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# THE INCIDENCE AND COST OF FARM INJURIES

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## 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 that will enable community driven Occupational Health & Safety (OH&S) programs for the farm population to be established and to promote farm safety." (Clarke 1991,10).

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

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

In undertaking these functions the FSAGs sought information on farm occupational safety in Australia 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. A farm-based injury survey is the major component of the project.

The purpose of this paper is to present an analysis of the first six months data from the 18 month surveillance period. The incidence of farm work-related injuries is one of three main areas of interest. The analysis of factors that may increase and individual's risk of injury is another. The third area of interest is the cost of injuries to producers and the industry.

### Survey Design

A pilot survey was carried out over 1990-91 in the Armidale Rural Lands Protection Board District. Low et al (1992) presented the results of this pilot survey. The main survey is a cross-sectional study that combines retrospective and prospective observation. The data collected cover a period of 18 months from January 1992 to July 1993. Collection started in July 1992, retrospective for the first six months, then prospective for the remaining 12 months. At the time of writing, data collection was still in progress and the following analysis is based on the six months to June 1992.

Table 1. The Value of Agricultural Production by Shire			
COMMODITY	COMMODITY AS A PROPORTION OF THE VALUE OF TOTAL SHIRE AGRICULTURAL PRODUCTION		
	YALLAROI (%)	GILGANDRA (%)	CARRATHOOL (%)
Wool	11.3	41.1	35.0
Sheep meat	0.5	2.5	1.3
Beef Cattle	18.5	12.8	7.5
Wheat	29.3	27.0	20.0
Total	59.6	83.4	63.9
Total Value of Shire Production (\$Millions)	\$79.080M	\$48.879M	\$105.486M
* Regional value of Agricultural commodities - Agricultural Census Data Australian Bureau of Statistics 1990-91			

The EFSAA project focuses on the sheep/wool, beef cattle and traditional dryland broadacre cropping industries. Three shires in the NSW Wheat/sheep belt, Yallaroi, Gilgandra and Carrathool were chosen to reflect this focus, and although samples were not taken from the entire population, the three shires

The map displays the Shire of Murrumbidgee, which is divided into several local government areas (LGAs). The central and northern parts of the shire are predominantly rural, with numerous small LGAs. The southern part of the shire is more densely populated, including the city of Wagga Wagga and the town of Albury. The Murrumbidgee River is shown flowing through the eastern part of the shire, and the Snowy Mountains are visible in the north-east. A scale bar at the bottom indicates distances in kilometers and miles.

A proportionate stratified random sample, stratifying by shire, was the sample design chosen, because of interest in any difference that may exist in injury rates between areas (shires). Each council's rural rates list was used as the population sampling frame. As people may own several rural rates listings as part of one farming operation, shire rates lists do not provide an accurate estimate of the number of farms in the shire. The actual number of farm businesses per shire is a matter of some conjecture, mainly centred on the definition used. The Australian Bureau of Statistics (ABS) Agricultural Census Data provide one estimate (see Table 2).

Their definition, however, only includes farms with a gross annual value of production greater than \$20,000 (for the period 1990-91). Even if those farms with a gross annual value of production less than this increased the ABS estimate by 10 percent, the samples achieved in this survey would still provide greater than 80 percent coverage of each shire's farm businesses.

Properties were selected by generating a random number list sufficient to achieve the required sample, given the expected response rate. The rural rates lists were numbered, and properties corresponding to the random number list were drawn. The farm business represented by that listing was defined as all the land owned, managed, farmed or share-farmed by the respondent in that shire. Where properties bordered another shire, these were all included for ease of reporting.

Telephone interviewing was chosen as the mode of data collection, having achieved a significantly higher response rate in the pilot survey than the mail questionnaire. Before starting the telephone interviews, each sampling unit (registered owner of a selected rural rates listing) was sent an introductory letter that briefly advised of the impending phone call and explained its purpose. A media campaign was also undertaken in each shire in the week before interviewing. Prominent local producers were lobbied to attend a meeting in support of the survey. These gatherings were reported on local television news, local newspapers and radio, and ABC regional radio.

The adjusted response rate (i.e., those who participated divided by those who were approached and identified as eligible) was 83.5 percent. The significant increase in response rate from the telephone component of the pilot survey (68.2 percent) was partly attributed to the support shown by prominent local producers and to the publicity campaign.

Each sampling unit completed sections of the questionnaire on property and personal information. If an injury was reported that satisfied the definition and had occurred on the property in the six months to June 1992, a third section relating specifically to that injury was also completed. For the purposes of the survey an injury is defined as where any of the following occurred as a result of farm work:

- usual activities are suspended for one day or more,
- usual activities are restricted for five days or more (cannot work at the same pace or with the same ease as usual) or
- professional medical care is sought.

At the time of the interview, respondents' co-operation was sought to record injuries in the farm diary if they kept one. Any injuries could then be related to interviewers when they called back at four-monthly intervals, during the prospective phase.

All of the 125 injuries on which information was available are used in estimates of the incidence of injuries, a profile of injury characteristics and the assessment

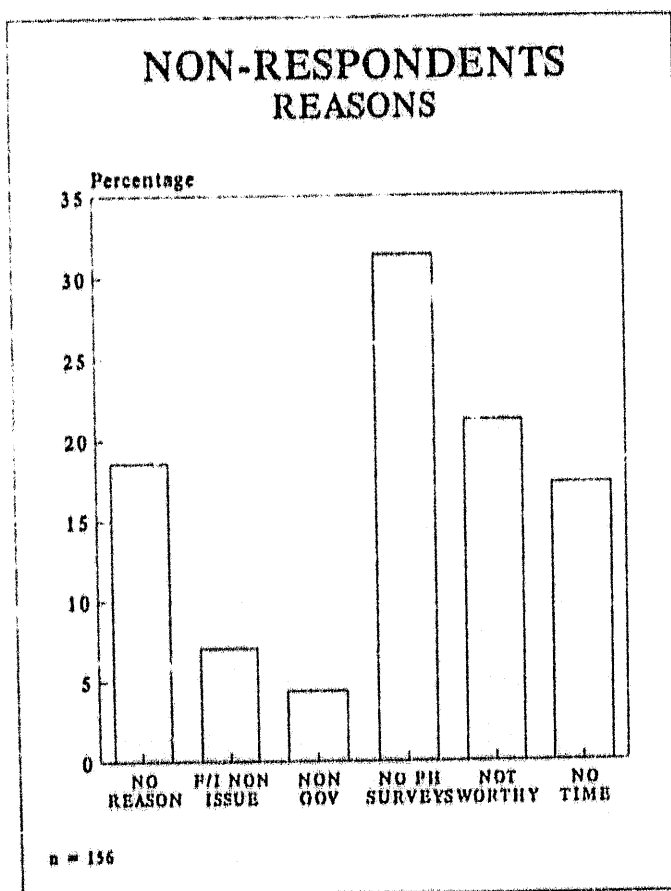
of the costs of injury. However only a subset of all the injuries were appropriate to include in the case-control analysis.

A case-control analysis of farm injuries was used to identify the major risk factors (i.e., attributes such as age or farm work experience), that may increase the risk of sustaining a farm work-related injury. Cases were those reporting an injury during the period of observation and controls were those initial respondents participating from properties that did not report any injuries. As the controls were all initial respondents, (i.e., owner/operators, managers or the person who has the most to do with the day-to-day running of the property), they form a subset of the farm population. Consequently it was only valid to use data from cases who were also initial respondents. This analysis uses 76 cases and 835 controls.

### Non-respondents

To try and identify any non-response bias that may have occurred, people who were approached and were eligible to do the survey but chose not to participate were asked why they did not wish to do so. If they didn't volunteer a reason they were provided with a range of response choices. Replies were obtained for 156 of the 187 non-respondents. These are presented in Figure 2.

FIGURE 2



The most common non-response reason chosen (31 percent) was that the person did not wish to participate in any telephone interviews. Many respondents commented on the frequency of telephone surveys, by market research agencies, university studies and government bodies. That the subject was not worthwhile or that they didn't have time, were two other common responses with 21 and 17 percent. Nineteen percent of non-respondents did not give a reason. The final two categories with 7 and 4 percent were that farm injuries were not an issue and that it was not appropriate to have government involvement.

The two responses showing a negative attitude towards the research, that farm injuries are not an issue and that this type of research is not worthwhile combined to 28 percent of non-respondents. Considering the large sample size in relation to the total population, the response rate of 83.5 percent and the range of non-response reasons, no indication of non-response bias is given. However, it is possible that it has occurred, and if so, would most likely result in an underestimate of injuries. That is, people would be more likely to not participate in the survey if they had experienced an injury on their property, than if they had not experienced any injuries.

### Incidence of Injuries

The rate of injury reported for the first six months of 1992 varied among shires. These rates can be seen in Table 2. None of the injuries were reported were fatal, and only eight resulted in anything more than a temporary disability. The incidence of injury estimate for the pilot survey was 24.4 percent per year. Several differences in methodology between the pilot and this survey make direct comparisons questionable.

Table 2. Incidence of Injury by Shire for the Six Months to June 30 1992			
	No. of farm businesses ABS Ag Census 1990-91	Actual Sample Size	Percentage of Farms Reporting > = 1 Injury
Yallaroi	331	305	14.1
Gilgandra	382	353	12.5
Carrathool	286	289	9.0
		947	11.9

The recall period for the pilot survey was 12 months. As the optimum accurate recall period for injuries is 6 months, the pilot survey incidence is likely to be underestimated. Also, the pilot survey was conducted in the Northern Tablelands of New South Wales, which does not share all of the production

characteristics of the Wheat/sheep belt. As the incidence of injuries varies among enterprises, this would also affect a comparison of the injury rates recorded. Extrapolating the main survey's six months data to an annual rate would also mean ignoring the possibility of the seasonality of injury occurrence. Despite these reservations the extrapolated annual incidence would be 23.8 percent of farms reporting one or more injuries, which is close to the pilot survey's annual rate of 24.4 percent.

### **Profile of Injuries**

The purpose of classifying injuries by a range of related variables is to identify variations in the incidence and severity of injury over different values of these variables. The more clearly the types of injuries occurring can be defined, the better equipped farm OH&S workers are to devise and focus preventative strategies.

As this data set covering six months includes only 125 injuries cell values can become small quite quickly when cross classifying. Consequently, only the more notable (apparent) relationships will be discussed. When the project data collection is completed and another 12 months data are available, relationships relevant to injury analysis should be more easily identified.

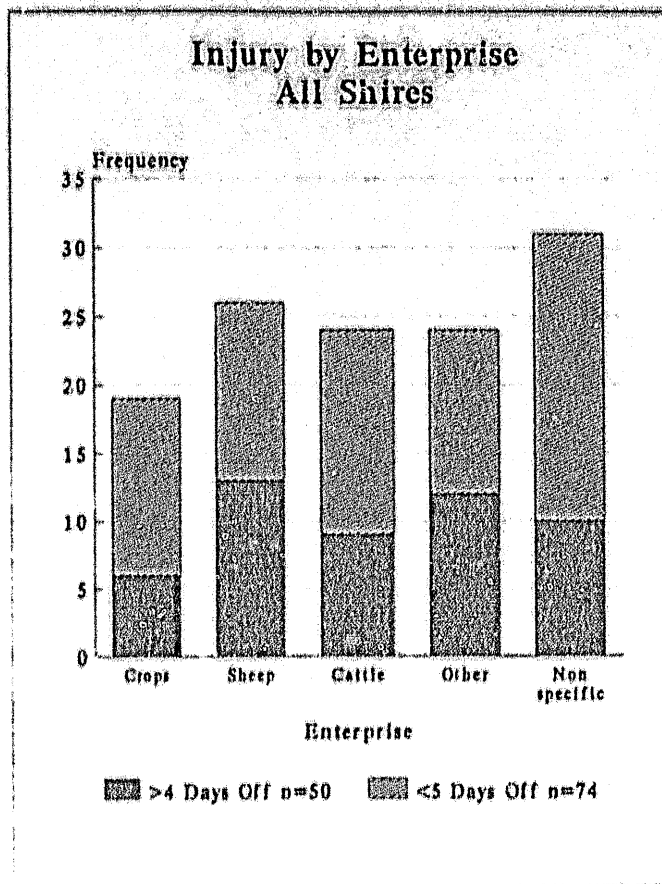
North West Plains Rural Injury Prevention Program (RIPP) data is used as a comparison for some variables. RIPP data includes only hospital accident and emergency (A&E) presentations, so the distribution of injuries is likely to be more serious on average than the survey data. It may also be a more narrow range of injury types, as it excludes injuries treated by health professionals other than A&E.

### **Enterprise**

The agricultural activities under scrutiny in the survey were sheep/wool, beef cattle and conventional broadacre cropping. Any injuries reported were classified on the basis of the work that was being done at the time of the injury. If the work related directly to one of the three activities mentioned it was classified accordingly. Where the work related to a specific enterprise, but was not one of the three areas of interest, the enterprise classification was "other". Injuries that occurred while doing work that wasn't wholly attributable to one enterprise were classified in the "non-specific" category.

Within each shire, the distribution of injury by enterprise type generally reflected the distribution of total production for that shire. Figures 3 to 6 show a comparison of the distributions of injury by enterprise for those requiring less than 5 days off work ("less serious") and those requiring 5 or more days off work ("more serious") injuries.

FIGURE 3



### Injury by Enterprise Over 3 Shires

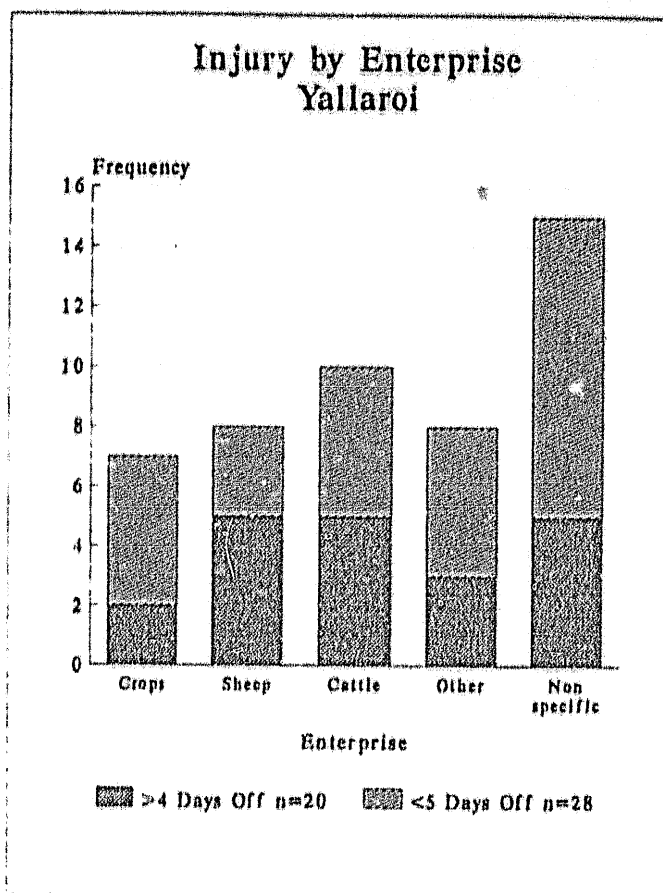
The combined distribution of injuries over the three shires confirms that farm work related injuries are not particular to any one enterprise. The distribution of more serious injuries among enterprises is fairly evenly divided over the 5 categories. Non-specific injuries form the largest category of all. This reflects the common nature of many activities on mixed farming operations. For example, the maintenance of farm vehicles and buildings, or weed control and pasture improvement that might relate to several stock enterprises fall into this category.

Sheep related injuries form the second largest category overall, and the largest if considering only the more serious injuries. The Cattle and Other enterprise categories shared the next highest frequency of injury. However, the more serious injuries comprised a slightly lower proportion of the cattle related injuries than they did for Other injuries. Cropping was the smallest category over all, with approximately one third of injuries falling into the more serious category.

### Yallaroi

The notable feature of Yallaroi's injury by enterprise distribution (see figure 4) is that the non-specific category is by far the largest when comparing all injuries. It is comparable to the other categories if looking at the more serious injuries. Commonly reported other enterprises included cotton, peas and other legumes, pigs and pecans.

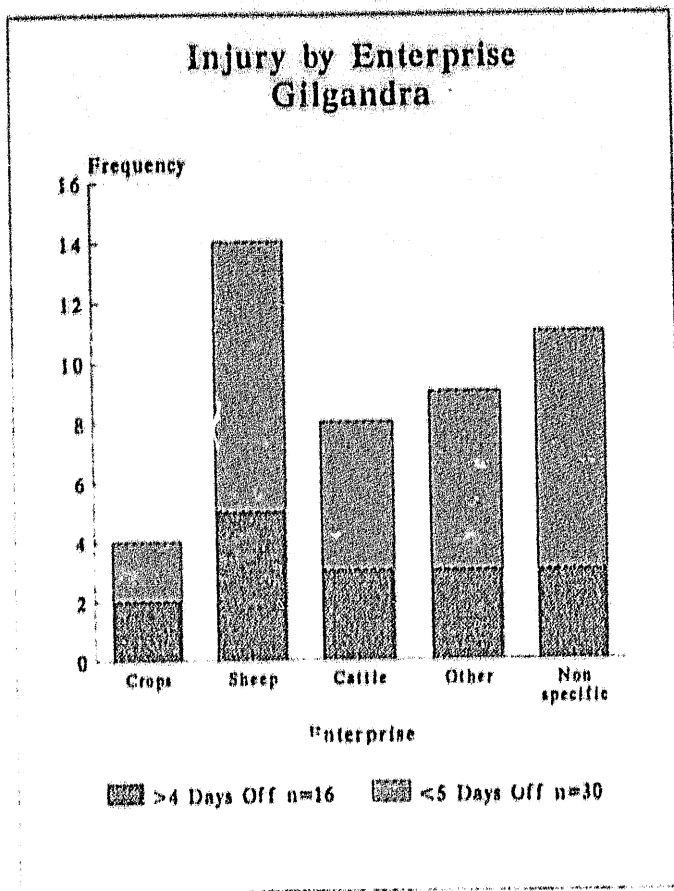
FIGURE 4



### Gilgandra

The distribution of Gilgandra's injuries by enterprise (see figure 5) clearly shows sheep related injuries to be the major category, for all injuries and also for the more serious injuries. This is not surprising, as sheep products combine to make up 43.6 percent of the value of agricultural production for Gilgandra in the 1990-91 year (ABS Agricultural Census Data 1992). Other enterprises reported by Gilgandra farms were hay production, peas and other legumes, pigs, deer and horses.

FIGURE 5



### Carrathool

In contrast to the other shires, crop enterprise related injuries are the largest injury category for Carrathool (see figure 6). However, 75 percent of the crop related injuries are in the less serious category. Other enterprise related injuries form the next largest contributor to injuries, with 85 percent falling into the more serious type. The more common other enterprises reported in Carrathool were rice, peas and other legumes, pigs, cotton and hay production.

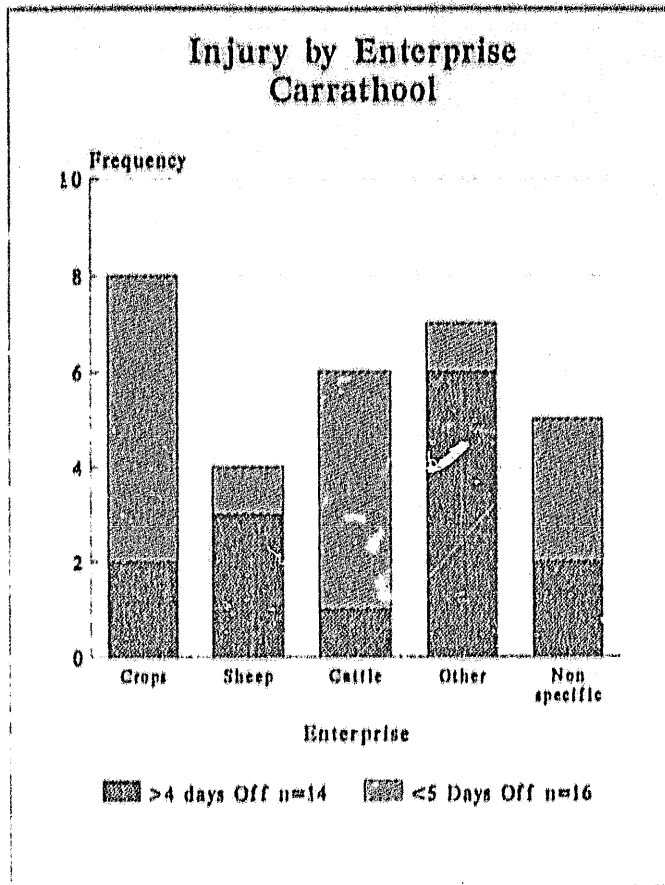
### Time of Day

The time of day that the injury occurred was recorded for 116 cases (see figure 7). Between two and five p.m. was the most frequent time category for injury occurrence, followed by eleven a.m. to two p.m., then eight to eleven a.m.

As these categories are within customary work hours, it follows that the exposure levels will be higher at these times. The increase in injury rate as the day wears on could be a reflection of increasing likelihood of tiredness and concentration lapses. It could also be related to body cycles where many people experience a "low" during the early afternoon.

The pattern indicated conforms to farm injury data from RIPP.

FIGURE 6



### Location

Collecting information about where injuries occur will help to identify the high risk locations. The most frequent site of injuries was the farm workshop or shed, closely followed by the pasture paddock (see figure 8). The cultivated paddock, stockyards and shearing shed were the next most common locations.

Almost half of the injuries occurring in the farm workshop or shed were associated with the non-specific enterprise category. For those occurring in a pasture paddock, the distribution of enterprise types was fairly even excluding "crops", which only reported one injury with a pasture paddock location.

FIGURE 7

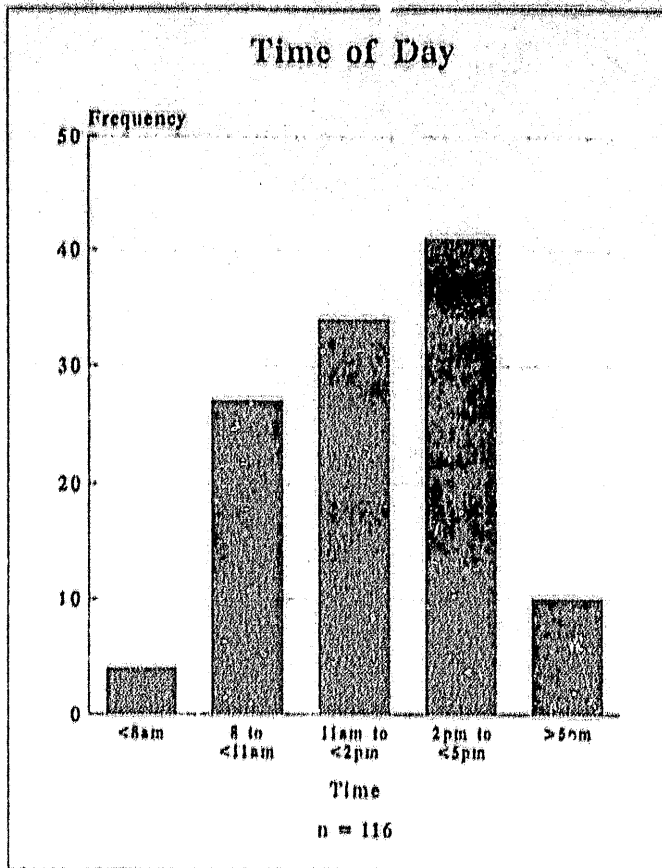
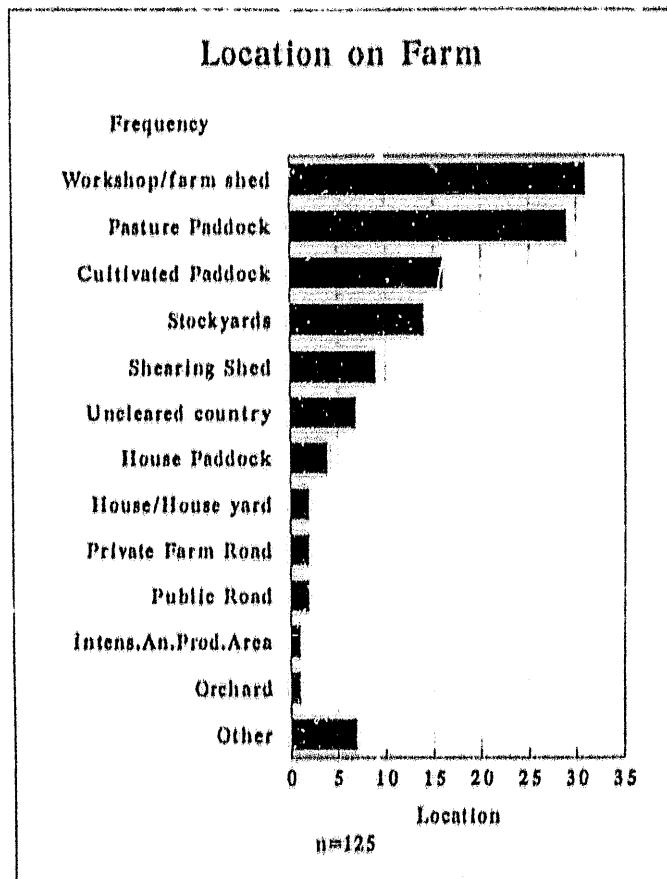


FIGURE 8



### Alone

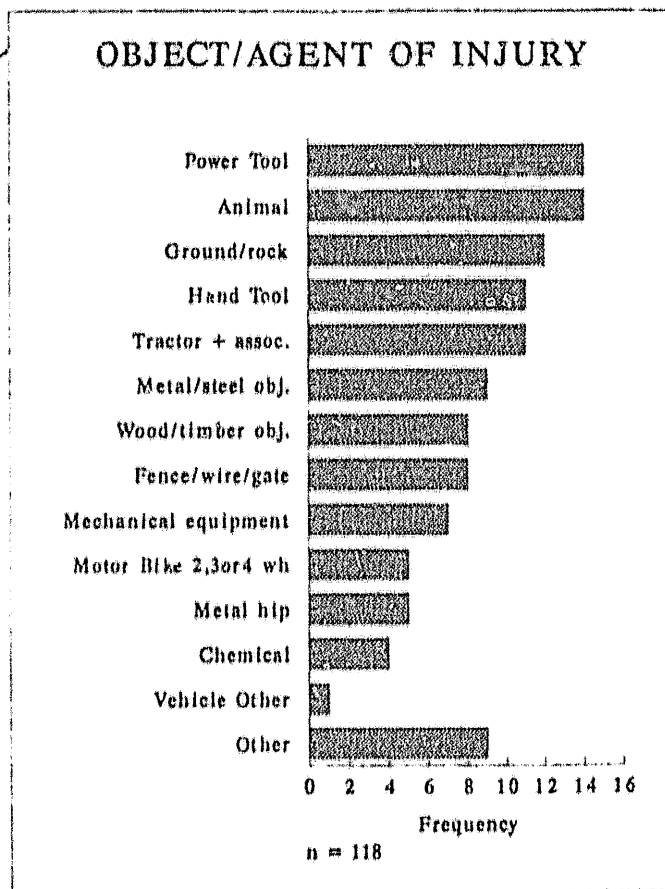
Of particular concern with farm work related injuries, especially in the more serious cases, is whether assistance is close at hand. Many farmers carry out tasks by themselves, away from the house or any form of communication. Of the 125 injuries on which data were obtained, 51.2 percent were alone when the injury occurred (i.e., without anyone in the immediate vicinity to find or assist the injured person in a short time).

### Object/Agent of Injury

The categories used to classify the object or agent of injury are many and broad. There are innumerable objects/agents eligible within each category. Classifying injuries in this way initially will only identify high risk categories. Further analysis and larger samples will be necessary to single out individual objects.

Power tools and animals share the highest frequency for object or agent of injury (see figure 9). The next three most frequent response categories are the ground, hand tools, and tractors and associated equipment.

FIGURE 9

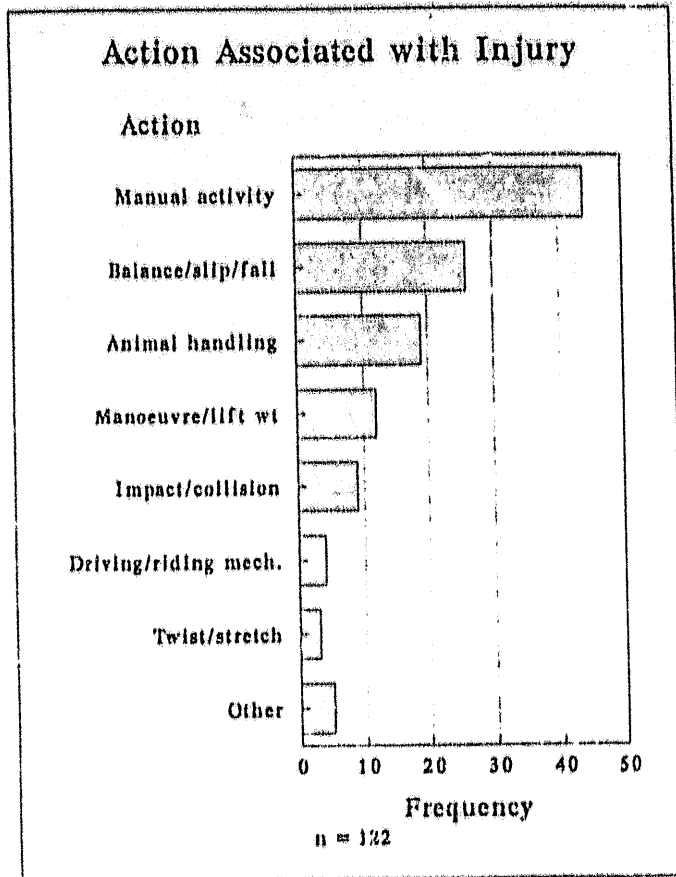


### Action Associated with Injury

The categories for action associated with injury can be seen in figure 10. Manual activity, (i.e., the majority of bodily movement or manipulation associated with the hands) was the most common type of action. This result corresponds with two prominent categories in agent of injury, power tools and hand tools. Balance related, or slip/fall incidents were the next most common,

followed by animal handling activities. These include riding horses, yardwork with sheep and cattle, shearing or crutching and slaughtering.

FIGURE 10



#### Nature of Injury

A wide range of groupings exists for nature of injury, but two categories, cut/laceration and sprain/strain, combined to make up 51.2 percent of injuries (see figure 11). Other significant injury types were "fractures", "bruising", "crushing" and "foreign body in soft tissue".

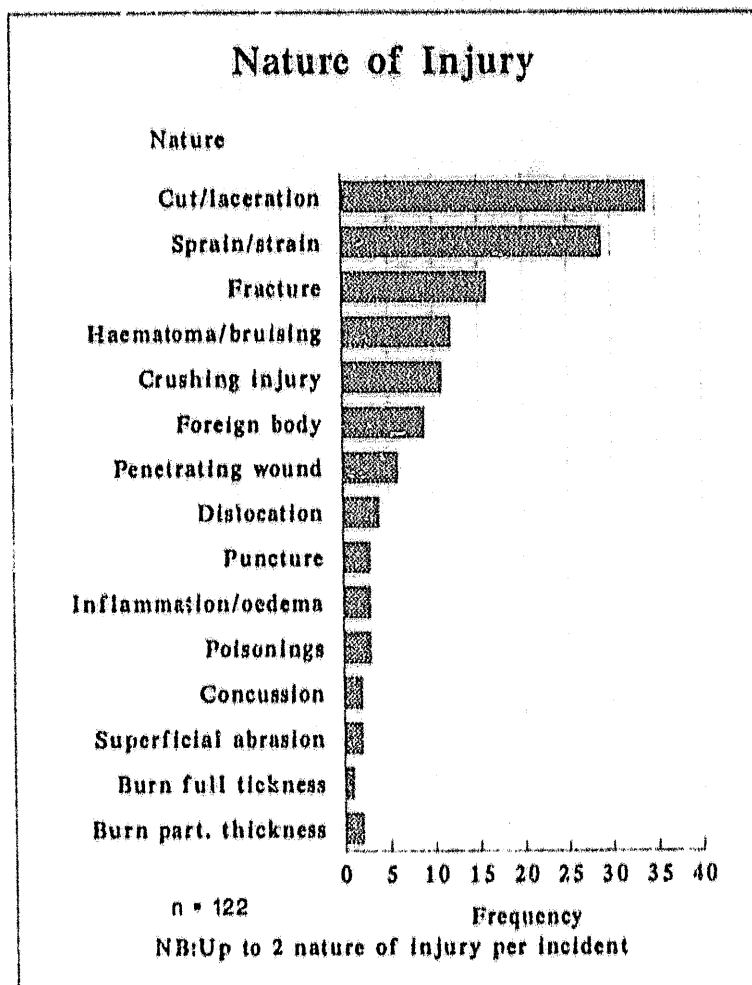
#### Bodily Location of Injury

The upper extremities, or shoulders, arms and hands were the most common body site for injury (see figure 12). Almost half of these injuries were cuts or lacerations. The next most common body area for injuries was the lower extremities, or hips, legs and feet. Cuts/lacerations and strain/sprain injuries each made up 21 percent of this category. The head was the third most common site of injury. Of this category, 34 percent resulted from a foreign body in soft tissue (often the eye). Another notable association for head injuries was that 37 percent were in the enterprise non-specific category, and 44 percent

occurred in the 2 - 5pm time slot. The trunk was almost as common a site of injury as the head and strain/sprain comprised 69.6 percent of trunk injuries. Only 2 digestive tract injuries were reported.

This distribution approximately reflects that of the RIPP data with one exception. The "trunk" category is significantly larger in the survey data relative to the other categories.

FIGURE 11



### Days in Hospital

The average number of days spent in hospital as a result of injury was 1.9. However, 102 of the 125 injuries were not admitted to hospital (see figure 13). The average length of stay over the 23 injuries that were admitted was 10.3 days. The most common location for those injuries hospitalised was the pasture paddock (34.8 percent), while cattle was the enterprise most often associated, also 34.8 percent.

FIGURE 12

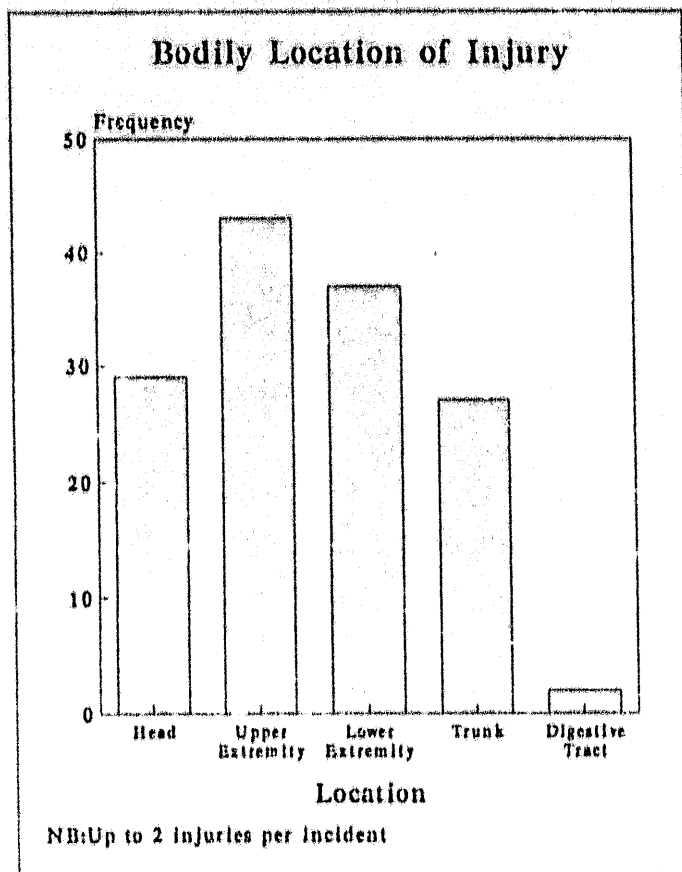
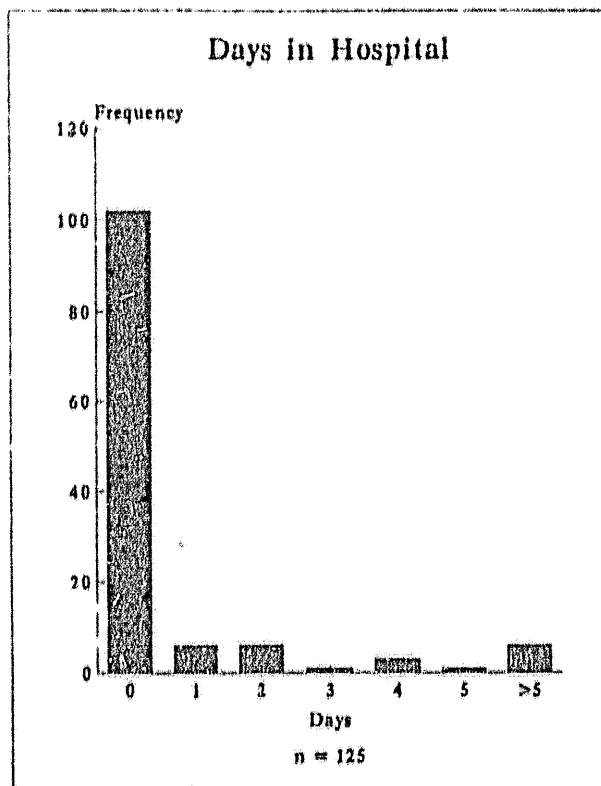


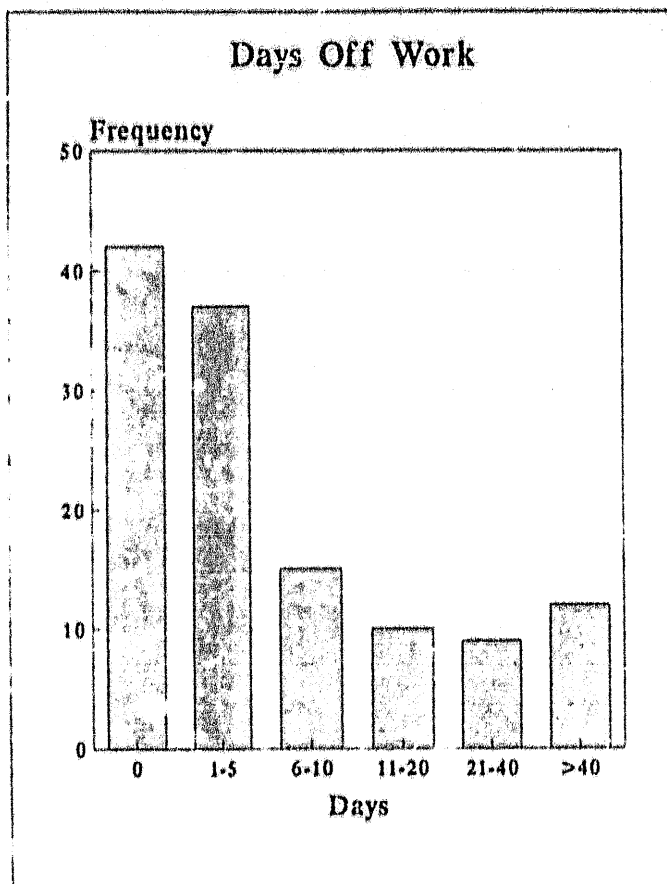
FIGURE 13



### Days Off Work

Of the 83 injuries that required time away from work, the average number of days off was 20.5. From 1-5 days was the largest category within this group, being 44.6 percent of those taking days off work. The distribution of days off work can be seen in figure 14.

FIGURE 14



### Days at Restricted Capability

Restricted capability was defined as when a person was unable to work at the same pace or with the same ease as usual. The average number of days for the 82 injuries that reported one day or more working at restricted capability was 26.7. The distribution of days working at restricted capability can be seen in figure 15.

### How Victim's Work Was Done During Their Incapacity

For the majority of reported injuries (50 percent), the work waited until the victim was able to return to it (see figure 16). Four other alternatives comprised the remaining 50 percent, existing staff working longer, employing extra staff, family and friends helping out, and "other".

FIGURE 15

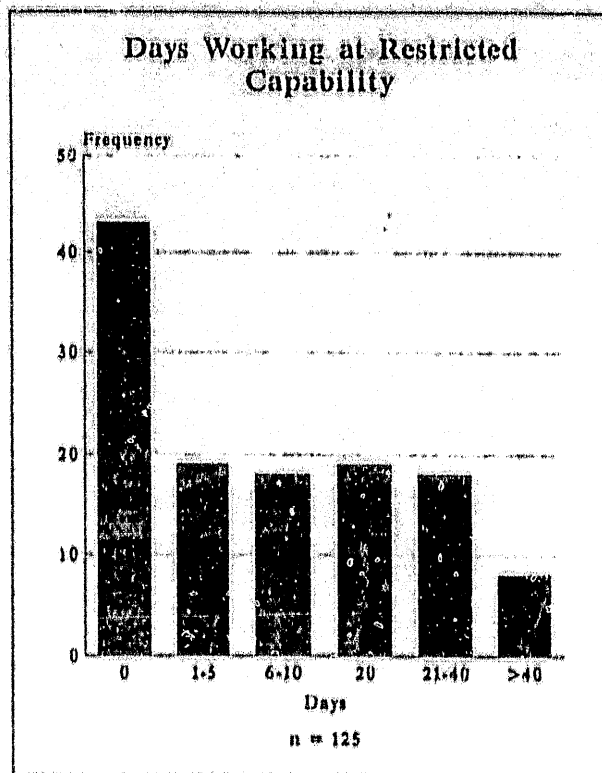
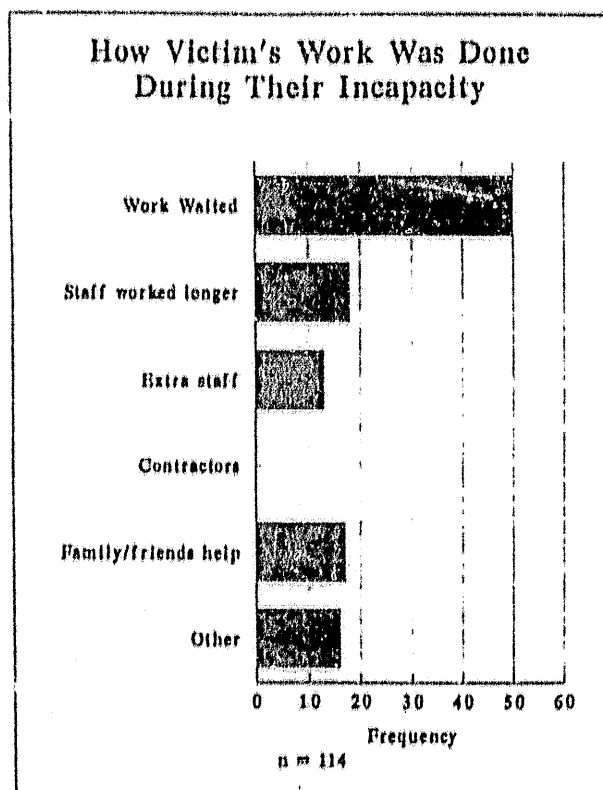


FIGURE 16



Where extra staff were employed, the number of days required off work for the injured person averaged 37, while for the other categories the average number of days off work was 15. This indicates that the need for extra labour is positively associated with the number of days off work, which in turn can be used as a proxy for severity of injury.

#### Personal Insurance Claims

Injuries were also classified whether or not a personal injury or workers compensation insurance claim was made. Of 123 injuries, 36 reported making an insurance claim. This is 15 less than the number of injuries reported as requiring 5 or more days off work (51). While the minimum time off in order to claim workers compensation is one week (5 working days), personal insurance policies can have an excess of up to 2 months off work before compensation will be paid. This is a cheaper option for farmers who are only concerned about the risk of injuries that would result in semi-permanent or permanent disabilities.

#### Risk Factors

The person representing each farm operation in the survey (identified as individual No 1.) was usually an owner or manager or "the person having the most to do with the day-to-day running of the property".

Table 3. Potential risk factors - personal variables		
Variable	Model	Comment
Age	included	95.0% confidence level
Gender	included	90.0% confidence level
Body Mass Index	excluded	
Farm work experience	excluded	
Hours of farm work	included	95.0% confidence level
Hours of other work	included	not significant
Hours of sleep	excluded	
Previous Injury	included	93.7% confidence level
Perceived Stress Scale	included	99.9% confidence level
Epworth Sleepiness Scale *	included	89.0% confidence level
Education	included	not significant
Handedness	included	87.0% confidence

\* Johns 1991

Where no injuries were reported on their property, they became the "controls". To avoid control bias because the cases came from a wider population than controls, only the injuries reported by individual No.1 have been used in the risk factor analysis.

Stepwise logistic regression procedures were used to test the statistical significance of suspected risk factors on both the individual's risk of injury and the number of injuries per property. The former was analysed using a generalised linear model (GLM) with a binomial error distribution and a logit link. A GLM with poisson errors and a log link function was used to test property variables' influence on the number of injuries reported. Variables were selected for inclusion in each model on the condition that they reduced the residual mean deviance.

Three of the personal variables were significant to a 95 percent confidence level or greater (Table 3). These were age, hours of farm work and the perceived stress scale (Cohen et al, 1983). Figures 17, 18 and 19 show the predicted relationship between these variables and the probability of injury occurrence (with a 95 percent confidence interval of estimates). The relationship between age and injury occurrence is negative, with a gradual decline in injury occurrence as age increases (within the range 25-85 years). Within this range, the results agree with RIPP data (Agricultural Health Unit, 1992) and also with Leathers and Williams (1984) New Zealand study.

FIGURE 17

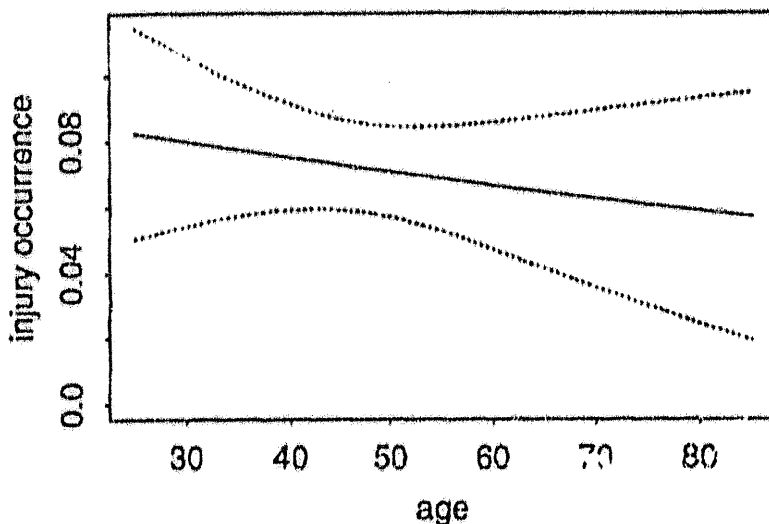
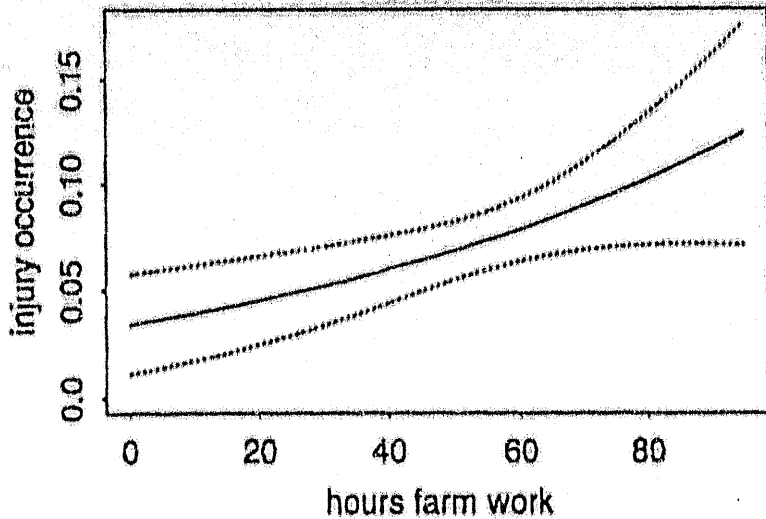
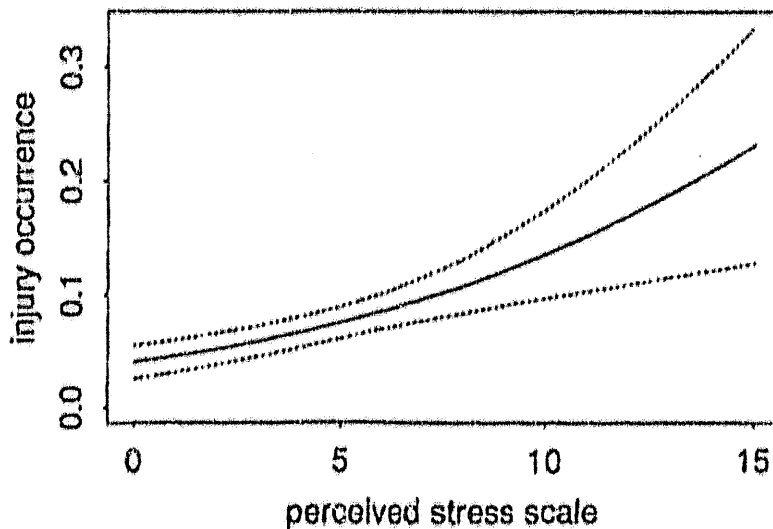


FIGURE 18



Hours of farm work shows a positive relationship with injury occurrence in agreement with previous work. In the pilot survey a mean deviance analysis of farm work hours was approaching 95 percent significant ( $F_{1,186}(5\%) = 3.84$ ), with a value of 3.57. In Elkington's (1990) US case-control study, 41 percent of farm work related injuries could be attributed to working more than eighty hours on the farm per week.

FIGURE 19



Elkington (1990) used data from a question asking whether the respondent had been diagnosed at any time by a health professional as having "stress, depression or other psychological problems", to analyse stress as a potential influence on injury occurrence. An estimated 4 percent of reported injuries were attributable to stress and other psychological problems. In Elkington's survey,

the respondent was required to have had any stress or other psychological condition diagnosed by a health professional. Consequently, people who might feel stressed sufficiently to affect their behaviour, concentration or judgement, but did not seek medical assistance, were overlooked.

This could explain the stronger relationship identified by the perceived stress scale (PSS). The measure in this case was the sum of scores from four questions, asking about how the respondent felt over the last month. Using the PSS enabled a finer measure of stress for each respondent (ie, a score from 0-16 rather than a yes/no response to diagnosed stress).

The confidence level of other variables such as previous injury history, the Epworth sleepiness scale and handedness were significant to levels between 87 and 94 percent.

For the property variables model (see Table 4), only the co-efficient for the number of cattle on the property was significant (to 95 percent confidence), see Table 4. The relationship here is a positive one, increasing cattle numbers means increasing risk of injury. Combinations of variables were also considered, including the sum of all crops and a total sheep and cattle DSE (dry sheep equivalent) measure.

Table 4. Potential risk factors - property variables		
Variable	Model	Comment
Property area (ha)	included	not significant
Number of sheep	excluded	
Number of cattle	included	99% confidence level
Area of cereals (ha)	excluded	
Area of coarse grains (ha)	included	not significant
Total stock (DSE's)	excluded	
Total Crops (ha)	excluded	

Variables that had given some previous indication of influence on injury occurrence, but were not significant in the personal GLM, have been analysed separately. Relative risk, odds ratios or Chi squared independence tests are presented.

#### Gender

Table 5 indicates the proportion of males to females in the sample, and the proportion of each reported as cases.

Table 5. Gender			
Injury Status	Female	Male	Total
Case	3	73	76
Control	79	756	835
Total	82	829	911

Survey injury rates for females are significantly lower than for males. The number of workers compensation claims for females over the 1990-91 period was too small to publish incidence rates. However, it is a well recognised fact that females in most work areas report a much lower rate of injury than males. To illustrate this, workers compensation figures overall for 1990-91 show an incidence of 36 claims per thousand workers for males and only 12 claims per thousand for females (WorkCover 1992).

#### Handedness

The effect of handedness on an individual's co-ordination in physical activities has long been a point of interest and debate. In the pilot study an odds ratio of 1.96 was calculated for left-handed people. That is, a left handed person was almost twice as likely to report an injury during the survey period as a right-handed or ambidextrous person. While it was a small sample of 157 controls and 33 cases, the results implied that left-handed people were more at risk of injury. Left-handed people have to deal with tools, equipment and machinery designed for right-handers which could put them at a disadvantage with regard to environmental factors. Coren (1989, quoted in Coren and Halpern 1991,96) from a sample of 1,896 subjects, estimated a relative risk of injury for left-handers that was 0.89 higher than for right-handers, a similar result to this study's pilot survey result.

Table 6. Handedness				
	Cases as a proportion of category total	Cases	Controls	Total
Left Handed	1.9%	1	51	52
Right Handed	8.9%	68	695	763
Ambidextrous	7.4%	7	88	95
Total		76	836	910

The survey data however (see Table 6), do not accord with the pilot data

results. With the calculated  $\chi^2$  value = 3.24, and the critical value of  $\chi^2$  (5%)(df=2)=5.99, any difference in the distribution of injuries between left-handers and others is not statistically significant at that level of confidence. This means that the independence of injury occurrence from handedness status cannot be refuted.

### Education

Each respondent was categorised into one of four education levels as can be seen in Table 7.

Table 7. Education Level				
Education Level	Cases as a proportion of category total	Cases	Controls	Total
No High-school	3.8%	4	102	106
High school up to School Cert. or Intermediate	7.6%	37	450	487
Higher School Certificate or equivalent	10.3%	19	166	185
Tertiary-degree, diploma	12.3%	16	114	130
Total		76	832	908

The calculated  $\chi^2 = 6.80$  while the critical  $\chi^2$  (5%)(df=3)=7.82. At that significance level the distributions are not considered significantly different. However, at  $\chi^2$  (7%)(df=3), they are. As can be seen by the second column of Table 7, the proportion of cases increases with the education level. This result reinforces pilot survey figures that showed the same tendency without being statistically significant. In contrast to these results, Elkington's (1990) US study concluded that there were no significant differences between cases and controls in the level of education completed.

### Previous Injury History

Injuries occurring before the survey period were classified into two categories, serious and less serious. Serious injuries included those resulting in permanent disfigurement, pain or discomfort lasting more than one month or causing a permanent disability. Less serious injuries were defined as anything outside the

serious category that suspended activities for one day or more.

Those respondents reporting one or more serious injuries before the survey period were 1.89 times more likely (relative risk) to report an injury during the survey period. Those respondents reporting both a serious and a less serious injury were 1.59 times more likely to report an injury during the survey period. As the critical value for  $\chi^2(1) = 3.84$ , the calculated  $\chi^2$  values for both scenarios were significant.  $\chi^2(df=1) = 6.57$  and  $5.66$  consecutively.

A case-control study of farm work-related injuries by Elkington (1990), indicated a significant relationship between injury history and injury occurrence within the observation period. For a sample of 80 cases and 234 controls, Elkington estimated an odds ratio of between 1.9 and 2.32 depending on the definition of injury used. An odds ratio approximates relative risk and is invariant across cohort and case-control study designs. This makes it appropriate to compare odds ratios between Elkington's case-control study and the data under analysis. This comparison can be seen in Table 8.

Table 8. Previous Injury Odds Ratios		
Injury Definition	Elkington	EFSAA Data
Less serious injury	1.9	1.28
Serious injury	2.32	1.89

While the ratios aren't as big for the EFSAA data, similar effects are shown. These results reinforce the theory that (for whatever reasons) some people are more prone to injury than others.

### The Cost of Farm Injuries

The results of the assessment of farm injury costs will be provided to FSAG's and rural OH&S workers. They propose to use these figures as a motivational aid for individual producers or industry bodies, to encourage an active interest in implementing safer farm work practices. Cost estimates will also enable more informed decisions on the allocation of OH&S funding among industries.

Some components of the cost of farm injuries can be measured quite reliably by their market price. Medical treatment services provided by general practitioners, physiotherapists, and chiropractors fall into this category. Presently, the federally operated Medicare system sets the scheduled fees (the amount on which a Medicare rebate can be claimed). However, before the Schedule of Medical Benefits was first introduced in 1970, a survey was undertaken in order to base the schedule on an average of the existing charges. Some anomalies in the relative fees were identified so an independent tribunal led by Justice Ludeke inquired into the schedule in 1973 and subsequent adjustments were made. Indexing of the schedule of benefits has occurred in order to maintain relativity with actual costs in the face of inflation. With this knowledge the Schedule of Benefits appears to provide a reasonable basis for the purpose of

estimating the true cost for these types of medical service.

Where health services are not covered by the Medicare Schedule of Benefits, professional bodies, such as the Chiropractor's Association of Australia, provide their own schedule of fees. These are a useful starting point for assessing the cost of services, although some adjustments have been made where a consistently higher or lower price regime was found over all three shires.

For other components of the true cost, market price is not a reliable indicator or true price. Market distortions may cause either an over or under valuing of the product or service to occur. For example, charges levied for hospital treatment are unlikely to reflect the true total cost of providing each service. Some proportion of the capital cost of owning and maintaining hospital buildings and facilities is subsidised by the state and federal governments. Workers compensation charges for hospital services are usually higher than standard medicare rates. They are the best available measure of the true cost of hospital services.

The costs most difficult to value are those recognised as a cost but they are not traded on any market and therefore have no commonly accepted dollar value attached. For example, the pain and suffering of the victim and the victim's family can be significant factors when a serious injury occurs. To put a dollar value on these would involve asking the victims how much they would be willing to pay to reduce the risk of injury by a set amount, and calculating what proportion of their responses could be attributed to these subjective costs. This willingness-to-pay method although theoretically valid is fraught with difficulties when implemented empirically.

Despite the recognised possibility of market distortions of some prices used and other subjective cost factors not being included, the following analysis will provide useful baseline figures for cost of injury estimates.

### **Medical Cost**

The survey recorded the number and type of medical treatments relating to each injury, from ambulance, general practitioners, and specialists through to x-rays, pathology, chiropractors and physiotherapists. It also includes hospital fees, both inpatients and Accident and Emergency. The average cost of medical services provided over 125 injuries was \$482. Averaged over the 107 injuries that actually required professional medical treatment, the cost was \$563.

### **Transport**

Each time an injured person travelled in a private vehicle to receive medical treatment, the trip was costed at \$0.53 per kilometre. This was the State Government official business rate for vehicles between 1600-2700cc. The average cost of transport for medical treatment over 125 injuries was \$177. Averaged over the 105 injured people who reported travelling for treatment, the cost was \$211.

### **Travel, Waiting and Treatment Time**

There is an opportunity cost to the person injured for the time taken to travel to the site of medical treatment, await consultation and be treated. 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 an 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 8 hours over the 125 injuries reported. Excluding the 14 injuries that did not report any treatment, the average time becomes 13.5 hours.

There are also opportunity costs of time and actual cost of travel involved where family members and friends travel to visit a hospitalised person. No estimates of these costs have been made.

### **Damage to Plant and Equipment**

From 125 injuries, 118 reported no damage to plant or equipment. Over the 7 injuries that did, the average value of damage reported was \$752. Over the entire 125 injuries the average cost of damage to plant and equipment was \$42. These figures lend support to the view that the human body is the most vulnerable object in the farm work environment.

### **Replacement Labour**

The flexibility of the family farm operation is shown by the small proportion of injuries where the employment of extra workers was necessary. The definition of injury included those who sought professional medical attention, worked at restricted capability for 5 days or more, or took one or more full days off work. Of the 125 reported injuries, 42 did not take any full days off work. The remainder dealt with their labour shortage in a variety of ways. In 18 cases the usual staff worked longer hours, and family and friends helped out in a further 17 cases. For 50 of the injuries the work was delayed until the injured person was able to return. The total cost of employing extra labour, \$16,713 was spread over 14 injuries with an average of \$1,194.

While an employee's time can be valued conveniently by a daily rate of pay, an owner-operator's time does not have a constant marginal value. Owners often do not draw a regular or set wage from the farm business, and even if they do, it does not necessarily reflect the value of their input. If only a short period of time (hours or one or two days) is taken off work, it doesn't necessarily have a measurable effect on the output of the farm (this may also apply to employees). However, the longer the period of time off work is, the more likely that there will be some cost to the business or reduction in total output. How crucial the work being done at the time is, has a significant influence on the magnitude of potential cost. Monk et al (1984) accounted for the variation in marginal productivity by applying "timeliness penalties" and "seasonal labour factors" in their cost of injury estimates. While these go part way to showing actual

variations in marginal productivity, they still don't reflect the marginal productivity being equal to zero for short periods of time.

While any replacement labour used has been valued at purchase price, time taken off work is also presented. The average number of days off work as a result of injury is a more relevant measure to the individual farmer than applying an arbitrary and constant value per day to lost days of labour.

### **Output Effects**

The owner/managers of properties on which an injury was reported were asked whether the injury led to any identifiable delays in important farming/grazing operations. If so, any effect on the output of the property was noted and valued where feasible. Many of the respondents could identify delays but found it difficult to quantify actual production losses. For example, responses included: the effect on output of delaying sheep drenching and fly control treatment for one week, or sowing a crop for one month, delayed shearing for 3 weeks and consequent income delay, and operating at restricted capability that reduced the efficiency of shearing, crutching and dipping. Only 10 of 125 injuries estimated dollar amounts and these averaged \$2,130 for the 10 incurring production losses. Averaged over the 125 injuries reported the figure for production losses is \$170.

### **Total Injury Cost**

Within the definition of injury and the cost categories able to be quantified, the total cost of injuries reported for all three shires over the six months to June 1992 was \$125,690. Figure 20 shows the cost categories that comprise the total amount. All medical costs, including transport for treatment, make up 76 percent of the total estimate. The major portion of farm costs are represented by the value foregone due to reduced output and extra labour costs. The average cost over the 125 reported injuries was \$1000. However, 13 of those injuries reported no quantifiable costs, making the average cost over the remaining 112 injuries, \$1120.

### **Cost of Injury Dissection**

The cost of injury was scrutinised on several different grounds to try and identify the high cost areas of injury. A comparison of the transport, medical and farm costs is shown in Figure 21, between all injuries and those requiring 5 or more days off work. Both injury categories have similar proportions of the transport, medical and farm cost components. The more serious injuries make up 41 percent of all reported injuries yet they account for 77 percent of the total quantified cost.

A comparison of medical, transport and farm costs among shires also reveals some variation (see Figure 22). For Gilgandra and Yallaroi, medical services form the bulk of the cost, while for Carrathool, farm costs are the majority. Transport costs appear lower in Gilgandra than in both other shires. While these comparisons are made it should be remembered that many reductions in output were unable to be quantified therefore farm costs should be considered partial or

FIGURE 20

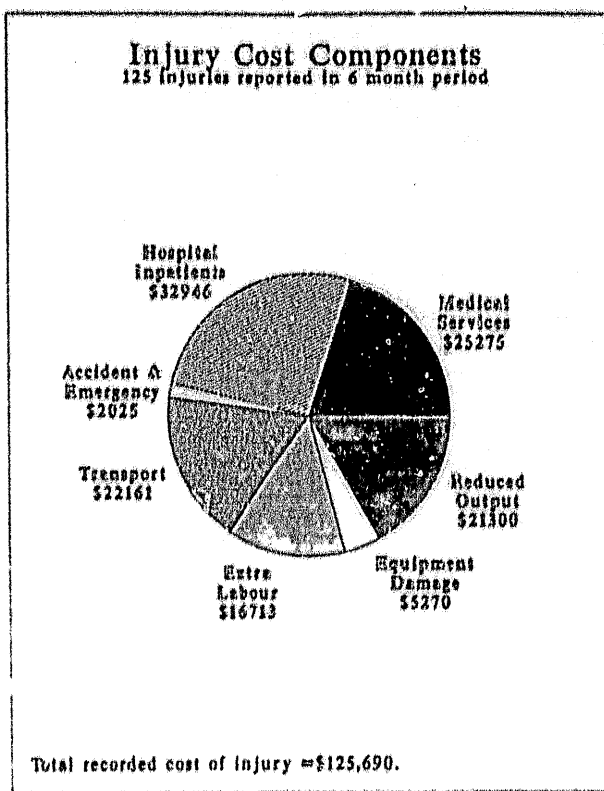


FIGURE 21

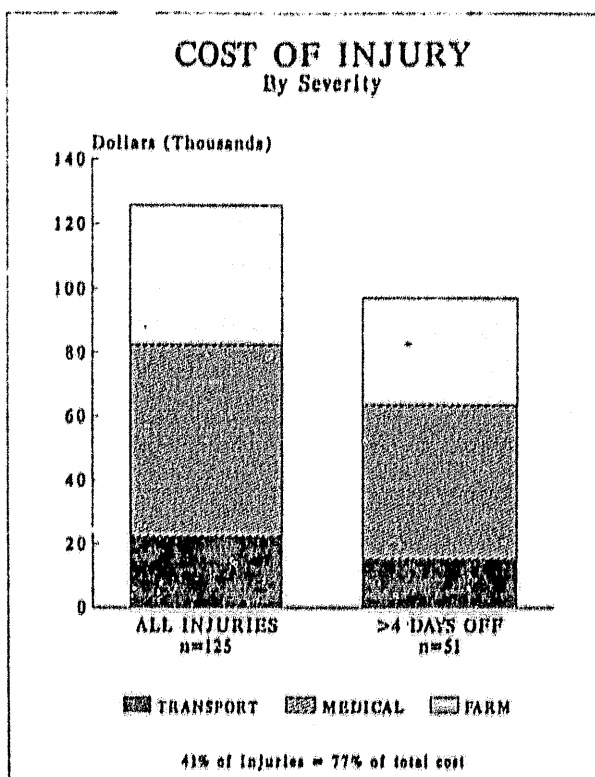


FIGURE 22

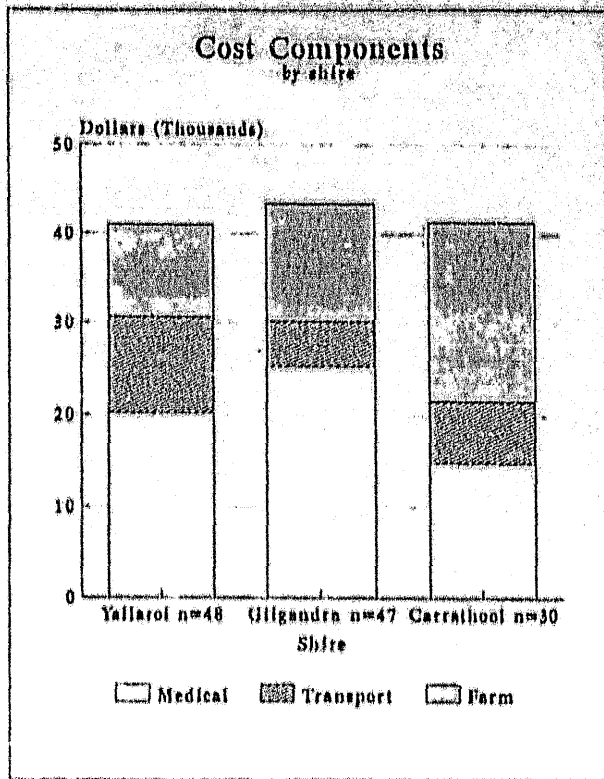
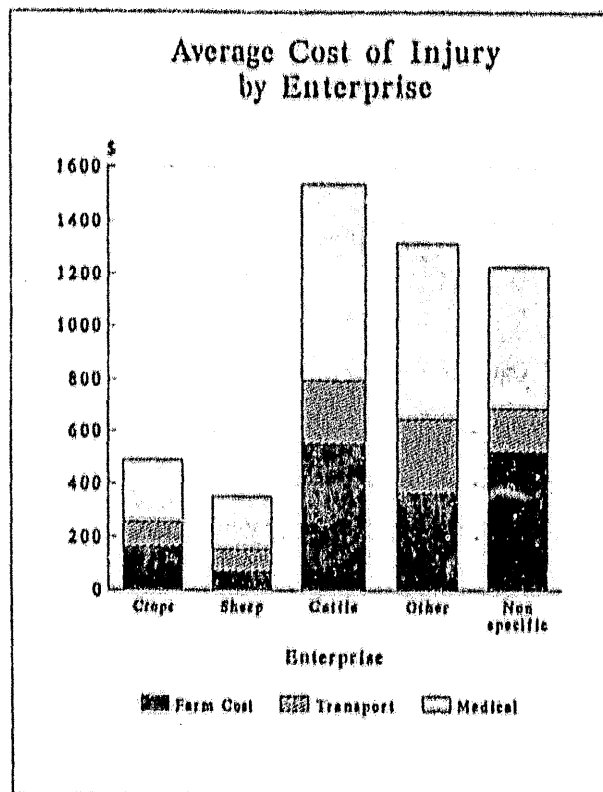


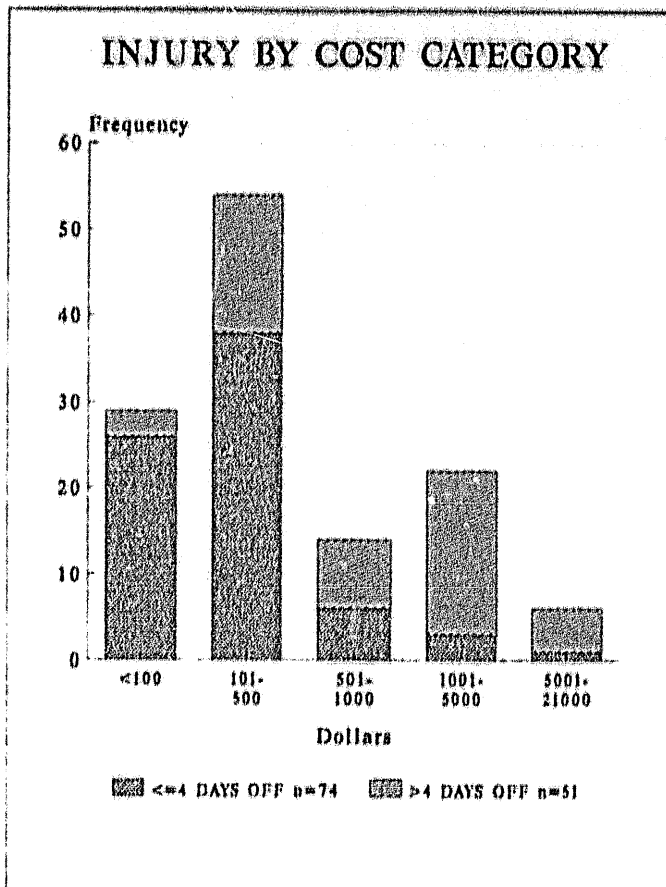
FIGURE 23



A dissection of average cost of injury by enterprise (see Figure 23) reveals two levels of cost. Crop and sheep enterprise related injuries both average under \$600 per injury. The remaining 3 categories are all at least twice that amount, with cattle enterprise related injuries the highest average cost at over \$1500.

Grouping injuries into cost categories (see Figure 24) shows \$101-\$500 as the most frequent range of cost. This is followed by the category "up to \$100". A jump in magnitude occurs for the third most common category to the \$1001-\$5000 range, which mostly comprises those in the more serious classification,

FIGURE 24



### Conclusion

Six months farm injury survey data has provided an extensive profile of farm injuries in the NSW Wheat/sheep belt. When the survey is completed and a further 12 months data is included, the estimations of incidence, risk factors and costs of injury are likely to be even more conclusive. Also, the potential bias, seasonality of injury occurrence, should be overcome.

The estimated annual incidence of farm work-related injury averaged over the Yallaroi, Gilgandra and Carrathool shires is 23.8 percent of farms having one or

more injuries (within the survey's injury definition). Individual shire rates range from 18 to 28.2 percent. A degree of confidence can be drawn from the similarity of injury rates between the pilot and the main survey.

Seven risk factors with adequate levels of statistical significance were identified. Age, the perceived stress scale (PSS) and hours of farm work were all significant to 95 percent or greater. Age was the only variable with a negative relationship (in the age range from 25-85 years) to injury occurrence. The identification of stress (by its proxy, PSS) as a significant risk factor, confirms what has previously been only an intuitively surmised relationship. The hours of farm work result confirms both intuitive assumptions and empirical results (Elkington 1990). Other variables with levels of statistical significance sufficient to warrant further investigation are previous injury history, the Epworth sleepiness scale (a proxy for sleep disorder potential) and handedness.

The only statistically significant property related risk factor was the number of cattle.

The opportunity cost of time off work for travel, treatment and incapacity is another significant factor of injury occurrence. An average of 8 hours per injury for travel, waiting and medical treatment was estimated. Days off work averaged 13.6 over the 125 injuries, while the average number of days working at restricted capability was 17.5.

The total quantified dollar cost of 125 non-fatal injuries was \$125,690, approximately \$1000 per injury. The 50 injuries that required 5 or more days off work comprised 77 percent of the total cost. This result indicates that further research should focus on the more serious injuries if the principal objective is to reduce the cost of injuries. Injuries related to a cattle enterprise, an "other" enterprise or a "non-specific" type of work, cost on average more than twice that of those related to sheep or cropping enterprises.

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