level and to society resulting from these farm accidents.

4. To analyse producer attitudes towards safety practices and to identify existing or potential incentives and disincentives for farm workers to adopt preferred work safety practices.

5. To assess the impact of recent and current farm safety extension programs in raising farmer's awareness of farm safety practices.

3 The Pilot Survey

A pilot survey was carried out in 1991 over the Armidale Rural Lands Protection Board District (RLPB). The area was chosen to minimise the cost of the interview phone calls, travel and co-ordination requirements, as the project is based in Armidale. However, the University of New England is also located there, and local residents are surveyed for a wide variety of subjects on a regular basis by university researchers and students. This could have had a negative effect on response rates.

A pilot survey is extremely useful in estimating probable response rates (Dillman 1978), parameter values and comparing data collection alternatives, in this case mail versus telephone. It is a test for clarity and possible ambiguity of questions, and also whether they actually yield the information required.

A random sample of 453 property owners was drawn from the RLPB roll. The questionnaire was applied using telephone interviews for 235 properties and a mail questionnaire for 218 properties (see Table 1). The "mail" group was sent the questionnaire accompanied by an introductory letter. The "phone" group was sent an introductory letter followed by a phone call to arrange a suitable time for a phone interview. The length of the phone interview ranged from 15 to 45 minutes, with an average time of 26 minutes.

Each property owner received a coupon with their introductory letter informing them of their eligibility

for a draw for two dinners-for-two, each to the value of $60, if they agreed to participate in the survey. This was intended to provide some small incentive to respond, without unduly influencing the quality of the answers. Research has shown (Woodward, Douglas and Miles 1985) that the response rate to a survey has been improved by offering the chance to win such a dinner.

Table 1. Farm Injury Survey Response

	Mail	Phone
Sample Size	218	235
Number Eligible (excluding non-agricultural)	191	211
Responses	65	144
Raw Response Rate	29.8 %	61.2 %
Adjusted Response Rate	34.0 %	68.2 %

Reminder phone calls were made to the "mail" non-respondents approximately two to three weeks after mailing the questionnaire. The majority of the phone interviews were carried out in the evenings.

As well as the much lower response rate for the mail section of the questionnaire, several other problems were encountered with this mode. Many of the mail questionnaires were returned incomplete and where questions were misinterpreted, there was no opportunity for clarification.

The questionnaire contained four sections. Section A included exposure data for family and employees, property size, enterprise mix and attitudinal questions. Section B gathered demographic information (education, height/weight, health, stress, etc) for the person having the most to do with the day-to-day running of the property. The other two sections were only used when an injury was reported in the time period from 1st July 1990 to 31st December 1991. This included a twelve month retrospective period from 1st July 1990 to the 30th June 1991 and a six month prospective period from the 1st July 1991 to 31st December 1991. Section C contained a description of the injured person and the circumstances of the injury and section D the costs incurred as a result of the accident.

In a study of farm injuries in the United States that utilised comprehensive medical records, Elkington (1990) concluded that for farm work-related injuries, six months was the maximum period for acceptable recall. However, in order to obtain sufficient data within time and budget limitations, the retrospective period for injury reporting for the pilot study was extended to twelve months (the 1990/91 financial year).

Another reason for covering the twelve month retrospective period was to try and avoid seasonal bias. The six month prospective part of the survey (July to December 1991) could have accounted for this, but its efficacy as a data collection method had not been verified.

A case/control study was carried out using the questionnaire data. The positive respondents, i.e., those that report an injury, were classed as cases. Controls were chosen from the respondents who answered sections A and B and did not have an accidental injury on their property. An unmatched analysis was to be followed by matching cases and controls by age group and gender. A ratio of one case to three controls is preferred to carry out a matched analysis on the data collected and to accept or reject the stated hypotheses.

The six-month prospective component was included in the survey to provide cases who had already completed section B prior to the injury, so that valid comparisons could be made on variables subject to change as a result of the injury such as weight, stress levels or sleep quality. Reporting injuries as they occur should also result in more accurate recall by respondents.

Follow-up calls every month or two over the six-month prospective component of the survey were planned to encourage reporting and check on each property's accident status. Limited labour resources did not allow this to occur. However one final call was made to participants after the six-month period to confirm their accident status.

The injury self-reporting for the prospective component of the survey was almost negligible- three injury notification forms over six months. Respondents were provided with an injury notification form and a reply paid envelope. They were also given the researcher's phone number, in case they found phone reporting of an injury more convenient. The final phone check also yielded a much lower injury rate than was identified in the retrospective component, 6.0 percent and 24.4 percent respectively. This may have been due to the brevity of the final phone call to ascertain injury status. After identification and greeting, the participant was reminded of their participation in the survey and asked whether any injuries that complied with the survey definition had occurred on the property from the time of the initial interview up until the end of December 1991.

The degree of severity of the injuries reported during the prospective period, e.g., broken collarbones, ribs and strained back indicated that respondents either ignored or had forgotten about the less serious injuries despite being prompted with the survey definition of injury.

In order to provide a comparison with the survey data, a second approach was taken to collect similar types of information. Six hospitals that would receive patients from the population under study were engaged to record every farm related accidental injury that occurred as they were presented at the hospital. If agreeable, patients would be interviewed using the pilot questionnaire. If not, the nature of their injury and postcode or RLPB district recorded. These data were to be used as a comparison.

4 Survey Data Analysis

Analysis of the pilot survey data includes odds ratios, Chi-squared tests for the hypotheses, cross-tabulation of some variables, and descriptive analysis for the attitudinal questions.

4.1 Descriptive Variables

Several questions were included to measure producer attitudes to safety and awareness of risk while working on the farm. First an inventory of the number and location of first aid kits on the farm was made. This has been summarised by two measures.

The first measure is the total number of first aid kits on the farm; of 208 responses, only 2 percent stated that they did not have a first aid kit or medicine cabinet on the property. Properties having either one or three first aid kits each made up 27 percent of the total. The modal value was two first aid kits, with 33 percent of properties having this number of kits.

The second measure, identified that 68 percent of properties had a first aid kit in their shearing shed while the shed was being used.

Respondents were then asked to apportion their own farm work time into the work classifications low, medium and high risk of injury. Definitions were not given for each of the categories, leaving responses as ordinal variables, as this question was intended to elicit farmers' perceptions of the risk associated with the work they do.

Over half of the respondents indicated that they spent more than 50 percent of their time on work

that they perceived to be low risk. The proportion of time most often spent on moderate risk activities was between 11 and 50 percent of farm work for 59 percent of the respondents. Work identified as being high risk by 62 percent of respondents took up less than 10 percent of their time and 92 percent felt that high risk work took up less than 50 percent of their time.

Thus farmers in this population generally perceived that the majority of their farm work time was spent on low risk work, a significant proportion on moderate risk work and a small proportion of their time on high risk work.

Respondents were also asked to rate a list of general farm work activities on the same basis, i.e., high, moderate and low risk of injury. Comments were often made when answering this question such as "the risk to me is low because I am more careful, but lots of people do get hurt doing that type of work". This illustrates an attitude to risk that is common in many situations (eg road travel) where individuals tend to discount the risk of injury to themselves. Risk of injury ratings for general farm-work activities as indicated by a majority of respondents, are displayed in Table 2.

Table 2. Perceived Risk of Injury Associated with Farm Work Activities

Low Risk	Moderate Risk	High Risk
Yardwork with sheep	Yardwork with cattle	Chainsaws
	Driving headers	Chemicals
	Mustering on horse-back	Firearms
Mustering in a vehicle	Mustering on a motor-bike	Augers
	Workshop maintenance of machinery	Tractors

Activities perceived as high risk appear to be those with the potential for severe injuries, however none of the injuries recorded in the pilot survey were associated with these. Over sixty percent of those recorded were related to sheep or cattle enterprises, either involving yardwork or mustering.

Accident and emergency records from the Agricultural Health Unit at Moree (1991) show that 16 percent of farm injuries presented in the North West Plains area relate to farm machinery and equipment maintenance. This was the second largest category of farm injuries reported. Only one injury recorded in the pilot survey would apply to the machinery and equipment maintenance category of this data. This reflects the concentration of grazing industries in the Armidale RLPB as opposed to the farming activities that are more predominant in the North West Plains area.

In order to obtain an indication of farmers' opinions about responsibility for the education of rural workers in OH&S, respondents were asked to rank the following groups in terms of responsibility: the government, farm industry organisations, local farm safety action groups, machinery manufacturers, insurance companies, the farmer/employer, the employee/individual and any other bodies that they considered had responsibility in this area.

By valuing the first choice of each respondent equal to seven points, the second at six and so on down to the seventh at one, a weighted score giving a measure of the perceived responsibility of that group for the education of rural workers in OH&S was obtained. If the respondent felt a group had no responsibility in that area, that group did not receive any points.

When the scores were summed, as can be seen in Figure 1 the individual and the employer were viewed overwhelmingly as the two main groups considered responsible for the education of rural workers in OH&S. In some cases it was suspected that despite the wording of the question, respondents tended to answer who they thought was responsible for the OH&S of rural workers rather than for their education in OH&S.

Figure 1: Responsibility for Educating Rural Workers in OH&S

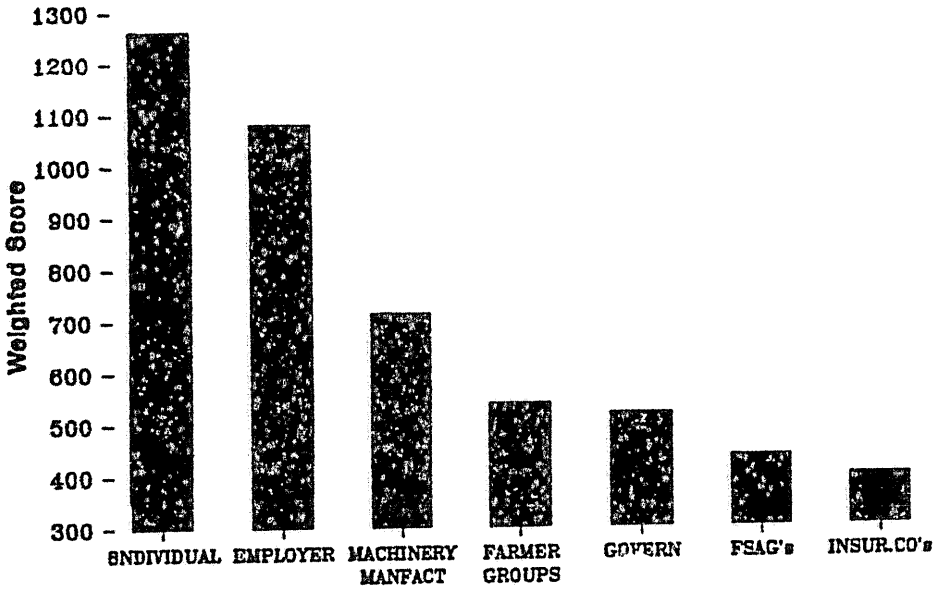
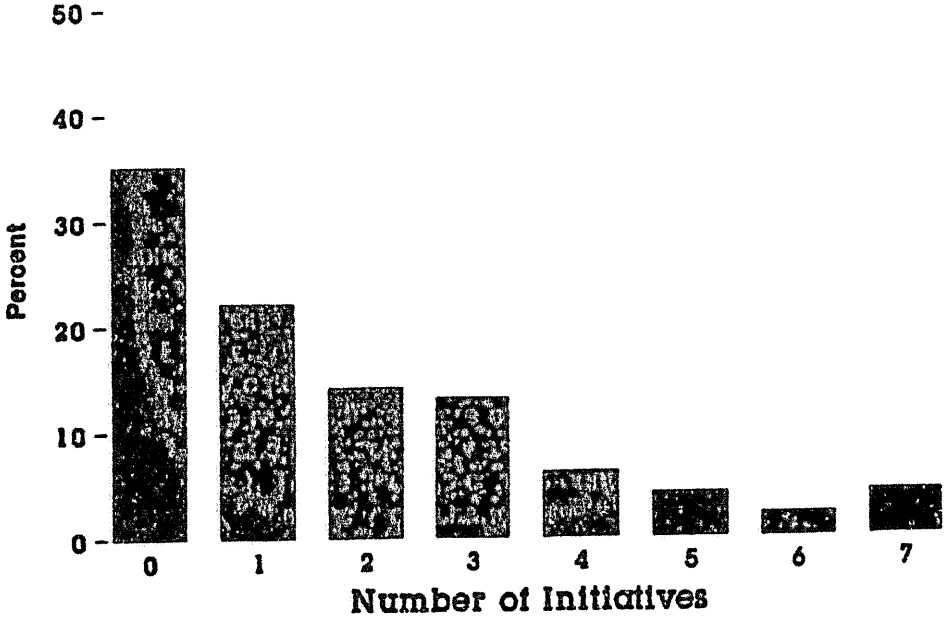


Figure 2: Number of Farm Safety Initiatives Recalled



A measure of awareness of any farm safety extension initiatives was taken along with which media had brought these initiatives to the farmers' attention. Initiatives listed as examples included safety seminars or workshops on the use of chainsaws, tractors, agricultural chemicals, noise induced hearing loss, and back injury. The number of initiatives recalled per respondent were summed and a frequency distribution is given in Figure 2.

This question was intended as a feedback mechanism for FSAGs when applied in areas where they had been active. Farm safety promotions have not been common in the Armidale RLPB district and the results tend to reflect this. The types of initiative most often mentioned were chainsaw safety/promotion days, sponsored by chainsaw retailers; or the farm safety television advertising campaign sponsored by Prime television and BP. However, 35 percent of respondents could not recall any recent farm safety initiatives.

Of the media categories identified, the "print media" category was indicated by 20 percent of respondents as the only form of media by which they had heard of farm safety promotions, followed closely by the "all three" (TV,radio and print) category with 19 percent. Eighteen percent of respondents indicated that they had not heard about farm safety initiatives through any of the media mentioned.

4.2 Exploratory Variables

A major area of interest for this survey was an estimate of the incidence of farm work-related injury for the population under study. Despite having no comparable figures to use as a benchmark and being the trial or pilot to refine the methodology, the data collected provide a starting point for an incidence of injury estimate.

For the purposes of this study an **injury** was defined as a situation in which any of the following had occurred:

- usual activities are restricted for one day or more (cannot work at the same pace or with the same ease as usual),
  professional medical care is sought,
- amnesia, loss of consciousness or awareness.

Farm work was defined as:
"any activity related to the farm operation carried out either on or off the farm".

For the twelve-month retrospective part of the survey, there were one or more injuries reported on 24.4 percent of the properties surveyed, that is, almost one in four properties experienced an injury (see Table 3).

Table 3. Incidence of Farm Work Related Injury

Injuries	Frequency	Percent
0	158	75.6
1	42	20.1
2	8	3.8
3	1	0.5
Total	209	100.00

The nature and location of the injury in relation to the associated enterprise were examined. As injury data were only available for 39 cases, the cross-tabulations (aggregated to 3x3 and 3x4

tables), of "nature of injury" by "location of injury", "nature of injury" by "enterprise type" and "location of injury" by "enterprise type", were not sufficient to provide valid Chi-square statistics. In summary though, injuries associated with sheep enterprises were more often lacerations located on either extremities or the head. Injuries associated with cattle enterprises tended to be sprains/strains or fractures to either extremities or the body trunk.

To compare the age distributions of those injured and those respondents who did not report an injury within the given time period, age was recorded in age-group categories of five year intervals (and presented in ten year intervals in Table 4). The central value of each five-year category was used to calculate the mean and standard deviation of cases = 41.47 (SD=12.88) and controls = 48.96 (SD=12.86). For the three categories up to 49 years of age, cases have a higher proportion of the total in each cell. The 20-29 age group has 15.8 percent of the cases and only 5.8 percent of the controls.

This distribution of injuries approximately reflects the Agricultural Health Unit's Profile of Farm Injury (1991) which indicates the highest risk age-group for males is between fifteen and thirty.

Another factor that may contribute to the distribution of cases over age groups is that the survey initially interviewed the person having the most to do with the day-to-day running of the property, usually a senior family member or manager. Consequently, controls are a subgroup of the farm population. As anyone involved in farm work on a participating property could be reported as an injury, and the rest of each farm population is likely to be the same age or younger than the farm manager, the mean age of cases could be lower than the mean age of controls.

The calculated χ^2 value = 12.78. The critical value, $\chi^2(5\%)(df=5)$ = 0.484, 11.1. Therefore we can conclude that there is a significant difference between the age distribution of cases and controls.

Table 4. Age Distribution

Age-Group	Controls		Cases	
	Frequency	Percent	Frequency	Percent
20-29	9	5.8	6	15.8
30-39	33	21.2	11	28.9
40-49	39	25.0	14	36.8
50-59	37	23.7	4	10.5
60-69	38	24.4	3	7.9
Total	156	100	38	100

Another factor that would have a high correlation with age and may influence the distribution of cases over age groups, would be the level of farm work experience (see Table 5). A comparison of the means shows no significant differences between cases, mean value = 21.88 years (SD = 16.28) and controls, mean value = 21.83 years and (SD = 16.98). The similarity of these distributions implies that experience does not influence the distribution of cases over age groups.

Collapsing Table 5 into three categories; 0 -10 years, 11-30 years and over 31 years farm work experience, results in expected cell values sufficient to calculate a Chi-square statistic. With a critical Chi-square value of 5.99 (2 degrees of freedom) and a calculated value of 0.18, no significant association between years of experience and injury occurrence is identified.

Table 5.	Level of Farm Work Experience			
Years Experience	Controls		Cases	
0	12	7.8%		
1 - 10	44	28.8%	11	33.3%
11 - 20	26	17 %	4	12.1%
21 - 30	25	16.3%	7	21.2%
31 - 40	20	13.1%	9	27.3%
41 - 50	21	13.7		
51 - 60	3	2 %	2	6.1%
61 -70	2	1.3%		
Total	153	100	33	100

Handedness was also measured for a possible relationship with injury occurrence. There was no statistically significant difference between the distribution of left, right and both handed (ambidextrous), for cases or controls.

Table 6.	Handedness	
	Controls	Cases
Left handed	5	2
Right or both handed	152	31
Total	157	33

When the categories were collapsed to left handed and right or both handed, the calculated Chi-square statistic remained insignificant. However, by calculating ψ, the odds ratio, which is defined as the ratio between the odds of exposure (in this case, being left handed) among cases and the odds of exposure among controls. If the odds ratio is greater than one, some evidence of association is concluded. Left handed people were found to be 1.96 times more likely to be cases than either right or both handed people (with a 95% confidence interval of 0.36 to 10.6). These figures indicate the possibility of some association between handedness and injury occurrence.

Three categories were used to measure the time taken off work as a result of injuries; days in hospital, days off farm work and days working at restricted capability (see Table 7). These categories are not mutually exclusive.

The enterprise associated with the work being done at the time of injury was recorded. The results presented in Table 8 reflect the major type of activities being undertaken in the Armidale RLPB district. The second biggest category, "enterprise non-specific", includes injuries such as fencing, tractor related, horse handling and farm maintenance; all activities that are difficult to attribute exclusively to one enterprise.

Table 7. Time Taken Off Work as a Result of Farm Injuries	
N = 39	Average Number of Days
Days in Hospital n = 1 (2.6%)	1
Days off Work n = 16 (41.0%)	8.8
Days at Restricted Capability n = 30 (76.9%)	7.4

Table 8. Enterprise Associated With Work Being Done At the Time of Injury		
	Frequency	Percent
Enterprise non-specific	11	28.9
Cattle	10	26.3
Sheep	14	36.8
Horticulture	2	5.3
Other	1	2.6
Total	38	100

4.3 Hypotheses for Cases and Controls

Ten hypotheses concerning differences between cases and controls were tested. Due to the small sample size and age and sex distribution of cases and controls, a matched analysis with a 1 to 3 case/control ratio was not feasible. The results of the unmatched analyses are presented in the following subsections and tables.

a) H_o: **Cases have not attended fewer first-aid and safety training courses on average, than controls.**

Table 9. First-Aid and Safety Course Attendance		
Attendance	Controls	Cases
Yes	25 - 15.8%	3 - 10.3%
No	133 - 84.2%	26 - 89.7%
Total Number	158 100 %	29 100%

Attendance at first-aid courses or farm safety workshops or seminars since January 1986 was reported (see Table 9). With a critical Chi-square value of 3.84 (one degree of freedom) and a calculated Chi-square statistic for first-aid and safety course attendance of 1.78, the null hypothesis cannot be rejected at the 5 percent level.

b) H_o: The level of education achieved by cases is not on average, lower than that achieved by controls.

An interesting feature of Table 10 is the high representation of diploma/degree category in the cases, 39.4 percent, as opposed to 28.4 percent of controls.

Table 10.	**Level of Education**	
	Controls	Cases
Up to School Certificate or equivalent	57 36.8%	11 33.3%
Higher School Certificate or equivalent, or trade	54 34.8%	9 27.3%
Diploma, Degree or Post graduate	44 28.4%	13 39.4%
Total	155 100%	33 100%

With a critical Chi-square value of 5.99 (two degrees of freedom) and a calculated Chi-square statistic for education level of 1.65, the null hypothesis cannot be rejected at the 5 percent level.

c) H_o: Cases have not incurred more prior injuries, on average than controls.

Any serious, or less serious injuries relating specifically to farm work, that occurred before July 1990 were recorded (see Table 11). A serious injury was defined as any injury "resulting in permanent disfigurement, pain or discomfort lasting more than one year or causing permanent disability, including the loss of part of the body". Less serious injuries were defined as any injury that restricted usual activities for one day or more.

Table 11.	**Serious and/or Less Serious Previous Injury**	
	Controls	Cases
No Previous Injuries	54 - 34.2%	7 - 21.2%
Either a Serious or Less Serious Injury	73 - 46.2%	21 - 63.6%
Both	31 - 19.6%	5 - 15.2%
Total Number	158 100 %	33 100 %

The previous injury categories were collapsed into one category to calculate a Chi-square variable. With a critical Chi-square value of 3.84 (one degree of freedom) and a calculated Chi-square statistic for prior injuries of 0.24 the null hypothesis cannot be rejected at the 5 percent level.

However the odds ratio was calculated as $\psi = 1.93$ with a confidence interval of 1.27 to 4.76. This indicates some positive relationship between previous injury and injury occurrence.

d) H_o: Cases will not have more pre-existing medical conditions (that either impair mobility, reduce alertness or sensory acuity), than controls.

Respondents were asked whether they had any of the health or medical problems reported in

Tables 12 to 18, over the five years from 1985 to 1990, that had been diagnosed by a doctor or other health care provider. The null hypothesis was not rejected for any of the seven conditions considered, suggesting that there is little difference between cases and controls with respect to these pre-existing medical conditions.

Table 12.	Chronic or Periodic Pain in any part of the Body	
	Controls	Cases
Yes	65 - 41.1%	15 - 45.5%
No	93 - 58.9%	18 - 54.5%
Total Number	158 100 %	33 100 %

With a critical Chi-square value of 3.84 (one degree of freedom) and a calculated Chi-square statistic for chronic pain of 0.07, the null hypothesis cannot be rejected at the 5 percent level. The odds ratio, $\psi = 1.19$ with a confidence interval of 0.54 to 2.59 also suggests little difference in the effect of chronic or periodic pain between cases and controls.

Table 13.	Heart-related Problems	
	Controls	Cases
Yes	10 - 6.3%	0
No	148 - 93.7%	32 - 100%
Total Number	158 100 %	32 100 %

No statistic was calculated as no "heart-related problems" cases were recorded.

Table 14.	High Blood Pressure	
	Controls	Cases
Yes	22 - 13.9%	2 - 6.3%
No	136 - 86.1%	30 - 93.8%
Total Number	158 100 %	32 100%

With a critical Chi-square value of 3.84 (one degree of freedom) and a calculated Chi-square statistic for high blood pressure of 0.81, the null hypothesis cannot be rejected at the 5 percent level. This is reinforced by the odds ratio of $\psi = 0.41$ with a confidence interval of 0.09 to 1.86.

Table 15.	Asthma or other Respiratory Problems	
	Controls	Cases
Yes	15 - 9.5%	2 - 6.3%
No	143 - 90.5%	30 - 93.8%
Total Number	158 100 %	32 100 %

With a critical Chi-square value of 3.84 (one degree of freedom) and a calculated Chi-square statistic for asthma of 0.06, the null hypothesis cannot be rejected at the 5 percent level. The odds ratio, $\psi = 0.64$ with a confidence interval of 0.14 to 2.94

Table 16.	Arthritis	
	Controls	Cases
Yes	28 - 17.7%	5 - 15.6%
No	130 - 82.3%	27 - 84.4%
Total Number	158 100 %	32 100 %

With a critical Chi-square value of 3.84 (one degree of freedom) and a calculated Chi-square statistic for arthritis of 0.0008, the null hypothesis cannot be rejected at the 5 percent level. The odds ratio, $\psi = 0.86$ with a confidence interval of 0.3 to 2.48

Table 17.	Vision Problems That Are Not Corrected With Lenses	
	Controls	Cases
Yes	9 - 5.7%	1 - 3.1%
No	149 - 94.3%	31 - 96.9%
Total Number	158 100 %	32 100 %

With a critical Chi-square value of 3.84 (one degree of freedom) and a calculated Chi-square statistic for vision problems of 0.03, the null hypothesis cannot be rejected at the 5 percent level. The odds ratio, $\psi = 0.53$ with a confidence interval of 0.21 to 13.74.

Table 18	Hearing Problems	
	Controls	Cases
Yes	35 - 22.2%	6 - 18.8%
No	123 - 77.8%	26 - 81.3%
Total Number	158 100 %	32 100 %

Hearing screening tests for farmers (Clarke and Challinor 1991, p8) have found that 71.9 percent of all farmers tested have significant noise induced hearing loss (NIHL) and 25.9 percent have severe to profound hearing loss. As Clarke and Challinor (1991) point out, those farmers with mild to moderate hearing loss are often unaware of their hearing defect. This observation casts doubt on the usefulness of self-reporting for hearing problems and it is likely that those responding in the affirmative for hearing problems are the severe and profoundly affected NIHL farmers.

With a critical Chi-square value of 3.84 (one degree of freedom) and a calculated Chi-square statistic for hearing problems of 0.04, the null hypothesis cannot be rejected. The odds ratio, $\psi = 0.8$ with a confidence interval of 0.23 to 2.73

e) H_o: **On average, cases will not have a higher weight/height ratio than controls.**

Respondents average weight for the twelve months to June 1991 was recorded, along with their height. The Commonwealth Department of Health has a table of acceptable weights-for-height. While the boundaries of acceptable weight/height ratios are not linear relationships (the acceptable ratio increases gradually with height), "acceptable" minimum and maximum ratio values can be identified.

Table 19.	Weight/Height Ratios (kg/cm)	
Ratio	Controls	Cases
Up to 0.50	121 83.4%	32 97.0%
Greater than 0.50	24 16.6%	1 0.3%
Total Number	145 100 %	33 100 %

Weight/height ratios were calculated in terms of kilograms per centimetre, and these values ranged from 0.28 to 0.69. The mean weight/height ratio for controls was 0.445 (SD = .065) and for cases was 0.436 (SD = 0.038).

Using the maximum acceptable ratio, 0.5 as the division, the weight/height readings were collapsed into two categories. With critical Chi-square values of 0.000982 and 5.02, and a calculated Chi-square statistic for weight/height ratio of 4.02, the null hypothesis cannot be rejected at the 5 percent level.

The direction of correlation displayed within the sample actually revealed a lower proportion of cases than controls over the maximum acceptable ratio. This could be attributed to the small sample size or the possibility that obese respondents do not carry out many of the activities that put them at risk of injury.

f) H_o: **Cases will not have had less daily sleep, on average, than controls.**

Table 20.	Average Daily Hours of Sleep	
	Controls	Cases
4	1 - 0.6%	0
5	3 - 1.9%	0
6	14 - 9.0%	5 - 15.2%
7	41 - 26.3%	9 - 27.3%
8	77 - 49.4%	15 - 45.5%
9	20 - 12.8%	4 - 12.1%
Total Number	156 100 %	33 100 %
Mean	7.6 (SD = 0.93)	7.55 (SD = 0.9)

The average number of hours of sleep per night for the twelve months to June 1991 was recorded. With a critical Chi-square value of 11.1 (five degrees of freedom) and a calculated Chi-square statistic for average hours of sleep of 3.78, the null hypothesis cannot be rejected at the 5 percent level.

g) H_o: Cases will not exhibit a higher average score on a sleep disorder scale than controls.

A sleepiness scale developed by Johns (1991) at the Epworth Hospital Sleep Disorders Unit, is used to measure the potential for sleep disorders such as obstructive sleep apnoea syndrome. It is called the Epworth Sleepiness Scale (ESS). These disorders result in daytime sleepiness and consequently reduced alertness. Eight alternative scenarios were put to the respondent and were rated according to how likely they would be to doze off in each situation. The response for each scenario was scored from zero to three, zero if they would never doze, up to three if they would have a high chance of dozing. The normal range of ESS scores is from 2 to 12. The mean score within a group of 104 "healthy" medical students was 7.6 (SD = 3.9)(Johns pers comm 1991).

Table 21. Epworth Sleepiness Scale

	Controls		Cases	
0	6	3.9%	1	3.0%
1	5	3.2%	1	3.0%
2	13	8.4%	4	12.1%
3	11	7.1%	3	9.1%
4	22	14.2%	3	9.1%
5	5	3.2%	3	9.1%
6	14	9.0%	1	3.0%
7	9	5.8%	2	6.1%
8	10	6.5%	4	12.1%
9	13	8.4%	4	12.1%
10	13	8.4%	1	3.0%
11	8	5.2%	3	9.1%
12	10	6.5%	1	3.0%
13	7	4.5%	1	3.0%
14	3	1.9%		
15	2	1.3%		
16	1	0.6%		
17	3	1.9%		
19			1	3.0%
Total	155	100%	33	100%

The controls' mean sleepiness score was 7.03 (SD = 4.17) while the cases' mean score was 6.67 (SD = 4.15). It is interesting to note that the mean score of cases is slightly lower than that of the controls, which is contrary to expectations. However there is no significant difference between the two means, therefore the null hypothesis cannot be rejected.

h) H_o: Cases will not exhibit a higher average stress level score than controls.

Table 22. Perceived Stress Scale (PSS)		
	Controls	Cases
Minimum Value	3	12
Maximum Value	45	34
Mean	19.86	20.89
Standard Deviation	7.21	5.7
n =	154	28

The Perceived Stress Scale (PSS) (Cohen, Kamarck and Mermelstein 1983) is based on a group of 14 questions measuring the perceived stressfulness of life during the last month. It has been used to determine whether "appraised" stress is a risk factor in behavioural disorders or disease. In the case of farm injuries, the hypothesis that stress levels may have some causal effect on injury occurrence is being explored.

The mean PSS score for the controls was 19.86 (SD =7.21) while the cases mean score was 20.89 (SD = 5.7). The score for cases is slightly higher but does not approach statistical significance. Therefore the null hypothesis cannot be rejected.

i) H_o: Cases will not have spent, on average, more hours per week farming and/or working than controls.

In an American farm injury study, Elkington (1990) concluded that the association between incurring a farm-work related injury and the total number of hours worked per week is only attributable to the number of hours worked on the farm, rather than the sum of farm and other work hours. She observed that an increase in the number of farm hours worked was associated with an increased risk of injury (p=0.002).

Table 23. Mean Hours Farm Work and Total Work - Per Week		
	Controls	Cases
Mean Hours Farm Work/week	37.6 (SD = 20.9)	45.8 (SD = 13)
Mean Total Work Hours/Week	48.8 (SD = 18.9)	52.7 (SD = 7.9)

In the pilot survey sample, the mean work hours for cases are higher for both farm work hours and for total work hours, however the standard deviations indicate that they cannot be concluded to be significantly different. A larger sample size such as planned for the main survey may achieve smaller standard deviations and allow a more definite inference to be made.

A mean deviance analysis of hours of farm work per week for cases and controls gave a mean deviance ratio with an F distribution, of 3.57. Where the critical value is $F_{1,186}(5\%) = 3.84$. While we cannot reject the null hypothesis, the ratio is approaching a significant value.

j) H_o: Cases will not have consumed greater quantities of alcohol on average, than controls .

Average weekly alcohol consumption was recorded in seven categories:

2 = did not drink
3 = didn't drink every week
4 = less than 5 standard drinks
5 = 5 to less than 14 standard drinks
6 = 14 to less than 21 standard drinks
7 = 21 to less than 35 standard drinks
8 = 35 standard drinks or more.

Table 24.	Alcohol Consumption			
	Controls		Cases	
2	30	19%	4	12%
3	30	19%	4	12%
4	25	16%	2	6%
5	48	32%	17	52%
6	16	10%	5	15%
7	5	3%	1	3%
8	2	1%		
Total	156	100%	33	100%

The mean alcohol consumption category was the same for cases and controls (category 4 i.e., less than 5 standard drinks per week SD = 1.48). As the means are not significantly different, we cannot reject the null hypothesis.

3.4 Cost of Injuries

Analysis of the incidence and causes of farm injuries in our market-driven society would not necessarily provide sufficient incentive for producers to change their work practices, or for governments to educate or regulate to achieve the same end. An awareness of the cost of injuries to individual producers and to the community, however, may supply an added economic inducement to initiate this action.

Using NSW workers' compensation data as an indicator, the annual average cost of injuries in Australian agriculture could be up to $400 million per annum (McCulloch 1991). One cannot treat this type of extrapolated cost estimate as reliable, but it does give some idea of the potential magnitude of the problem.

Medical Expenses

In the survey, insurance status was recorded for medical/health insurance (see Table 25) and for personal accident/income protection insurance (see Table 26). Nine of the 26 people with accident/injury insurance indicated that a claim was, or would be made, as a result of the injury.

Medical treatments were priced according to:

- the medicare fee schedule used during 1990/91,
- rates charged for workers' compensation cases where no medicare charge is applicable (accident and emergency services charge $45 basic fee, plus $45 for additional services such as physiotherapy, pathology, X-ray etc.), or
- professional body recommended fees, depending on whether they are provided by a

hospital or private medical service, for physiotherapy and chiropractic services.

Table 25. Health Insurance Status		
	Frequency	Percent
Private Health Insurance	23	63.9
Medicare	13	36.1
Total	36	100

The average cost of medical treatment for the sample was $56.25. This average includes 32 percent of cases whose injuries did not require any medical treatment other than first-aid. Calculating the average only for those who sought medical treatment, the cost is $82.20 per injury.

Table 26. Insurance for Accidental Injury/ Income Protection		
	Frequency	Percent
Workers Compensation	13	34.2
Personal Accident and/or Illness	11	28.9
Disability/Income Replacement Cover	1	2.6
Life Insurance Including Permanent Disability	1	2.6
No Insurance	12	31.6
Total	38	100

Transport Costs for Medical Treatment

Each round trip to visit medical treatment was costed at $0.2 per kilometre. This was the state government rate for reimbursing private cars used for work purposes during 1991. This rate is considered to compensate for fuel and vehicle maintenance cost for engines over 2700cc. The average cost of travel for treatment was $24.95 per injury.

Time Taken for Medical Treatment

While a dollar value is not being ascribed to this variable, there is an opportunity cost to the injured person for the time it takes to travel to the site of medical treatment, await consultation and be treated. This time has been calculated in the following way. For travelling time an average speed of 90 kilometres per hour has been assumed. For Accident and Emergency cases, an average waiting time of 45 minutes and average treatment time of 90 minutes was estimated. For other medical treatments average waiting and treatment times of 30 minutes each have been assumed.

Summing the travelling, waiting and treatment times results in an average time per injury of 2.8 hours. This average again includes the 32 percent who did not have treatment other than first-aid. Calculating the average only for those who sought medical treatment, the time estimate becomes approximately 4 hours per injury.

Extra Labour and/or Equipment Hire

Two out of 38 injuries required the hiring of extra labour (see Table 27). For one property, this cost was in the range of $101 to $500 and for the other in the range $1001 to $3000.

Table 27. How Victim's Work Was Handled		
	Frequency	Percent
The work waited	31	81.5
Employed extra	2	5.3
Family helped out	5	13.2
	38	100

Damage to Plant and Equipment

Damage to the following categories was included: buildings, machinery, livestock, plant and equipment, fences, stored produce, stored supplies, and crops. The only categories recording damage in the pilot survey were livestock (incurred a cost of $450) and fences (incurred a cost of $150).

Reductions in Farm Output

Respondents were asked whether the accident led to delays in any important farming operations, i.e., enough to identify some reduction in farm output such as a delay in drenching breeding ewes affecting lambing percentage, or a delay in harvesting a crop, thereby reducing the quality of the grain.

From the pilot survey, all of the injured respondents indicated that the accident did not lead to any significant delays. Many of the respondents commented that if the injury had occurred earlier, then costly delays would have occurred, but they seemed to happen toward the end of a job (e.g., shearing).

Overview

If all of the cost categories are summed on a "per injury" basis, then the average cost of an injury, as defined for the pilot survey, is $156.20 and 2.8 hours for travel, waiting and treatment time. Adjustments should be made to account for Medicare or private health insurance refunds when measuring private and community cost. This average cost is likely to be a significant underestimate as no fatalities or extreme injuries occurred in the population over the surveillance period. Even a single serious case would have large medical costs that would inflate the average. The chosen definition of injury also affected the average as relatively trivial (in terms of medical treatment required) injuries were included. Had the definition excluded these, the average cost would have risen markedly.

If the incidence and cost of injury described by the pilot survey is applied to the Armidale RLPB population, then the combined cost of medical treatment, travel for treatment, damage to property and increased labour costs for the 1990/91 financial year are estimated at $102,000. The combined travel, waiting and treatment time is in the order of 1,844 hours or 205 nine hour person/days. However, it should be noted that even one serious injury would boost these figures considerably.

5 Implications for Main Survey

Survey Design

The definition of injury used in the pilot survey questionnaire may have caused some bias in the incidence rates estimated. The two telephone interviewers felt that the "less serious" in the range of injuries included under the definition provided were considered by many of the respondents as trivial "everyday" occurrences that did not rate a mention and were an accepted occupational hazard. Consequently it was suspected that the majority of these "lesser" injuries were not declared.

One of the aims of the project is to obtain an estimate of the incidence of farm injury. However, if the real rate of incidence of injuries according to the original definition is going to be underestimated because of the non-reporting of less serious injuries, then it is worth redefining injury with a minimum injury more in keeping with farmers' perceptions. This should only have a marginal effect on the incidence rates recorded.

A prospective survey component is desirable to validate case/control differences with variables that may be altered by the injury (stress, sleep, weight, etc). They therefore need to be measured before injury occurs. The disappointing response to the prospective component of the pilot survey means that significant improvements should be made if this is to be included as a part of the main survey.

A reduction in the number of variables requiring data collection would decrease the time taken per interview and therefore increase the number of interviews per unit of cost. As many of the variables explored in the pilot survey seem to be associated with either small or no increase in risk, it would be preferable to identify more positively (by means of a larger sample) those identified in the pilot as being more likely to have a greater impact of the risk of injury.

An alternative injury data collection method would be to obtain agreement from respondents to participate by answering two-monthly phone calls. During these calls they would be asked a short series of questions about the types of farm-work activities undertaken in the preceding two months and then questions on several categories of injury that may have occurred. This should achieve better results because the more regular and detailed review of the work done would allow improved recall of injuries that have occurred.

While the hospitals agreed in principle to the recording of rural injuries, in practise reporting was sporadic, if at all. The location (postcode and RLPB) of the property on which the injury occurred often was not identified. This made it impossible to ascertain whether or not the injured person came from the population under study. If this type of supplementary data collection is included in the main survey, there would need to be some access to medical records. To be successful, the system should only require consent and access on the part of the hospitals.

Variables

The pilot questionnaire provided pre-specified, mutually exclusive response categories for some variables such as age, number of days off work and cost of extra labour. This was intended to help respondents who where reluctant to, or unsure about giving an exact response. Continuous response options should be considered however, as they provide more detailed information and more accurate statistical measures.

A weight/height ratio was used to test whether heavier people (relative to height) might be less agile or have slower reflexes making them more prone to injury. A more standard measure used in medical studies is called the body mass index (BMI).

The formula for body mass index is;

$$BMI = \frac{weight}{height^2}$$

This measure will be used in the main survey.

6 Conclusion

The pilot survey revealed an incidence of 24.4 injuries per hundred farms for the Armidale RLPB district. With a predominance of grazing industries in the district, sheep and cattle handling or mustering related injuries comprised over 60 percent of those recorded.

A significant difference between the distribution of age of cases (injured farm workers) and controls (uninjured workers) was identified. Cases were more heavily represented in the age groups up to 49 years, suggesting that those under this age, especially in the 20 to 29 year group, are at greater risk of injury.

Left handed people were found to be 1.96 times more likely to be cases than either right or both handed people.

A comparison of weight/height ratios between cases and controls revealed figures contrary to expectations, with a lower proportion of cases than controls over the maximum acceptable limit. Further exploration of this area using body mass index as the variable should help to clarify any link on injury occurrence.

Another variable exhibiting results contrary to expectations was the Epworth Sleepiness Scale. The difference in the means however, (cases had marginally less daytime sleepiness than controls) was not statistically significant.

The distribution between cases and controls of mean hours of farm work was approaching statistical significance. Cases had a higher mean farm work hours per week than did controls. Larger sample sizes should help to identify any relationship more clearly.

Those variables tested but not mentioned in this section did not display any statistically significant measures of difference between cases and controls.

Consideration of the pilot survey results leads to the recommendation of several methodological features for inclusion in the main survey. The use of a telephone questionnaire is one component that proved its efficiency ahead of the mail questionnaire in the pilot. A reduction in the number of variables under study would allow a larger sample size. This would enable more confident inferences to be made about those variables identified by the pilot and other research as contributors to risk of injury. An increased number of telephone call-backs to collect better injury data is also required.

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