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The Cost of Australian Farm Injuries

J.M. Low and G.R. Griffith*

A telephone survey was conducted of 919 farms from three shires in the sheep/wheat belt of New South Wales. Data from the cohort study spanning 18 months measured the incidence and profile of farm work related injury, risk factors and the range of costs associated with injury occurrence. On average, 22.6 per cent of farm businesses reported one or more injuries per year, while 8.3 per cent reported one or more serious injuries per year. Seven categories of injury were identified as significant problem areas. These were manual handling, eye, motorcycle-related, sheep-related, cattle-related, tractor-related and horse-related injuries. The costs associated with injury occurrence that were measured included medical treatment, transport for treatment, replacement labour, damage to plant and production losses. The average cost of an injury was around \$1000, while the average cost of a serious injury was around \$2500. The maximum estimated cost exceeded \$26,000 for one particular injury. Approximately half of the average costs were accounted for by medical treatment, and approximately one-third of the average costs were accounted for by onfarm production losses, replacement labour costs and repairs to damaged equipment.

1. Background

Australian agriculture is characterised by a combination of factors that have retarded the improvement of occupational health and safety (OH&S) standards of farm workers. These include the fact that farms are both family home and place of work; the high proportion of self-employed labour; the considerable variety of tasks, work sites and climatic conditions; the consequent range of skills required; the range of ages and educational levels of farm workers; and frequently, the geographical isolation. A consequence of this diversity in locations, tasks, skills and experience is the variety of OH&S problems encountered by farm workers. Further, attitudes are not always conducive to overcoming or even minimising these problems. For example, Stanford (in Hegney) suggested that farmers consider work hazards to be a natural and acceptable risk of their occupation. Emmet (in Hegney) believed that farmers would risk damaging their health for the sake of productivity. Brush and Clemes (Table 1) reported results from previous work suggesting that a considerable number of farmers do not use recommended agrichemical protective equipment. These

problems and attitudes provide a challenging task for those wishing to improve Australian agriculture's OH&S record. However, since the Farmsafe '88 conference (WorkSafe Australia), rural OH&S has been acknowledged increasingly by producer groups and the government as an issue worthy of more attention and resources.

McCulloch collated the characteristics and cost estimates of rural injuries from Australian and international studies, to gain an appreciation of the variety of OH&S problems and to speculate whether there was an underinvestment of public resources in this issue. Some of these results are reported below. A major outcome of this review was the realisation that there was a lack of comprehensive data available on farm safety issues. In Australia, data sources on farm-work related injury and associated costs have been restricted to Workers Compensation statistics, some hospital records and small local surveys.

1.1 Previous Injury Estimates

Fatality rates for farm workers were relatively well covered in this data because of legal requirements. Thus it has been shown that fatality rates for farm workers in the early 1980s were the third highest in Australia after mining and transport industry workers (Harrison *et al.*).

The proportion of agricultural workers involved in work-related accidents had been estimated at varying levels given different methods of measurement. Esti-

* Economist and Principal Research Scientist respectively, NSW Agriculture, Regional Veterinary Laboratory, PMB (UNE), Armidale, NSW 2351. The authors acknowledge the assistance of Clair Alston, Steve Harden and Bob Murison, Biometrics Unit, NSW Agriculture; Kevin Parton, Department of Health Studies, University of New England and Lyn Clarke, Agricultural Health Unit, NSW Health, advisors to the project; Kevin Parton, Xueyan Zhao and an anonymous referee for comments on an earlier draft; and all of the survey respondents who willingly provided data on themselves and their injuries. The project was funded by the Rural Industries Research and Development Corporation.

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mates include 3.6 per cent in New Zealand (Leathers and Williams, p.45) and 7.9 per cent in NSW (Australian Bureau of Statistics 1988, p.10). The Australian Bureau of Statistics estimate only related to farm workers in NSW covered by the Workers Compensation Scheme. Elkington, with access to accurate medical records, estimated that each year in the US state of Minnesota, 1 in 7 farms was involved in a farm-work related accident.

More recently, 1991/92 Workers Compensation statistics for NSW show agriculture as having 49 employment injuries (temporary or permanent disability, or fatality) per thousand workers, compared with the average over all workers of 25 employment injuries per thousand (WorkCover Authority 1993a,b). Agriculture had the seventh highest incidence of injury of the 24 industry classifications in the Workers Compensation statistics. A year earlier, agriculture had 51 injuries per thousand workers, the fifth highest industry incidence.

1.2 Previous Cost Estimates

Farm accidents result in a variety of costs to the individual, the farm business and to society, such as lost productive capacity, restorative action, rehabilitation, pain and suffering, and community/social costs. The magnitudes of many of these costs are unknown.

In the year ended June 1987, NSW Workers' Compensation statistics indicated that a total of \$27.4m was paid out for agricultural cases that resulted in either death, or incapacity for three days or more (up from some \$6m in 1983/84 (Webster *et al.*). These Workers' Compensation payments related to the 28,479 wage and salary earners in agriculture (Griffith and Low, Table 2), who make up approximately one-quarter of the rural labour force, and not to self-employed farmers. The average compensation cost of farm-work related accidents per farm wage and salary earner was \$963. Assuming that similar costs pertain to the other categories of agricultural workers, the compensation cost of farm-work related accidents in NSW for 1986-87 could have been in the order of \$106m. Assuming also, that this average is indicative for agricultural workers nationally, the compensation cost of accidents in Australian agriculture could be in the range of \$350-\$390m per annum. This was equivalent to 4.3 per cent of the gross value of production of farming in Australia in 1986-87. From more recent Worker's Compensation data (Workcover Authority 1993a,b), the average cost of employment injuries over

all industries for 1991/92 was \$8,700, while agriculture's average cost (excluding forestry and logging) was \$9,200. In the previous year the respective costs were \$7,329 and \$8,218.

However, Workers' Compensation payments are an imprecise proxy for the total cost of farm-work related accidents. In some cases, agricultural wage and salary earners do not claim Workers' Compensation when they are entitled to do so. Further, Workers Compensation is intended to represent the foregone wages and medical costs resulting from a work-related injury, but there are other costs incurred, such as replacement labour, to be considered. Loss of production and physical resource damage are additional types of costs associated with farm-work related injuries. On the other hand, Worker's Compensation pay-outs can also include investigation and legal expenses, and compensation for pain and suffering. Finally, these data exclude self-employed farmers and unpaid family helpers.

1.3 Government Funding

The proportion of the total Australian agricultural work force involved in work-related injuries has yet to be estimated with any confidence and current cost estimates are imprecise. Therefore a major barrier to the efficient allocation of OH&S funds is thought to exist in Australia because of this lack of data on the extent and cost of injuries resulting from farm accidents. There is considerable anecdotal evidence (Davidson; Dennis; Knobel; Leeder and Barton; Parton, 1988; Renwick) to suggest that there has been an under-investment in rural OH&S in Australia. If this is the case, society should receive a "good return" from investing in improved farm OH&S programs. Further, within agriculture, OH&S funds can be allocated either between industries (e.g., sheep versus wheat), or between specific OH&S issues (e.g., a program on correct animal handling could be applied across several industries, as could one on safe machinery operation techniques). In addition there is a need to accurately determine priorities among the various programs. More detailed information needs to be collected on the incidence and cost of farm injuries to allow these issues to be properly examined and to assist in making these decisions.

To attempt to rectify some of the data deficiencies mentioned above, a farm injury survey was undertaken (other important farm OH&S problems such as noise-induced hearing loss and long term illnesses due to

poorly designed equipment, dust, sun exposure, chemical exposure, etc, were not addressed). The survey covered the three traditional broadacre agricultural enterprise types in Australia, sheep/wool, beef cattle and dryland broadacre cropping (cereals, coarse grains and oilseeds) in three shires in the NSW sheep/wheat belt. The incidence and a profile of farm-work related injury types were recorded along with the cost estimates for these injuries and the risk factors which might contribute to their occurrence. The data reported in this paper emphasise the cost aspect of the injuries. The incidence, profile and risk factor data can be found in Griffith and Low (1994) and Low, Griffith and Alston (1996).

2. Survey Method

Following a pilot survey carried out over 1990-91 in the Armidale Rural Lands Protection District (Low *et al.*, 1992), the main survey was designed to combine retrospective and prospective observation. Data collection started in July 1992, retrospective for the six months from January 1992, then prospective for the 12 months to June 1993. After the initial interview, three call-backs were made at four-monthly intervals during the prospective phase.

Three shires in the NSW wheat/sheep belt, Yallaroi, Gilgandra and Carrathool, were chosen to reflect the focus on sheep/wool, beef cattle and traditional dryland broadacre cropping. These three shires were considered representative of the population by two criteria. First, the types of production were representative of the region as a whole. Each of the shires chosen was a significant producer of at least two of the three enterprise groups of interest, and the three groups contributed at least 60 per cent of the gross value of agricultural production in each shire (ABS 1991). Second, these shires provided a representative range of climate, topography and farming intensity for the wheat/sheep belt both in NSW and in other states. A proportionate stratified random sample, stratified by shire, was the sample design chosen, because of interest in any difference that may exist in injury rates between shires.

Telephone interviewing was chosen as the mode of data collection, having achieved a significantly higher response rate in the pilot survey than a 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 telephone call and explained its purpose. A media campaign was also undertaken in each shire in the week before interviewing.

There were 919 properties in the final sample, giving a response rate of 83.5 per cent. The significant increase in response rate from the telephone component of the pilot survey (68.2 per cent) was attributed partly to the support shown by prominent local producers and to the publicity campaign. Using the Australian Bureau of Statistics 1990/91 Agricultural Census figures for the number of farm businesses in each shire and adding 10 per cent for those farms with an Estimated Value of Operations under \$20,000, the samples in this survey provided greater than 80 per cent coverage of each shire's farm businesses. Overall, the sample represented some 2.6 per cent of farm businesses in NSW in 1992.

For the purposes of the survey an **injury** was defined as where any of the following occurred as a result of farm work: usual activities were suspended for one day or more; or usual activities were restricted for five days or more (cannot work at the same pace or with the same ease as usual); or professional medical care was sought. A **serious injury** was defined for the purposes of the survey as where five or more days were taken off work. This definition eliminated those injuries that were often considered superficial by farmers, did not cause a great amount of disruption to the farm work schedule and utilised either none or only a small amount of professional medical care. This definition is also close to that used in Worker's Compensation claims.

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 during the prospective phase of the survey.

3. Incidence and Profile of Injury and Risk Factors

3.1 Average Injury Rates

Of the 919 properties that completed the 18 month survey period, 425 injuries were reported. Some properties reported more than one injury during this period. All of the 425 injuries on which information was available were used in estimates of the incidence of injuries, the profile of injury characteristics and the

assessment of the costs of injury. Of these 425 injuries, 143 were classed as serious injuries. A weighted annual average rate of 22.6 per cent of properties reported one or more injuries (more than one in five properties) (see Table 1). For serious injuries, the estimated average rate was 8.3 per cent of properties, that is, close to one in twelve properties. These latter rates are above the 5 per cent estimated from Worker's Compensation data (WorkCover Authority 1993a,b) but similar to the ABS (1988) estimate of 7.9 per cent. The rates of injury were statistically significantly different among shires (Low *et al.*, 1996), a result also observed by Parton (1990) specifically for back injuries on farms. This points to the diversity of OH&S problems encountered by farm workers and the need for regional farm safety programs.

Shire	Average Annual Rate of Injury (All injuries) %	Average Annual Rate of Serious Injury (>4 days off work) %
Yallaroi	26.5	9.9
Gilgandra	19.3	6.3
Carrathool	22.8	9.3
Average	22.6	8.3
Sample size = 919 properties.		

3.2 Fatalities

No farm-work related fatalities were reported during the survey, although the WorkCover Authority recorded 18 farm-work related fatalities in NSW over that time. As there seemed to be very few permanent disabilities or otherwise serious injuries reported in the survey, a check with ambulance records was carried out on two of the three shires (the third did not respond to the request). No unreported ambulance services relating to farm injuries on any of the properties involved in the survey were identified.

Worker's Compensation data for agriculture in NSW 1991/92 showed the ratio of farm-work related injuries (temporary disability less than 6 months) to fatalities at 95:1. Applying this ratio to the survey data where 143 serious injuries equivalent to the Worker's Compensation definition occurred, 1.4 fatalities would be expected on average. Statistically then, it is quite reasonable not to observe any fatalities, and clearly, a

much larger sample of injuries is needed to give an insight into the occurrence of permanent disabilities and fatalities.

3.3 Injury Categories

Injury categories useful in terms of formulating preventive strategies are presented in Table 2 as Notable Injury Groups, along with a considerable amount of related data on the profile of different injuries. These classifications are not mutually exclusive, for example a motorcycle related injury may also involve a sheep or a cow. These data are discussed in detail in Griffith and Low.

3.4 Personal Accident Insurance

To gain some idea of attitudes of farm workers to the risk of farm injuries, questions were asked on insurance coverage. Over the case/control group, 40.6 per cent indicated that they had no form of either Workers Compensation or personal accident insurance (including life, personal accident, disability income, total and permanent disability). For a group who are in the main self-employed, this is a high proportion without any apparent form of income protection. One explanation is that farm workers' perceptions of their risk of serious injury is somewhat lower than the actual risk indicated by the survey. This could be due to their perceptions being based on personal and neighbouring rural workers experience. This breadth of experience is unlikely to comprise a representative sample of the rural labour force and the frequency and severity of work-related injury, therefore a biased view of their own risk of work-related injury results. For less serious injuries, whether or not their perception of the risk they face is accurate, there is generally a stoic acceptance of minor injuries as an occupational hazard.

Of this same group 70 per cent indicated that they had some form of private medical/health insurance. This is significantly higher than the proportion of the NSW population with private health cover which stood at about 50 per cent during 1992/93 (ABS 1993).

3.5 Personal Risk Factors

The personal variables considered most likely to have a significant influence were measured and assessed for their association with, or possible causal influence on, injury occurrence. This assessment was carried out as a case-control study using 76 cases and 835 controls.

Table 2: Notable Groups from 425 Reported Injuries

Type of Injury	% of Total Injuries	Type of Activity	% Female	Location %	Body Part Injured %	Nature of Injury	>=5 days off work %	% of Injuries Identified as Preventable by Authors
Manual Handling	12.0	lifting pushing/pulling	5.6	24% workshop, 24% pasture paddock	51% back 12% shoulder	71% strain/sprain 12% fracture/dislocation	31.2	19.6 (indicated preventable by injured)
Eye Injuries	10.1	operating grinder/welde	4.7	74.4% workshop	eye	65% foreign body in soft tissue	19.5	74.4
Agent - Motorcycle	8.7	fall from motorcycle	5.4	pasture paddock	48.6% lower extremities	32.4% fractures or dislocations, 24.3% strains/sprains	24.3	24.3
Agent - Sheep	8.7	handling sheep, 16.2% shearing handpiece	2.8	40.5% shearing shed, 32.4% stockyards	54% upper extremities, 19% knee, 19% lower back	40.5% strain/sprains, 16.2% fracture/dislocations, 16.2% lacerations	45.9	
Agent - Cattle	8.0	handling/loading cattle	8.8	64.7 stockyards	41% lower extremities, 32.4% upper extremities	29.4% haematoma/bruising, 23.5% sprain/strain	31.2	
Agent - Tractor/linkage	5.9	20% alighting, 20% sitting/driving	12	40% cultivated paddock, 24% workshop/shed	36% lower extremities, 24% upper extremities	24% strain/sprain, 20% fracture/dislocate, 20% lacerations	43.5	
Agent - Horse	5.4	74% fall from horse	17.4	34.8% pasture paddock, 26% house paddock	30.4% lower extremities, 26% upper extremities, 26% trunk	34.8% sprain/strain, 26% haematoma/bruising	42.9	8.7

Age, gender, body mass, education, farm work experience, previous injury status, handedness, hours of work, hours of sleep, sleep quality, and stress were the factors tested. The factors that showed a statistically significant difference between the distributions of cases and controls were age, previous injury status, body mass index, hours of sleep, a sleep quality measure (Epworth Sleepiness Scale) and a stress measure (Perceived Stress Scale). All of these factors showed positive linear effects on the probability of injury, and the interaction between previous injury and stress was positive, however all other interaction terms showed negative effects. A more detailed discussion of these factors can be found in Low *et al.*, (1996).

4. Cost of Injury

4.1 Estimation Procedures and Total Costs

Questions in the interviews sought data on direct medical costs (including ambulance if required), the costs of transport to medical services, direct losses of farm production, damage to plant and equipment, and the cost of extra farm labour if required.

While many respondents could identify actual costs in the above categories, many could not, and estimates were made based on reported types of procedures, days in hospital, number of trips, etc. The cost of medical treatments were valued at the Medicare scheduled fee where applicable, or the relevant association's scheduled fee where the service was not covered by Medicare (e.g., chiropractic). The hospital bed day rate used was the rate charged for Worker's Compensation cases in 1993. Medical services were not recorded in detail, so an average cost for some services classified by bodily location, was used (such as X-rays and surgery). Ambulance services were included in the medical treatment costs. The cost of private vehicle transport to receive treatment was calculated using the NSW Government rate for official business in a vehicle with a 1600-2700cc (medium sized) engine, \$0.53/km. This compensates for fuel, oil, maintenance, registration, insurance and depreciation costs. Where public or charter transport was used, these were valued at the retail price of the journeys undertaken. Where replacement labour was required but the actual cost was not provided, the cost was estimated using the number of hours or days needed at the Pastoral Employees State Award as of August 1992. This rate was \$325.40 per week.

Overall, the average cost per injury over all injuries was estimated to be just under \$1,000 (Table 3). The average cost of each serious injury was estimated to be almost \$2,500 while the average cost of minor injuries was \$281. The range in cost was from zero to over \$26,000. Median values were low relative to the means, indicating the extremely skewed nature of the distributions of cost per injury.

4.2 Components of the Cost of Injury

In an attempt to determine where farm safety programs might be better focussed, the five components of these total costs as described above were examined in more detail.

4.2.1 Medical treatment

Medical treatment included hospital bed-days and out-patients services, general practitioners, specialists, x-ray services, physiotherapy, chiropractic, ambulance, and pharmaceuticals. The average cost of medical treatment for all the 425 injuries reported was \$497 (Table 3). This makes up slightly more than half of the average total cost of injury. In comparison, the median value for medical cost was only \$75, suggesting that for many injuries, no medical cost was incurred or may be just one visit to the local GP. This is confirmed in the non-serious injury columns. The average cost of medical treatment for serious injuries was \$1,281, again just over half of the average total cost of serious injury. However, the medical cost for one serious injury totalled almost \$26,000.

4.2.2 Travel for medical treatment

The estimated cost of transport for medical treatment averaged \$150, or about 15 per cent of the average total cost of injury. For serious injuries, transport costs averaged \$312 or 12 per cent of the average total cost, and ranged up to \$3,155. Thus the geographical isolation inherent even in shires in the sheep/wheat belt compounds the cost of injuries which require repeated visits to service centres for medical treatment. This issue is further illustrated by the median value for serious injuries in particular lying much closer to the mean than for any other cost category.

4.2.3 Damage to plant and equipment

Estimates of the cost of damage to plant and equipment for all injuries comprised approximately 4 per cent of the average total cost. However, 95 per cent of all

Table 3: Cost Categories - All Injuries, Serious Injuries and Non-serious Injuries

Cost Category	\$ Average over All Injuries n=425	\$ Median Value	\$ Average Serious Injury n=134	\$ Median Value	\$ Average Non-serious Injury n=291	\$ Median Value	\$ Maximum Value
Transport (excl ambulance)	150	59	312	148	75	0	3,155
Medical (incl ambulance)	497	75	1281	269	136	25	25,918
Extra Labour	142	0	392	0	27	0	9,999
Damage to Plant	39	0	94	0	14	0	9,000
Production Losses	149	0	411	0	28	0	9,999
Total Farm Cost	330	0	897	0	69	0	11,199
Average Total Cost	977	174	2,489	871	281	40	26,174

injuries recorded no cost for damage to plant and equipment. For those injuries (22 out of 425) reporting a cost of damage greater than zero, the average cost was \$750, and in one injury this cost was calculated at \$9,000. Thus damage to plant and equipment was rare, but expensive when it did happen.

4.2.4 Replacement labour

The definition of injury included those who took one or more full days off work. Thirty-four per cent of injuries reported did not take any full days off work. For these there would be little need to find replacement labour except in some particularly timely operations (e.g., shearing) where very little labour force flexibility existed.

The flexibility of the family farm operation is shown by the small proportion of injuries where the employment of extra workers was necessary. Only 9 per cent of injuries reported employing extra labour. For those that did not employ extra labour, no cost in this category was recorded, so the average cost for non-serious injuries was very low at \$27 per injury. For more serious injuries the cost was higher at \$392 and averaged out at \$142. However the average cost of extra labour over the 9 per cent of injuries that did need hired help, was \$1,548, and in one case some \$10,000 was spent on extra hired labour.

For 38 per cent of reported injuries, the work waited until the injured person returned to work. Family and friends coped with the extra workload left by the injured person in 15.5 per cent of cases, while the other

usual staff dealt with the work load in 17 per cent of cases.

The time taken off work was also collected (Table 4). The average number of days off work is often a more relevant measure to the individual farmer than applying an arbitrary and constant cost per day to lost days of labour. This approach rests on the assumption that labour may have a varying marginal value depending on how crucial the timing is of the work being done at the time of injury. For all injuries, the average time taken off work was 8.4 days, with a further 15 days on average, working at a restricted capability. For serious injuries the average number of days off was 23, with a further 21 days working at a restricted capability. For one injury, six months was taken off work with another year at restricted capability.

Of the 425 injuries on which data were collected, 67 were admitted to hospital. The average time in hospital was one day, but did reach 60 days for one recorded injury. The 67 admissions is equivalent to an average 4.9 admissions per hundred farm workers per annum. NSW hospital records show the statewide rate of admissions for farm injuries to be 6.1 per hundred farms per annum (1991/92). However, this rate includes injuries that are not work related (Dr Lyn Clarke, pers. comm. 1993).

4.2.5 Priced production losses

This variable only indicates those production losses that producers felt they could quantify and attribute to the occurrence of the injury with some confidence.

Table 4: Time Off Work Resulting From Injury

	Average Days	Minimum Days	Maximum Days	Median
Days in Hospital	0.85	0	60	0
Days off Work (Incl. days hosp.)	8.40	0	180	1
Days at Restricted Capability	15.15	0	365	5
Time off Work for Others	0.34	0	30	0

Priced production losses comprised around 15 per cent of the average total cost, or about \$150 per injury (Table 3). However, for 93 per cent of all injuries, no priced production losses were indicated. For the 7 per cent of injuries that provided a dollar figure for production losses, the average amount was \$2,039 but a value of \$10,000 was estimated by one injured producer.

4.2.6 Cost category comparison by activity and by injury type

In comparing the average cost for various types of injury, an interesting contrast appeared between injuries that occurred in cultivated or in pasture paddocks. While the proportions of transport, medical and farm cost (damage to plant and equipment, replacement labour and production losses) were similar, there was a major difference in the magnitude of the total cost. For the 54 injuries that occurred in a cultivated paddock the average cost of injury was \$548, while for injuries that occurred in pasture paddocks the average cost was \$1,407.

The difference in average cost is attributed to the higher proportion of fracture injuries occurring in pasture paddocks (20 per cent versus 6 per cent) and the corresponding higher number of days in hospital. Injuries occurring in pasture paddocks were mainly attributed to sheep, cattle and non-specific enterprises, while those occurring in cultivated paddocks were predominantly related to cropping and non-specific enterprises. Ride/fall, impact/collision and lifting heavy objects were the main activities at the time of injury for pasture paddocks, while the use of hand or power tools, twist/stretch/bend and impact/collision were the main activities for cultivated paddocks. Between these two injury locations, the difference in cost was most pronounced in the Carrathool Shire where the cost of a pasture paddock injury was 5.7 times that

of a cultivated paddock injury while Yallaroi and Gilgandra were 1.7 and 2.2 times respectively.

Manual handling and eye injuries comprised the highest proportion of injuries but they incurred the lowest cost per injury, at \$274 and \$365 respectively (Table 5). Conversely, tractor- and horse-related injuries comprised smaller proportions of the total injuries but the costs of each of these types of injuries was quite substantial and similar to the overall average cost of injury. Over 40 per cent of these latter injuries were serious injuries, while only 20 per cent of eye injuries were serious.

Table 5: Costs of Notable Injury Groups

Percentage of Total Injuries	Group	Average Cost
12.0%	Manual Handling	\$365
10.1%	Eyes	\$274
8.7%	Motorcycle Related	\$1,247
8.7%	Sheep Related	\$990
8.0%	Cattle Related	\$980
5.9%	Tractor Related	\$1,032
5.4%	Horse Related	\$1,338

4.2.7 Unpriced production losses

Production cycles in broadacre agriculture are at least six months in duration. Where a farm-work related injury impacts at the beginning of a production cycle, variation in weather conditions and market prices over the remainder of the cycle make it difficult to accurately estimate the value of production losses resulting from the injury. Where this situation arose, a description of the impact on farm work was recorded. Some of the unpriced productivity effects of injury occurrence are reported in Table 6. Many of these effects

would have had substantial financial implications through reduced yields or prices.

Table 6: The Impact of Injury on the Farm Work Program

Number of Responses	Description
5	Delayed ground preparation and cultivation
6	Delayed sowing
1	Didn't sow
1	Delayed joining ewes 1 month
6	Lost sheep to fly-strike
4	Delayed shearing
6	Delayed general farm maintenance and improvements

4.2.8 Time taken for travel, waiting and treatment

There is also 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 was 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 were assumed. On this basis, the average time taken for travel, waiting and treatment per injury was estimated at 7.3 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. In Table 4 it was reported that "others" had to take about a third of a day off work for each injury. No estimates of either of these costs have been made, but they may total around \$100 per injury if also valued at the Pastoral Employees State Award.

4.2.9 Relationship of estimated costs to workers compensation and private insurance payouts

For the year 1991/92 the average cost for a Workers Compensation claim in agriculture in NSW was \$9,200 (WorkCover Authority 1993a). This amount is significantly higher than the average cost of serious injury estimated in the survey, of \$2,489. This is partly

due to the Workers Compensation average figure including the costs of compensation of 17 fatalities and 179 permanent disabilities, whereas the survey, because of its limited size, did not record any fatalities or any confirmed permanent disabilities. Worker's Compensation pay-outs can also include investigation and legal expenses, and compensation for pain and suffering, none of which are included in the survey injury cost estimates. Another reason for the lower average cost of injury in the survey was the small proportion of replacement labour hired relative to time taken off work. If the reported cost of actual replacement labour was replaced with a valuation of the time taken off work at the Pastoral Employees State Award, the average cost of a serious injury in the survey would increase by more than \$1,100 to \$3,637.

Seven insurance companies supplied data on claims on personal accident policies and disability income policies taken out by farmers or farmworkers Australia-wide for the year 1990/91. The number of policies of interest in force over this period with these companies was 18,200. A total of 1,667 claims in that time resulted in a claim rate of just over nine per cent. The total payout for these claims was \$3,333,561, with an average payout of \$2,000. The incidence of claims and the average payment per injury claim compare closely with the survey data. However, it is of interest to note that the compensation paid by insurance companies generally was at an agreed weekly rate and did not represent the actual cost associated with the injury. Further, an excess period ranging from one to 22 weeks applied to 38 per cent of the policies. For these, income lost during the excess period would not be compensated.

4.2.10 Relationship of estimated costs to value of "statistical injury" estimates

Brush and Clemes estimate the social willingness to pay to prevent a non-fatal injury, severe enough to involve time off work, at about \$NZ14,200. This was based on evidence that the value of a non-fatal injury was around 0.5 per cent of the value of a fatal injury (Moore and Viscusi), and that recent New Zealand research had estimated the value of a "statistical life" to be in the order of \$NZ2.8 million (Miller and Guria).

Applying the appropriate exchange rate would infer a figure of around \$A13,000 as the value to society for avoiding a serious injury in Australia at the time of the farm survey. This amount is substantially higher than the average cost of serious injury estimated in the

survey, of \$2,489, and also considerably higher than \$9,200 average farm-work Workers Compensation claim, even though the latter includes the costs of compensation of a number of fatalities and permanent disabilities. The relationship between these various costs and benefits, and their implications for setting priorities in farm safety training programs, is an area for further work.¹

5. Conclusions and Implications

The results of the farm injury survey reported in this and related papers have confirmed several things that were previously only suspected by Australian rural OH&S professionals. The recorded frequency of farm-work related injuries shows them not only as a significant rural OH&S issue, but also as worthy of concern from a production efficiency point of view due to the disruption to farm work programs. More than one in five properties in the survey reported at least one farm-related injury per year. Each injury averaged 8 days off work and another 15 days working at restricted capability. Similarly, one in twelve properties reported at least one serious injury per year, averaging 23 days off work plus another 21 days at restricted capability.

The measured financial expenses associated with these injuries, such as medical treatment, travel for treatment, replacement labour, damage to plant and equipment, and production losses, were quite substantial. Across all injury types, the average cost to a farm where an injury occurred was around \$1000, while the average cost of a serious injury came close to \$2,500. For the estimated number of farm businesses in Australia of some 120,000, the survey data would suggest that a farm injury would occur on some 26,000 of these farms each year. The cost to the farm sector of these injuries would therefore total some \$26m each year, and of this figure about one-third would be a direct cost to the farm business in terms of lost output, the cost of extra labour and damage to farm plant and equipment.

While this aggregate estimate is not of the same magnitude as estimates using Worker's Compensation data (McCulloch), rural OH&S problems are confirmed as having a major and direct economic impact on farm families. In addition, the economic effects of these injuries are wide ranging and many are unpriced, including the opportunity cost of the time taken for travel, waiting and medical treatment, and unpriced losses in production due to delayed farm operations. Also, for farm families there is the pressure of extra

work taken on by family or friends or by the injured person returning to work, and the pain and suffering of the injured person. The costs of all these effects would be substantial and are often included in Workers Compensation payments (as are legal and investigation expenses). Finally, in the specific context of the survey, no fatalities or permanent disabilities were recorded in the sample and this would bias the estimated cost of injury down considerably.

The survey provided the first cross-sectional measure of the incidence of injury and an assessment of the costs associated with injury occurrence that covers the entire Australian rural labour force (employees, self-employed and unpaid family labour) in the traditional mixed farming context. In the past many farmers have not been moved to improve the safety of work practices by the risk of physical pain and suffering alone. The information collected in the survey can be used to make primary producers more aware of the levels of risk they face, and of the consequences such as disruption to work programs, the cost of medical treatment and rehabilitation, and losses in productivity and output, associated with the occurrence of an injury. The information can be utilised by the Farm Safety Action Group network to better target farm safety programs. The survey results also provide base data for injury occurrence in Australian mixed farming from which to monitor the effects of farm safety promotions, and the survey framework utilised may also provide a basis for monitoring changes in injury rates in other countries (eg updating the New Zealand work of Leathers and Williams).

¹ We thank the referee for raising these points.

References

- AUSTRALIAN BUREAU OF STATISTICS (1993), *Health Insurance Survey, Australia, June 1992*, AGPS, Canberra.
- AUSTRALIAN BUREAU OF STATISTICS (1991), *Regional Value of Agricultural Commodities, Agricultural Census Data, 1990/91*, AGPS, Canberra.
- AUSTRALIAN BUREAU OF STATISTICS (1988), *Employment Injuries New South Wales 1986-87*, Catalogue No. 6311.1, AGPS, Canberra.
- BRUSH, G.J. and CLEMES, M.D. (1995), "Market failure and chemical use", *Review of Marketing and Agricultural Economics* 63(3), 394-407.
- DAVIDSON, B. (1988), Deficiencies of workers compensation based statistics and options for improved data collection, FarmSafe Document, WorkSafe Australia, Canberra.

- DENNIS, B. (1988), Rural occupational health and safety in south-east New South Wales, Rural Occupational Health and Safety Project, National Community Health Program, Commonwealth Department of Health, Australia.
- ELKINGTON, J.M. (1990), A case-control study of potential risk factors for farmwork related injuries, unpublished PhD, University of Minnesota.
- GRIFFITH, G.R. and LOW, J.M. (1994), *The Economics of Farm Safety in Australian Agriculture, Final Report to the Rural Industries Research and Development Corporation*, NSW Agriculture, Armidale, March.
- HARRISON, J.E., FROMMER, M.S., RUCK, E.A. and BLYTH, F.M. (1989), "Deaths as a result of work-related injury in Australia, 1982-84", *The Medical Journal of Australia* 150(Feb 6).
- HEGNEY, D. (1993), "Agricultural occupational health and safety: farming families presenting a challenge to wellness", *The Australian Journal of Rural Health* 1(3), 27-33.
- KNOBEL, G.E. (1988), Collection of information on occupational accidents and disease in rural industry, CSIRO Occupational Health and Safety Unit, Dickson.
- LEATHERS, K.L. and WILLIAMS, J.D. (1984), *The economics of farm accidents and safety in New Zealand agriculture*, Agricultural Economics Research Unit, Report No. 154, Lincoln College, New Zealand, May.
- LEEDER, S.R. and BARTON, G. (1988), Health and delivery of health services to people engaged in primary production, FarmSafe Document 14D, WorkSafe Australia, Canberra.
- LOW, J.M., GRIFFITH, G.R., PARTON, K.A. and CLARKE, L.J. (1992), The incidence of farm injury: results from a pilot survey, Paper presented at the 35th Annual Australian Agricultural Economics Society Conference, Canberra.
- LOW, J.M. and GRIFFITH, G.R. (1993), The incidence and cost of farm injuries, Paper presented at the 36th Annual Australian Agricultural Economic Society Conference, Sydney.
- LOW, J.M., GRIFFITH, G.R. and ALSTON, C.L. (1996), "Australian farm work injuries: incidence, diversity and personal risk factors", *Australian Journal of Rural Health* (in press).
- MCCULLOCH, J. (1991), "Farm accidents - causes and costs", *Farm Safety Symposium: National Agricultural and Resources Outlook Conference 1991*, ABARE, Canberra, 1-7.
- MILLER, T. and GURIA, J. (1991), *The Value of Statistical Life in New Zealand: Market Research on Road Safety*, Land Transport Division, Wellington.
- MOORE, M.J. and VISCUSI, W.J. (1988), "The quality-adjusted value of life", *Economic Enquiry* 26, 369-88.
- PARTON, K.A. (1988), Cost-benefit aspects of health, occupational health and safety in the primary industries, paper presented at Farmsafe '88: A national conference on rural health and safety, University of New England, Armidale, pp13.
- PARTON, K.A. (1990), "Back injuries on farms: regional variations in New South Wales", *Journal of Occupational Health and Safety - Australia and New Zealand* 6(1), 53-9.
- RENWICK, M.Y. (1988), Occupational Hazards in Agriculture in Northern NSW: farmers' perceptions and experiences, unpublished paper, Canberra.
- WEBSTER, M.E.D., BATH, P.R. and LUSH, D.P. (1984), "The pattern and frequency of injury and illness among farm workers in NSW", *Proceedings of the Annual Conference of the Ergonomics Society of Australia and New Zealand*, Toowoomba, 64-9.
- WORKCOVER AUTHORITY (1993a), *Employment Injuries in Agriculture and Forestry: Workers Compensation Statistics, NSW, 1991/92*, WorkCover Authority, Sydney.
- WORKCOVER AUTHORITY (1993b), *Workers Compensation Statistics, NSW, 1991/92*, WorkCover Authority, Sydney.
- WORKSAFE AUSTRALIA (1988), *Farmsafe '88' Conference on Rural Occupational Health and Safety*, University of New England, Armidale.