

WORK-RELATED EYE INJURIES IN AUSTRALIA



JULY 2008



Australian Government
**Australian Safety and
Compensation Council**

Copyright Notice

© Commonwealth of Australia 2008

ISBN 978 0 642 32756 7

This work is copyright. You may download, display, print and reproduce this material in unaltered form only (retaining this notice) for your personal, non-commercial use or use within your organisation. Apart from any use as permitted under the *Copyright Act 1968*, all other rights are reserved. Requests and inquiries concerning reproduction and rights should be addressed to Commonwealth Copyright Administration, Attorney-General's Department, Robert Garran Offices, National Circuit, Barton ACT 2600 or posted at <http://www.ag.gov.au/cca>

TABLE OF CONTENTS

TABLE OF CONTENTS	ii
BACKGROUND OF THE PROJECT TEAM	iii
ACKNOWLEDGEMENTS AND DISCLAIMER	iii
GLOSSARY	iii
EXECUTIVE SUMMARY	iv
1. INTRODUCTION	5
1.1 Background	5
1.2 Project aims	6
1.3 Outline of the structure of the report	6
2. METHODS	7
2.1 Emergency department data	7
2.2 Hospital data	8
2.3 Workers' compensation data	8
2.4 Format of results.	8
3. RESULTS	10
3.1 Introduction	10
3.2 Gender	11
3.3 Age	11
3.4 Industry	12
3.5 Place	13
3.6 External cause	14
3.7 Nature of injury	15
3.8 Length of stay	15
3.9 Circumstances of injury	17
3.10 Personal protective equipment	18
4. DISCUSSION	20
5. CONCLUSIONS	22
6. REFERENCES	23
APPENDIX 1: DETAILED ANALYSIS OF WORK-RELATED EYE INJURIES REQUIRING HOSPITAL ADMISSION	24

BACKGROUND OF THE PROJECT TEAM

This report was prepared by Dr Tim Driscoll, Dr Louise Flood and Dr James Harrison.

Dr Driscoll is an independent consultant in epidemiology, occupational health and public health. He is a specialist in occupational medicine and public health medicine, and previous head of the Epidemiology Unit at the National Occupational Health and Safety Commission. He is also a fellow of the Australasian Faculty of Occupational Medicine and the Australasian Faculty of Public Health Medicine.

Dr Flood is a medical practitioner and Research Officer at the Research Centre for Injury Studies at Flinders University.

Dr Harrison is Associate Professor and Director of the Research Centre for Injury Studies, and a fellow of the Australasian Faculty of Public Health Medicine.

ACKNOWLEDGEMENTS AND DISCLAIMER

Data from the Victorian Emergency Minimum Dataset were provided by Dr Erin Cassell and Ms Karen Ashby, Co-ordinator of the Victorian Injury Surveillance Unit. Data from the Queensland Injury Surveillance Unit were provided by Ms Ruth Barker. The authors would like to thank all these persons.

The analysis of hospital separations presented in this report is based on data made available by the Australian Institute of Health and Welfare (AIHW). The authors, and not AIHW, are responsible for the use made of the data in this report.

Louise Flood, James E Harrison, Research Centre for Injury Studies, Flinders University
Timothy Driscoll, ELMATOM Pty Ltd

GLOSSARY

FB Foreign body

EXECUTIVE SUMMARY

Background

The project aimed to provide an analysis of recent work-related eye injuries in Australia, focussing in particular on presentations to emergency departments and admissions to hospitals, although some information from workers' compensation agencies was also used.

Methods

The report focuses on emergency department presentations, hospital admissions and completed workers' compensation claims in 2002-2003 and 2003-2004. The emergency department data came primarily from Victoria, with some minor supplementation from Queensland. Hospital admissions data were for the whole of Australia. Workers' compensation data came from Queensland, South Australia and Tasmania.

Findings

Work-related eye injuries remain an important problem in the Australian workforce. They are a common cause of work-related injury presentation to emergency departments in Australia and also result in about 500 admissions to hospital per year.

Most of the injuries that occur appear to be relatively minor (not requiring hospital admission) and most involve foreign bodies on the eye, particularly on the cornea.

Grinding and welding are the two most common tasks being performed when an eye injury occurs, but there is a very wide range of circumstances that can result in an eye injury.

The construction and manufacturing industries, and to a lesser extent the agriculture, forestry and fishing and mining industries, appear to be the industries where workers most commonly sustain an eye injury in the course of work. This is probably due to the tasks being undertaken and the processes that can generate lightweight foreign bodies travelling at high speed.

Not surprisingly, many of the eye injuries occurred when the person was not wearing appropriate eye protection. However, a considerable proportion of cases occurred when appropriate eye protection does appear to have been worn. This suggests the need to examine the design of the safety eyewear and/or improve the training of workers so that they know how to properly wear the eye protection.

1. INTRODUCTION

1.1 BACKGROUND

Injury is known to be an important cause of work-related morbidity and mortality of workers in Australia (Driscoll and Mayhew, 1999). Information on such injury is potentially available from a variety of sources. Most of these sources are primarily based on one or more administrative criteria. For example, an injured person may be identified because the injuries they sustained resulted in death (which almost always results in notification to a coroner), hospitalisation, presentation to an emergency department, presentation to a general practitioner, a successful claim for workers' compensation, investigation by an occupational health and safety agency, the person taking one or more days off work, and so on. Some of these systems have a reasonably close alignment with the severity of the injury. For example, an injured person presenting to an emergency department but not requiring admission to hospital is likely to have more severe injuries than a person who presents to a general practitioner but less severe injuries than a person who is admitted to hospital as a result of their injuries. In contrast, injuries for which workers' compensation payments are received can range from being relatively minor (with the proviso that one working week off work is usually required for an injured person to be included in publicly available workers' compensation data) to fatal.

Some injury episodes will result in the injured person being recorded in more than one data set, but many injured persons will only be recorded in one or no data sets. The extent of overlap between the various data sources is not known. However, it is clear that to gain a full appreciation of the extent of work-related injury in the community, information will be required from several different sources. In addition, one of the keys to developing effective interventions aimed at preventing injury is having a good understanding of the characteristics of the injured persons, their injuries, and the circumstances in which the injuries occurred. Since each data source probably has characteristic injuries with characteristics injury circumstances, it is necessary to examine information from a range of data sources in order to plan appropriate interventions.

Injured persons presenting to emergency departments in Australia have been the subject of five publications – presentations to Victorian emergency departments in the early 1990s (Routley and Valuri 1993, 1994) and 1999 to 2002 inclusive (Stathakis and Cassell, 2004); presentations to a sample of Queensland emergency departments in 1996/1997 (Hockey and Miles, 1999); and a more recent combined analysis of Victorian and Queensland data (Driscoll and Harrison, 2007). This most recent report recommended, among other things, a more detailed examination of work-related eye injuries and work-related hand injuries.

This report presents the detailed analysis of eye injuries. The detailed analysis of hand injuries is presented in a companion report.

The current report was commissioned by The Office of the Australian Safety and Compensation Council of the Australian Government Department of Education, Employment and Workplace Relations. It aims to provide a detailed analysis of recent work-related eye injuries in Australia, focussing in particular on presentations to emergency departments and admissions to hospitals, although some information from workers' compensation agencies was also used.

The report focuses on emergency department presentations, hospital admissions and completed workers' compensation claims in 2002-2003 and 2003-2004. The emergency department data came primarily from Victoria, with some minor supplementation from Queensland. Hospital admissions data were for the whole of Australia. Workers' compensation data came from Queensland, South Australia and Tasmania and included only serious claims for injury. Serious claims are those defined as involving one or more weeks off work.

1.2 PROJECT AIMS

The project aimed to provide a detailed analysis of recent work-related eye injuries in Australia, focussing in particular on presentations to emergency departments and admissions to hospitals.

1.3 OUTLINE OF THE STRUCTURE OF THE REPORT

This report has six main chapters. The Introduction provides background regarding the project. The approach taken in conducting the project is described in Chapter 2. Chapter 3 provides the main findings. Chapter 4 provides a discussion of the results, Chapter 5 presents a brief summary and conclusions, and the references are provided in Chapter 6. A more detailed consideration of eye injuries resulting in hospital admission is provided in Appendix 1.

2. METHODS

2.1 EMERGENCY DEPARTMENT DATA

There is no source of national information on emergency department presentations in Australia. Information used in this study comes primarily from the most comprehensive of the available collections – the Victorian Emergency Minimum Dataset (VEMD), run by the Victorian Injury Surveillance Unit. Some other information was also provided by the Queensland Injury Surveillance Unit (QISU). For both collections, the data covered injury presentations over the two year period 1 July 2002 to 30 June 2004 inclusive.

The Victorian data covered injured persons treated at the emergency departments of the 38 hospitals collecting data in accordance with the. The injury information was coded using the International Classification of Diseases ICD-10-AM, edition 3 (NCCH, 2002). Eligible cases were persons aged 15 years or over who had a coded activity at the time of injury equal to “*working for income*” and who sustained an eye injury. Variables used for the current analysis were age, sex, injury cause, location, nature of main injury, body region, departure status, referral on departure and a brief text description of the injury event. For each of the main injury circumstances, as identified by the analysis of coded variables, a random sample of the text descriptions of 200 cases was obtained. This represented 8% to 65% of the relevant cases, depending on the number of cases in each circumstance. These descriptions were read and common themes identified. The Victorian data exclude persons that presented to an emergency department and were subsequently admitted as a result of their injury. Victorian data do not include information on industry.

The Queensland data covered injured persons treated at any one of the 16 hospitals participating in the data collection activities of the QISU. Three regions are covered by these 16 hospitals - metropolitan (South Brisbane); regional (Mackay and Moranbah Health Districts) and remote (Mt Isa). The precise coverage of the Queensland population, and of the Queensland working population, by the Queensland data collection is not known. Similarly, it is not known to what extent the collection is representative of the Queensland workforce. Eligible cases were persons of any age who had a coded activity at the time of injury equal to “*working for income*”. All the variables used from the Victorian data were also available from Queensland. In addition, the Queensland data had information available on the industry of employment of the injured person. Text descriptions were provided for all the Queensland cases, but there was no coded information to allow determination of the relevant industry of the worker whose injury was described in the text description.

The analysis of emergency department data presented here focuses on the Victorian data, as they cover nearly the whole of Victoria and are more likely to be representative of a broad range of industries. Analysis of the Queensland data also indicated that the type of incidents resulting in eye injuries were similar in Queensland and Victoria. Queensland data are used primarily to provide some information on industry specific issues.

2.2 HOSPITAL DATA

Data on eye injuries resulting in hospital admissions came from the Australian Institute of Health and Welfare's hospital separations data base. This covers virtually all admissions to public and private hospitals in Australia. Cases were all persons with a date of separation (which equates almost directly to an episode of admission) from hospital between 1 July 2002 and 30 June 2004; an eye injury as recorded by the coded information; and a code indicating they were working for income at the time of the injury (U73.0). The data were coded with the third edition of ICD-10-AM (NCCH, 2002). Separate "cases" which involved a transfer from another acute-care hospital (meaning they were not new incident cases) were excluded, except for calculation of length of stay.

2.3 WORKERS' COMPENSATION DATA

Workers' compensation data were included primarily to examine the text descriptions available for cases. Information on accepted claims for serious eye injuries that occurred from 1 July 2002 to 30 June 2004 inclusive were obtained from Queensland, South Australia and Tasmania. Text descriptions were also available from Queensland and South Australia.

2.4 FORMAT OF RESULTS.

Where possible, results are presented for the three main data sources – emergency department presentations, hospital admissions and workers' compensation claims – in each section of the results. Where this is not possible, only the data sources that could provide useful data were included. In some areas, relevant data were only available from one of the data sources.

The absolute number of cases in any one category was generally not of major interest because only the hospital separations data are national, and the focus of this analysis was on obtaining a qualitative as well as a quantitative assessment of eye injury cases. For this reason, most of the information presented is in terms of percentages rather than absolute numbers.

Generally, categories presented in tables were not separately included if they contained less than 10 cases. Where data are presented in terms of categories and sub-categories, only the categories with more than 10 cases are included. This means that the sub-category percentages presented in the tables may be less than the total for the relevant category. An asterix (*) in a table means there was at least one case. A dash (-) means there were no cases.

3. RESULTS

3.1 INTRODUCTION

This report considers eye injuries which occurred in the period 1 July 2002 to 30 June 2004 inclusive. As mentioned, the absolute number of cases of eye injury was not of primary interest in this analysis. In order to provide an understanding of the scope of the problem and the number of cases on which the percentages are based, the overall numbers are indicated in each table as appropriate.

There were 1049 cases of work-related eye injury resulting in hospital admission. This represented all cases of work-related eye injury admitted to hospital in Australia in the two-year period covered by the study. Work-related eye injuries comprised 2.2% of all work-related injury admissions over that period.

There were 7299 emergency department presentations in Victoria for work-related eye injuries over the two-year study period. This represented 19.1% of the 38 210 work-related presentations to emergency departments in Victoria over the same period. Another 139 work-related eye injury cases presented to one of these emergency departments and resulted in admission (i.e. about 1.9% of persons presenting to an emergency department with a work-related eye injury required admission). In Queensland, there were 2144 cases of work-related eye injury, which represented 28% of the 7552 work-related cases of injury that presented to the involved emergency departments over the same period.

There were 822 accepted serious claims for eye injuries in the workers' compensation data provided by Queensland, South Australia and Tasmania for the 2 year period. These claims involved the injured working requiring one or more weeks off work.

3.2 GENDER

The vast majority of eye injuries occurred in males. This was the case for all three data sources (Table 1).

Table 1 Sex of injured persons – eye injuries - work-related hospital admissions, emergency department presentations and workers' compensation claims, July 2002 to June 2004. Per cent

	Hospital¹ N = 1049	ED² N = 7299	WC³ N = 822
Male	93.0	91.8	88.2
Female	7.0	8.2	11.8
Total	100.0	100.0	100.0

1: Hospital admissions - Australia

2: Emergency department admissions - Victoria

3: Serious workers' compensation claims – Queensland, South Australia and Tasmania

3.3 AGE

Work-related injuries occurred to people of all ages from 15 years onwards, but about 80% of injuries occurred to persons aged between 20 and 44 years. The distribution of injuries across age groups was similar in all three data sets (Table 2).

Table 2 Age of injured persons – eye injuries – work-related hospital admissions, emergency department presentations and workers' compensation claims, July 2002 to June 2004. Per cent

	Hospital¹ N = 1049	ED² N = 7299	WC³ N = 822
15-19	8.1	6.2	6.9
20-24	12.8	13.0	13.9
25-29	15.5	13.5	14.7
30-34	14.6	13.2	14.8
35-39	13.9	11.2	14.7
40-44	11.7	26.8	11.6
45-49	8.6	6.6	9.7
50-54	5.7	5.0	7.1
55-59	4.5	2.8	4.6
60-64	*	1.3	1.8
65+	*	0.3	*
Total	100.0	100.0	100.0

1: Hospital admissions - Australia

2: Emergency department admissions - Victoria

3: Serious workers' compensation claims – Queensland, South Australia and Tasmania

3.4 INDUSTRY

Information on industry was not available for the Victorian data. The hospital data unfortunately had no industry coded for just over one third of cases, and an “other specified” industry for another 21%. Of the remainder, construction, agriculture, forestry and fishing and manufacturing were the main industries of the injured persons. The industry information was much more complete for the workers’ compensation information, in which the manufacturing industry was the dominant industry, being the industry of employment for 38% of the cases. The next most common industries were construction and wholesale and retail trade (Table 3). In the Queensland data, the most common industries were manufacturing (21%), construction (19%), and mining (13%).

Table 3 Industry of injured persons – eye injuries – work-related hospital admissions and workers’ compensation claims, July 2002 to June 2004. Per cent

	Hospital ¹ N = 1049	ED ² N = 7299	WC ³ N = 822
Agriculture, forestry & fishing	8.7		7.7
Mining	2.6		1.6
Manufacturing	7.7		38.0
Construction	12.3		11.9
Wholesale & retail trade	4.6		10.8
Accommodation, Cafes and Restaurants	-		3.4
Transport & storage	4.1		4.5
Property and business services	-		7.7
Government administration and defence	0.9		2.7
Education	-		4.0
Health services	1.7		3.0
Personal and other services	-		3.6
Other specified work for income	21.0		1.1
Unspecified working for income	36.5		-
Total	100.0		100.0

1: Hospital admissions - Australia

2: Emergency department admissions – Victoria – no industry information

3: Serious workers’ compensation claims – Queensland, South Australia and Tasmania

3.5 PLACE

The main places of occurrence for the eye injuries resulting in hospital admission were industrial and construction areas (32%) such as factories and constructions sites, and trade and service areas (14%) such as eating places and commercial garages. Farms were also relatively common sites for eye injuries to occur.

For emergency department presentations the rank order was reversed, with the majority of incidents occurring in trade and service areas (62%), and most of the rest occurring at industrial and construction areas (23%). Place of occurrence was not available for the workers' compensation data (Table 4).

Table 4 Place of injury occurrence – eye injuries – work-related hospital admissions and emergency department, July 2002 to June 2004. Per cent

	Hospital ¹ N = 1049	ED ² N = 7299	WC ³ N = 822
Trade & service area	13.8	62.0	
Commercial garage†	2.5		
Café, hotel & restaurant	3.2		
Other specified trade & service area	3.3		
Unspecified trade & service area†	4.7		
Industrial & construction area	32.4	22.7	
Construction area	5.9		
Factory & plant	10.1		
Mine & quarry†	2.4		
Other specified industrial & construction area	3.8		
Unspecified industrial & construction area†	10.0		
Medical / hospital†	-	3.8	
Home†	2.5	1.9	
Public highway, street & road†	3.1	1.1	
Farm	6.2	1.7	
Residential institution & public administrative area	2.9	0.7	
Other specified place of occurrence	5.2	4.0	
Unspecified place of occurrence	33.6	2.1	
Total	100.0	100.0	

1: Hospital admissions - Australia

2: Emergency department admissions – Victoria

3: Serious workers' compensation claims – Queensland, South Australia and Tasmania – no place information

†: The hospital percentages are estimates based on the analysis of injuries in males. The exact percentages cannot be provided due to confidentiality issues with small numbers of females.

3.6 EXTERNAL CAUSE

There was a wide range of external causes associated with the eye injuries, but the predominant cause in all data sets was exposure to inanimate mechanical forces. There appeared to be some variation in the way the coding scheme was applied, with the Victorian emergency department data not having any cases coded to the specific ICD-10 category “Foreign body (FB) entering into or through eye or natural orifice”, a category that clearly would cover a significant proportion of the eye injuries. The emergency department data highlighted the importance of being hit in the eye by something and the involvement of machinery. The workers compensation data were not coded to ICD-10, but the variables and categories used for the workers' compensation data allowed an approximate translation to ICD-10 categories, and this confirmed the predominance of foreign bodies.

Table 5 External cause of injury – eye injuries – work-related hospital admissions and emergency department, July 2002 to June 2004. Per cent

	Hospital ¹ N = 1049	ED ² N = 7299	WC ³ N = 822
Exposure to inanimate mechanical forces	67.9	54.2	80.0
<i>Struck by or collision with object</i>	18.4	34.5	4.1
<i>Machinery</i>	5.2	12.8	
<i>Cutting, piercing object</i>		6.9	
<i>FB entering into or through eye or natural orifice</i>	35.2		64.2
<i>FB or object entering through skin</i>	2.6		
<i>Exposure to other & unspecified inanimate mechanical forces[†]</i>	4.1		11.7
Accidental poisoning	17.4	1.0	8.2
Exposure to animate mechanical forces	1.5	4.2	1.0
<i>Struck by or collision with person</i>	-	4.2	0.9
Contact with heat and hot substances	1.5	7.1	3.2
<i>Contact burn (hot object)</i>		6.4	
<i>Scalds</i>		0.7	
Assault	4.7		2.3
Fire, flames, smoke		0.5	
Transport accidents [†]	2.6	0.2	0.4
Electricity		0.2	
Falls	2.0		1.2
Other specified external causes [†]		24.7	2.6
Unspecified causes [†]	2.0	7.5	1.2
Total	100.0	100.0	100.0

1: Hospital admissions - Australia

2: Emergency department admissions – Victoria

3: Serious workers' compensation claims – Queensland, South Australia and Tasmania – data based on Type of Occurrence Mechanism codes.

†: The hospital percentages are estimates based on the analysis of injuries in males. The exact percentages cannot be provided due to confidentiality issues with small numbers of females.

FB – foreign body

3.7 NATURE OF INJURY

There were only two types of eye injury recorded in the emergency department data – a foreign body in the eye (63.5%) or some other type of eye injury (36.5%). Detailed information on the nature of injury was only available for the hospital admissions data. Not surprisingly, foreign bodies on the eye predominated, but there were also a considerable proportion of more serious injuries. A foreign body in the cornea (17.6%) or unspecified part of the eye (6.7%) was the most common principal diagnosis in work-related eye injury hospitalisations (299 cases). Fourteen and a half per cent of eye work-related injury hospitalisations were due to a penetrating wound of the orbit or eyeball (152 cases), and 13.9% of hospitalisations were due to a burn of the eye and adnexa (146 cases). Burns included injury caused by caustic substances as well as those caused by bright lights, fire and heat or hot substances (Table 6). One third of the injuries in construction workers involved penetrating eye injuries, with the next highest percentage being for the agriculture, forestry and fishing industries, for which 14.3% of admissions were for penetrating eye injuries.

3.8 LENGTH OF STAY

The majority of persons hospitalised for work-related eye injuries were discharged on the day of admission (51.6%). However, this did vary by diagnosis. Eighty-six per cent of persons hospitalised with 'FB in external eye' were discharged on the day of admission. In contrast, only 17.3% of persons hospitalised with a principal diagnosis of 'ocular laceration' were discharged on the day of admission. The mean length of stay for work-related hospitalisations with a principal diagnosis of an eye injury was 2.2 days.

Table 6 Nature of injury – by sex – eye injuries - work-related hospital admissions, July 2002 to June 2004. Per cent

Injury	Per cent
Superficial injury of eyelid & peri-ocular area	1.4
Open wound of eyelid & peri-ocular area	5.7
Fracture of orbital floor	7.3
Injury of conjunctiva & corneal abrasion without mention of FB†	2.8
Contusion of eyeball & orbital tissues§ †	5.5
Ocular laceration	
<i>Ocular laceration & rupture with prolapse or loss of intraocular tissue†</i>	5.1
<i>Ocular laceration without prolapse or loss of intraocular tissue</i>	4.3
Penetrating wound	
<i>Penetrating wound of orbit with or without FB</i>	2.7
<i>Penetrating wound of eyeball with FB</i>	8.5
<i>Penetrating wound of eyeball without FB</i>	3.3
Other injuries of eye & orbit†	4.8
Injury of eye & orbit, part unspecified	3.8
Foreign body (FB)	
<i>FB in cornea</i>	17.6
<i>FB in conjunctival sac†</i>	1.8
<i>FB in other & multiple parts of external eye†</i>	3.7
<i>FB on external eye, part unspecified</i>	6.7
Burn	
<i>Burn of eyelid & periocular area†</i>	0.9
<i>Burn of cornea & conjunctival sac</i>	6.9
<i>Burn of other parts of eye & adnexa†</i>	0.7
<i>Burn of eye & adnexa, part unspecified</i>	5.1
Total	100.0

† The hospital percentages are estimates based on the analysis of injuries in males. The exact percentages cannot be provided due to confidentiality issues with small numbers of females.

§ Includes traumatic hyphaema.

FB – foreign body.

Table 7 Mean length of stay – eye injuries – by principal diagnosis and sex - work-related hospital admissions, July 2002 to June 2004. Per cent and days

Principal diagnosis	Percentage discharged on same day	Length of stay (days)		
		Males	Females	Persons
Superficial injuries of eyelid & periocular area	60.0%	1.6	2.0	1.8
Open wound of eyelid & periocular area	55.0%	1.3	3.0	1.4
Fracture of orbital floor	20.8%	3.1	5.6	3.4
Injury of conjunctiva & corneal abrasion without mention of FB	45.2%	1.6	1.3	1.6
Contusion of eyeball & orbital tissues [§]	27.1%	3.0	1.7	3.0
Ocular laceration	17.3%	3.7	1.0	3.6
Penetrating wound of orbit & or eyeball	28.9%	2.6	0	2.7
Other injuries of eye & orbit	55.2%	1.8	1.4	1.8
FB in external eye	86.0%	1.1	1.0	1.1
Burn of eye & adnexa	46.6%	2.9	2.1	2.8
Total	51.6 %	2.2	2.2	2.2

§ Includes traumatic hyphaema.
FB = foreign body.

3.9 CIRCUMSTANCES OF INJURY

Only the emergency department data from Queensland and the workers' compensation data provided coded detail on the type of equipment involved. This showed the prominent role of grinders in particular, and drills and welders to a lesser extent. This was particularly the case for the manufacturing industry. The text descriptions confirmed this.

The text descriptions revealed that there was a very wide range of injury circumstances leading to eye injuries presenting to emergency departments, but confirmed that the most prominent activities in all circumstances apart from burns were using grinders and welders, and welders were commonly involved in burns.

3.10 PERSONAL PROTECTIVE EQUIPMENT

Information on the use or non-use of personal protective equipment relevant to eye injuries (that is, safety glasses or goggles or a face shield) was available in only a minority of the text descriptions. The main features of the text descriptions relevant to the use of eye safety equipment were the considerable number of persons who recorded that they were wearing goggles (or occasionally a face shield) at the time of the injury, and the large proportion of text descriptions that did not mention whether or not eye protection was being worn.

Of the 1000 text descriptions provided for Victorian cases, 14.7% mentioned that eye protection was definitely worn, 10.3% mentioned that eye protection definitely wasn't worn or was not worn properly, and 75% did not mention eye protection at all. For injuries involving grinders the information provided on this was a little better, with 40% of text descriptions stating that eye protection was being worn at the time of the injury, 14% stating that eye protection was not being worn or not being used properly, and 56% not commenting on eye protection at all. For welding-related eye injuries, 23% of injured persons reported wearing appropriate eye protection, 15% reported not wearing eye protection or not wearing it properly, and 62% did not mention eye protection. Those text descriptions that did not mention eye protection sometimes had an implication that eye protection was not worn. There was also a small proportion of cases where the circumstances appeared to be such that eye protection would not usually be expected to be worn.

The results in the Queensland emergency department text descriptions and in workers' compensation text descriptions were similar, except that the workers' compensation descriptions, although generally more comprehensive in terms of the circumstances, were less likely to mention eye protection for the grinding and welding incidents (Table 8).

The majority of the incidents where persons were injured despite wearing eye protection mentioned that a foreign body of some sort flew under, over, or to the side of the protective edge of the glasses and onto the eye.

Table 8 Information on use of eye protection – eye injuries – emergency department presentations and workers' compensation claims, July 2002 to June 2004. Per cent

	ED Victoria	ED Queensland ²	WC ³
All incidents			
- Worn	14.7	25.6	18.2
- Not worn	10.3	0.7	3.5
- Not mentioned	75.0	73.7	78.3
Grinder incidents			
- Worn	40.3	35.4	29.1
- Not worn	13.6	0.5	0
- Not mentioned	46.0	64.0	70.9
Welding incidents			
- Worn	23.2	35.3	14.0
- Not worn	14.5	2.6	1.8
- Not mentioned	62.3	62.1	84.2
Total	100.0	100.0	100.0

1: Emergency department admissions – Victoria

2: Emergency department admissions – Queensland

3: Serious workers' compensation claims – Queensland and South Australia

4. DISCUSSION

Eye injuries have previously been shown to be an important reason for presentation at emergency departments (Driscoll and Harrison, 2007). This report used information from emergency departments, hospital separations and workers' compensation to examine the characteristics of these injuries, and the circumstances surrounding their occurrence, in more depth. This analysis confirmed that eye injuries comprise a considerable proportion (about 20% to 25%) of all work-related injuries presenting to emergency departments, but that nearly all such eye injuries do not require hospital admission. Work-related eye injuries comprise a much smaller proportion of all work-related injuries requiring admission to hospital (about 2%), but nevertheless about 500 persons each year sustain a work-related eye injury that is severe enough to require hospitalization.

The main industries in which eye injuries appear to be a problem are the construction industry, manufacturing industry, agriculture, forestry and fishing industry and the mining industry (based on the Queensland emergency department information). The construction industry appears to have a higher proportion of more severe eye injuries. Using a powered grinder is clearly the task resulting in the highest number of work-related eye injuries, usually as a result of foreign bodies striking the cornea. Welding is the most common cause of burn injuries to the eye. Similar results have been reported for Australia (De La Hunty and Sprivulis, 1994; Fong and Taouk, 1995; Imberger et al, 1998) and elsewhere (Peate, 2007).

There is no doubt that wearing eye protection dramatically decreases the risk of sustaining an eye injury at work. Nevertheless, a surprisingly high proportion of eye injuries occur when the worker is apparently wearing eye protection in an appropriate manner. This is particularly the case for persons using grinders and, to a lesser extent, people sustaining an injury while welding. It might be argued that it is in the workers' interests to state that they were wearing eye protection even if they weren't, as this might be perceived as having some implication for compensation. However, the issue of injuries occurring when eye protection was reported to have been worn was documented in all three data sources that provided text information, and the incentive to falsely claim the use of eye protection seems markedly diminished in the hospital emergency department setting. Therefore, it seems unlikely that this would explain the findings. Where information was provided in the text descriptions, a high proportion of descriptions implied that the glasses provided inadequate protection. However, there was also little information to allow an assessment of whether the workers were really wearing the protection properly, or whether the equipment complied with the relevant Australian standard (Australian Standard AS 1336). Eye injuries occurring despite wearing safety glasses has previously been reported in

Australia (Moller, 1997; Moller and Bordeaux, 1998) and the results here suggest the design of some safety eye wear remains a problem in certain circumstances.

Only the hospital data provided national coverage. The emergency department data came primarily from Victoria and provide almost complete coverage of emergency department admissions in that State. Therefore, the information should provide a valid description of work-related eye injuries in Victoria. Since Victoria has a wide range of industries (with mining perhaps being the one industry not likely to be well represented in the data set), this information should be broadly applicable to Australia as a whole. The workers' compensation text information was only from two states, but it is likely that the circumstances of injury for a given task would be similar. Since the information was used primarily to gain an understanding of the way the eye injuries were occurring, using information from only two jurisdictions is unlikely to introduce important bias. Regardless, text descriptions were not available electronically from other jurisdictions for this project.

The lack of mention of eye safety equipment in many of the text descriptions highlights the difficulties in using narrative data that are not specifically designed to answer a particular research question. Nevertheless, some useful information was available in the text fields. There may be benefit in developing some simple written guidelines that could be given to persons completing narrative fields, so that they have an understanding of the sort of information that would be useful to people who may make use of the data at a later time. There is probably more chance of meaningfully influencing the recording of text fields in emergency department data sets than in workers' compensation cases, as presumably it is health personnel rather than the injured person who usually write the text. However, whether such an approach would have any meaningful impact on the quality and usefulness of the data provided from either source would need to be tested.

5. CONCLUSIONS

Work-related eye injuries remain an important problem in the Australian workforce. They are a common cause of work-related injury presentation to emergency departments in Australia and also result in about 500 admissions to hospital per year.

Most of the injuries that occur appear to be relatively minor (not requiring hospital admission) and most involve foreign bodies on the eye, particularly on the cornea.

Grinding and welding are the two most common tasks being performed when an eye injury occurs, but there is a very wide range of circumstances that can result in an eye injury.

The construction and manufacturing industries, and to a lesser extent the agriculture, forestry and fishing industries and the mining industry, appear to be the industries where workers most commonly sustain an eye injury in the course of work. This is probably due to the tasks being undertaken and the processes that can generate lightweight foreign bodies travelling at high speed.

Not surprisingly, many of the eye injuries occur when the person is not wearing appropriate eye protection. However, a considerable proportion of cases occur when appropriate eye protection does appear to have been worn. This suggests the need to examine the design of the safety eyewear and/or improve the training of workers so that they know how to properly wear the eye protection.

6. REFERENCES

- De La Hunt D, Sprivulis P (1994). Safety goggles should be worn by Australian workers. *Australian and New Zealand Journal of Ophthalmology*; 22(1):49-52.
- Driscoll TR, Harrison JE (2007). *Work-related injuries using emergency department data*. Canberra: The Australian Safety and Compensation Council.
- Driscoll T, Mayhew C (1999). Extent and cost of occupational injury and illness, in *Occupational health and safety in Australia*. C. Mayhew, C. Peterson, Editors. Allen & Unwin: Sydney. p. 28-51.
- Hockey R, Miles E (1999). *Workplace injury*.
http://www.qisu.org.au/modcore/PreviousBulliten/backend/upload_file/issue053.pdf
Accessed May 2008.
- Imberger A, Altmann A, Watson W (1998). *Unintentional adult eye injuries in Victoria*. Melbourne: MUARC. Report 137.
- Moller J (1997). Keeping an eye on eye protection. *Injury Issues Monitor*; 10:1-2.
- Moller J, Bordeaux S (1998). *Eye injuries in the workplace occurring while wearing recommended and approved eye protection*. Adelaide: Research Centre for Injury Studies. <http://www.nisu.flinders.edu.au/pubs/eyeinjury/eyeinjury.html>. Accessed May 2008.
- National Centre for Classification in Health (NCCH) (2002). *The International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification, (ICD-10-AM)*, Third edition: University of Sydney.
- Peate WF (2007). Work-related eye injuries and illnesses. *American Family Physician*; 75(7):1017-1022.
- Routley V, Valuri J (1993). *Work-related injuries*. VISU: Melbourne.
- Routley V, Valuri J (1994). *Work-related injuries*. VISU: Melbourne.
- Stathakis V, Cassell E (2004). *Overview of unintentional hospital-treated work injury, Victoria 1999-2002*. VISAR: Melbourne.
- Fong LP, Taouk Y (1995). The role of eye protection in work-related eye injuries. *Australian and New Zealand Journal of Ophthalmology*; 23(2):101-106.

APPENDIX 1: DETAILED ANALYSIS OF WORK-RELATED EYE INJURIES REQUIRING HOSPITAL ADMISSION

A1.1	Hospitalised eye injury in context of all work-related injury	25
A1.2	Hospitalised eye injury	27
	Sex and age	27
	Industry sector and worker's compensation status	27
	Mechanism of injury	28
	Place of injury	29
	Remoteness of residence	29
	Month and day of admission	30
	Principal diagnosis	31
	Length of stay	35
A1.3	Data issues	37
	Inclusion criteria	37
	Exclusion criteria	38
	Small case numbers	38
	Length of stay	38
	References	39

A1.1 Hospitalised eye injury in context of all work-related injury

Selection criteria: *

- While working for income (U73.0)
- July 2002 to June 2004
- All work-related injury compared with work-related injury cases with eye diagnosis in the principal diagnosis

Only 2.0% of all hospitalised work-related injury was work-related eye injury. This proportion fairly evenly spread across age groups and sexes, with a range from 0.0% to 2.9% (Table A1.1).

Appendix Table 1.1: Sex and age group at admission for work-related injury hospitalisations and proportion of work-related eye injury hospitalisations, in Australia, 2002–2004

Age group at admission (years)	All work-related injury hospitalisations			Proportion that is work-related eye injury hospitalisations**		
	Males	Females	Persons	Males	Females	Persons
0–14	93	37	130	2.2%	2.7%	2.3%
15–19	2968	468	3436	2.6%	1.7%	2.5%
20–24	5425	802	6227	2.3%	1.0%	2.2%
25–29	5266	786	6052	2.9%	1.0%	2.7%
30–34	5773	737	6510	2.5%	1.4%	2.4%
35–39	5332	796	6128	2.6%	0.6%	2.4%
40–44	5272	1024	6296	2.2%	0.9%	2.0%
45–49	4519	1031	5550	1.9%	0.6%	1.6%
50–54	3760	891	4651	1.4%	0.9%	1.3%
55–59	2846	723	3569	1.5%	0.6%	1.3%
60–64	1481	278	1759	1.9%	0.7%	1.7%
65–69	579	109	688	1.4%	0.0%	1.2%
70+	508	274	782	0.6%	1.5%	0.9%
Total	43 822	7956	51 778	2.2 %	0.9 %	2.0 %

** Only includes cases with eye injury in the principal diagnosis (see data issues for inclusion criteria).

The construction industry had the highest proportion of work-related eye injury hospitalisations, compared with all work-related injury hospitalisations, with 2.3% and the government administration and defence industry and health services industry had the lowest proportion of work-related eye injury with 1.3% each. In most industries (except agriculture, forestry and fishing) males had a higher proportion of hospitalised work-related eye injuries than in females (Table A1.2).

The proportion of injury work-related hospitalisations that were eye injury work-related hospitalisations varied with the mechanism of injury. 86.2% of admissions with a 'FB entering into or through eye or natural orifice' were admitted with an eye injury diagnosis in the principal diagnosis field. 41.5% of accidental poisoning related work-related injury hospitalisations had an eye injury as the principal diagnosis. In contrast, only 0.2% of work-related injury hospitalisations with a mechanism of injury of 'falls' had an eye injury as the principal diagnosis (Table A1.3).

* See data issues for further details on selection criteria.

Appendix Table 1.2: Sex and industry for work-related injury hospitalisations and proportion of work-related eye injury hospitalisations, in Australia, 2002–2004

Industry sector (code)	All work-related injury hospitalisations			Proportion that is work-related eye injury hospitalisations **		
	Males	Females	Persons	Males	Females	Persons
Agriculture, forestry & fishing (U73.00)	4520	537	5057	1.8%	2.0%	1.8%
Mining (U73.01)	1314	40	1354	2.1%	0.0%	2.0%
Manufacturing (U73.02)	3861	338	4199	2.0%	0.6%	1.9%
Construction (U73.03)	5477	53	5530	2.4%	0.0%	2.3%
Wholesale & retail trade (U73.04)	2487	1054	3541	1.5%	0.9%	1.4%
Transport & storage (U73.05)	2430	149	2579	1.7%	0.7%	1.7%
Government administration & defence (U73.06)	563	150	713	1.4%	0.7%	1.3%
Health services (U73.07)	371	975	1346	2.4%	0.9%	1.3%
Other specified work for income (U73.08)	8231	1948	10 179	2.5%	0.8%	2.2%
Unspecified working for income (U73.09)	14 568	2712	17 280	2.5%	0.9%	2.2%
Total	43 822	7956	51 778	2.2%	0.9%	2.0%

** Only includes cases with eye injury in the principal diagnosis.

Appendix Table 1.3: Mechanism of injury by sex for work-related injury hospitalisations and proportion of work-related eye injury hospitalisations, in Australia, 2002–2004

Mechanism of injury	All work-related injury hospitalisations			Proportion that is work-related eye injury hospitalisations **		
	Males	Females	Persons	Males	Females	Persons
Transport accidents	4156	842	4998	0.6%		0.6%
Falls	6328	2153	8481	0.2%	0.4%	0.2%
Exposure to inanimate mechanical forces	21 086	1840	22 926	3.3%	1.3%	3.1%
<i>Struck by thrown, projected or falling object</i>	2557	213	2770	4.2%	2.3%	4.1%
<i>Striking against or struck by other objects</i>	1452	214	1666	5.2%	1.9%	4.8%
<i>Contact with other powered hand tools & household machinery</i>	2122	102	2224	1.0%	0.0%	0.9%
<i>Contact with other machinery</i>	5981	436	6417	0.6%	0.0%	0.5%
<i>Explosion of pressurised device, discharge of firework & explosion of other materials[†]</i>	223	8	231	10.8%		10.8%
<i>FB entering into or through eye or natural orifice</i>	406	22	428	87.9%	54.5%	86.2%
<i>FB or object entering through skin</i>	1816	102	1918	1.5%	0.0%	1.4%
<i>Exposure to other & unspecified inanimate mechanical forces[†]</i>	6529	743	7272	0.6%		0.6%
Exposure to animate mechanical forces & contact with venomous animal or plant	1271	357	1628	0.9%	1.4%	1.0%
Accidental poisoning	369	72	441	42.3%	37.5%	41.5%
Assault [†]	700	133	833	6.9%		6.0%
Other & unspecified	9912	2559	12 471	0.3%	0.2%	0.3%
Total	43 822	7956	51 778	2.2%	0.9%	2.0%

** Only includes cases with eye injury in the principal diagnosis.

[†] Case numbers and/or percentages not shown due to small case numbers, see note in data issues.

FB = foreign body.

A1.2 Hospitalised eye injury

Selection criteria^{*}

- Eye diagnosis in the principal diagnosis
- While working for income (U73.0)
- July 2002 to June 2004

Sex and age

There were 1049 work-related eye injury hospitalisations, which was 2.0% of all work-related injury hospitalisations. The majority of work-related hospitalisations with a principal diagnosis of eye injury were in the 20–39 year age bracket (596, 56.8%). 93.0% of hospitalisations were in males (Table A2.1).

Appendix Table 2.1: Sex by age group at admission for work-related eye injury hospitalisations, in Australia, 2002–2004

Age group at admission (years)	Cases			Per cent		
	Males	Females	Persons	Males	Females	Persons
0–14 [†]						
15–19	77	8	85	7.9%	11.0%	8.1%
20–24	126	8	134	12.9%	11.0%	12.8%
25–29	155	8	163	15.9%	11.0%	15.5%
30–34	143	10	153	14.7%	13.7%	14.6%
35–39	141	5	146	14.4%	6.8%	13.9%
40–44	114	9	123	11.7%	12.3%	11.7%
45–49	84	6	90	8.6%	8.2%	8.6%
50–54	52	8	60	5.3%	11.0%	5.7%
55–59	43	4	47	4.4%	5.5%	4.5%
60–64 [†]	28			2.9%		
65–69	8	0	8	0.8%	0.0%	0.8%
70+ [†]		4			5.5%	
Total	976	73	1049	100.0%	100.0%	100.0%

[†] Case numbers and percentages not shown due to small case numbers, see note in data issues.

Industry sector and worker's compensation status

The majority of work-related principal eye injury hospitalisations (603, 57.5%) had either an 'other specified work for income' or 'unspecified working for income' industry code. The specified industry sector with the highest number of work-related principal eye injury hospitalisations was the construction industry (129 cases). (Table A2.2)

In the wholesale and retail trade industry, 64.6% of work-related eye injury hospitalisations had worker's compensation as the 'expected principal source of funds', however, in the agriculture, forestry and fishing industry, only 31.9% of work-related eye injury hospitalisations had workers' compensation as the 'expected principal source of funds' (National Health Data Committee, 2003). (Table A2.2)

^{*} See data issues for further details on selection criteria.

Appendix Table 2.2: Industry sector and worker's compensation status for work-related eye injury hospitalisations, in Australia, 2002–2004

Industry sector (code)	Worker's compensation status [†]		Total
	Cases	Per cent	
Agriculture, forestry & fishing (U73.00)	29	31.9%	91
Mining (U73.01)	16	59.3%	27
Manufacturing (U73.02)	39	48.1%	81
Construction (U73.03)	63	48.8%	129
Wholesale & retail trade (U73.04)	31	64.6%	48
Transport & storage (U73.05)	27	62.8%	43
Government administration & defence (U73.06) [†]			9
Health services (U73.07) [†]			18
Other specified work for income (U73.08)	111	50.5%	220
Unspecified working for income (U73.09)	220	57.4%	383
Total	548	52.2%	1049

[†] Case numbers and percentages not shown due to small case numbers, see note in data issues.

[‡] Cases categorised by 'Expected principal source of funds for an admitted patient episode' (National Health Data Committee, 2003).

Mechanism of injury

In the majority of work-related injury hospitalisations with a principal diagnosis of an eye injury, the mechanism of injury was exposure to inanimate mechanical forces (712, 67.9%) and the most common type was foreign body entering into or through eye or natural orifice (369, 35.2%). 17.4% of hospitalisations (183 hospitalisations) were due to accidental poisoning (Table A2.3).

Appendix Table 2.3: Mechanism of injury by sex, for work-related eye injury hospitalisations, in Australia, 2002–2004

Mechanism of injury	Cases			Per cent		
	Males	Females	Persons	Males	Females	Persons
Transport accidents [†]	26			2.7%		
Falls	13	8	21	1.3%	11.0%	2.0%
Exposure to inanimate mechanical forces	688	24	712	70.5%	32.9%	67.9%
<i>Struck by thrown, projected or falling object</i>	108	5	113	11.1%	6.8%	10.8%
<i>Striking against or struck by other objects</i>	76	4	80	7.8%	5.5%	7.6%
<i>Explosion of pressurised device, discharge of firework & explosion of other materials[†]</i>	24			2.5%		
<i>Contact with machinery</i>	55	0	55	5.6%	0.0%	5.2%
<i>FB entering into or through eye or natural orifice</i>	357	12	369	36.6%	16.4%	35.2%
<i>FB or object entering through skin</i>	27	0	27	2.8%	0.0%	2.6%
<i>Exposure to other & unspecified inanimate mechanical forces[†]</i>	41			4.2%		
Exposure to animate mechanical forces & contact with venomous animal or plant	11	5	16	1.1%	6.8%	1.5%
Accidental poisoning	156	27	183	16.0%	37.0%	17.4%
Assault [†]	48			4.9%		
Contact with heat & hot substances [†]	14			1.4%		
Other & unspecified [†]	20			2.0%		
Total	976	73	1049	100.0%	100.0%	100.0%

[†] Case numbers and percentages not shown due to small case numbers, see note in data issues.

FB = foreign body.

Place of injury

In more than one third of work-related eye injury hospitalisations in males the place of occurrence was an industrial and construction area, compared with only 12.3% of such hospitalisations in females. In contrast 17.8% of work-related eye injury hospitalisations in females occurred at a trade and service area, compared with 13.5% of such hospitalisations in males. More than one third of work-related eye injury hospitalisations occurred at an unspecified place of occurrence (Table A2.4).

Appendix Table 2.4: Place of occurrence by sex, for work-related eye injury hospitalisations, in Australia, 2002–2004

Place of incident	Cases			Per cent		
	Males	Females	Persons	Males	Females	Persons
Home [†]	25			2.6%		
Residential institution & public administrative area	19	11	30	1.9%	15.1%	2.9%
Public highway, street & road [†]	31			3.2%		
Trade & service area	132	13	145	13.5%	17.8%	13.8%
Commercial garage [†]	25			2.6%		
Café, hotel & restaurant	28	6	34	2.9%	8.2%	3.2%
Other specified trade & service area	31	4	35	3.2%	5.5%	3.3%
Unspecified trade & service area [†]	48			4.9%		
Industrial & construction area	331	9	340	33.9%	12.3%	32.4%
Construction area	62	0	62	6.4%	0.0%	5.9%
Factory & plant	101	5	106	10.3%	6.8%	10.1%
Mine & quarry [†]	24			2.5%		
Other specified industrial & construction area	40	0	40	4.1%	0.0%	3.8%
Unspecified industrial & construction area [†]	104			10.7%		
Farm	58	7	65	5.9%	9.6%	6.2%
Other specified place of occurrence	45	10	55	4.6%	13.7%	5.2%
Unspecified place of occurrence	335	17	352	34.3%	23.3%	33.6%
Total	976	73	1049	100.0%	100.0%	100.0%

[†] Case numbers and percentages not shown due to small case numbers, see note in data issues.

Remoteness of residence

In 53.4% of work-related eye injury hospitalisations the patient resided in a major city. This proportion was highest in the government administration and defence sector and health services sector (both 66.7%) and lowest in the agriculture, forestry and fishing sector (5.5%). 'Inner regional' area was the most common area of residence for persons hospitalised for eye injury related reasons in the agriculture, forestry and fishing industry (36.3%), compared with 26.1% for all work-related hospitalisations with a principal diagnosis of eye injury (Table A2.5).

Appendix Table 2.5: Remoteness of residence by industry sector for work-related eye injury hospitalisations, in Australia, 2002–2004

Industry type	Remoteness of residence						Total
	Major cities ^a	Inner Regional ^b	Outer Regional ^c	Remote ^d	Very Remote ^e	Not reported	
Total	560	274	142	29	30	14	1049
Agriculture, forestry & fishing	5.5%	36.3%	31.9%	12.1%	14.3%	0.0%	100.0 %
Mining [†]	14.8%	18.5%	37.0%	25.9%			100.0 %
Manufacturing [†]	55.6%	24.7%	8.6%		7.4%		100.0 %
Construction [†]	62.8%	21.7%	11.6%				100.0 %
Wholesale & retail trade [†]	54.2%	20.8%	20.8%			0.0%	100.0 %
Transport & storage [†]	72.1%	23.3%			0.0%		100.0 %
Government administration & defence [†]	66.7%			0.0%	0.0%		100.0 %
Health services [†]	66.7%		22.2%	0.0%	0.0%		100.0 %
Other specified work for income [†]	65.0%	18.6%	11.8%			1.8%	100.0 %
Unspecified working for income [†]	54.0%	32.4%	10.4%		1.3%		100.0 %
Total	53.4 %	26.1 %	13.5 %	2.8 %	2.9 %	1.3 %	100.0 %

^a Major cities: CDs with average ARIA index value of 0 to 0.2.

^b Inner Regional, CDs with average ARIA index value >0.2 and <=2.4.

^c Outer Regional, CDs with average ARIA value >2.4 and <=5.92,

^d Remote, CDs with average ARIA index value >5.92 and <=10.53.

^e Very Remote, CDs with average ARIA index value >10.53.

[†] Case numbers and percentages not shown due to small case numbers, see note in data issues.

Month and day of admission

The highest number of work-related eye hospitalisations occurred on Fridays (182 hospitalisations, 17.3%) and the lowest number of hospitalisations occurred on Sundays (69 hospitalisations, 6.6%). March was the month with the highest number of work-related eye hospitalisations (103, 9.8%) (Table A2.6).

Appendix Table 2.6: Month and day of admission for work-related eye injury hospitalisations, in Australia, 2002–2004

Month of admission	Day of admission							Total
	Sun	Mon	Tues	Wed	Thurs	Fri	Sat	
Total	69	152	170	180	167	182	129	1049
January	0.4%	1.8%	2.2%	1.0%	0.9%	1.0%	1.4%	8.8 %
February	0.4%	1.0%	0.9%	1.6%	1.2%	1.1%	1.0%	7.2 %
March	0.7%	1.5%	1.8%	1.8%	1.7%	1.3%	1.0%	9.8 %
April [†]		1.1%	1.3%	1.3%	1.2%	1.0%		7.1 %
May	0.9%	1.2%	1.3%	1.5%	1.1%	1.1%	1.6%	8.9 %
June [†]		1.0%	0.9%	1.7%	1.8%	1.0%		7.8 %
July [†]		1.8%	1.5%	1.1%	1.5%	1.7%		8.6 %
August	0.6%	1.0%	1.3%	1.2%	1.8%	1.4%	0.7%	8.0 %
September	0.9%	1.4%	1.1%	1.9%	1.0%	1.9%	1.0%	9.2 %
October [†]		1.1%	1.0%	1.3%	1.2%	2.2%		7.7 %
November	1.2%	0.7%	1.5%	1.4%	1.1%	1.9%	0.9%	8.8 %
December	0.8%	0.9%	1.2%	1.0%	1.2%	1.6%	1.4%	8.2 %
Total	6.6 %	14.5 %	16.2 %	17.2 %	15.9 %	17.3 %	12.3 %	100.0 %

[†] Case percentages not shown due to small case numbers, see note in data issues.

Principal diagnosis

A foreign body in the cornea was the most common principal diagnosis in work-related eye injury hospitalisations (185 cases, 17.6%). 14.5% of eye work-related injury hospitalisations were due to a penetrating wound of the orbit or eyeball (152 cases). 13.9% of hospitalisations were due to burn of the eye and adnexa (146 cases). Burns include injury caused by caustic substances as well as those caused by bright lights, fire and heat or hot substances (Table A2.7).

The majority of work-related eye injury hospitalisations in the manufacturing industry were due to a foreign body in the external eye (50.6%, 41 cases). Whereas, 44.4% of mining related eye injury hospitalisations were due to a burn of the eye and adnexa (12 cases). 44.4% of hospitalisations in the government administration and defence industry were due to penetrating wound of orbit and/or eyeball (4 cases) (Table A2.8).

Appendix Table 2.7: Principal diagnosis by sex, cases and proportions, for work-related eye injury hospitalisations, in Australia, 2002–2004

Principal diagnosis	Cases			Per cent		
	Males	Females	Persons	Males	Females	Persons
Superficial injury of eyelid & periocular area	8	7	15	0.8%	9.6%	1.4%
Open wound of eyelid & periocular area	56	4	60	5.7%	5.5%	5.7%
Fracture of orbital floor	69	8	77	7.1%	11.0%	7.3%
Nerve injury						
Injury of optic nerve & pathways [†]		0			0.0%	
Injury of oculomotor nerve [‡]	0	0	0	0.0%	0.0%	0.0%
Injury of trochlear nerve [‡]	0	0	0	0.0%	0.0%	0.0%
Injury of abducent nerve [‡]	0	0	0	0.0%	0.0%	0.0%
Injury of conjunctiva & corneal abrasion without mention of FB [†]	28			2.9%		
Contusion of eyeball & orbital tissues ^{§ †}	56			5.7%		
Ocular laceration						
Ocular laceration & rupture with prolapse or loss of intraocular tissue [†]	52			5.3%		
Ocular laceration without prolapse or loss of intraocular tissue	45	0	45	4.6%	0.0%	4.3%
Penetrating wound						
Penetrating wound of orbit with or without FB	28	0	28	2.9%	0.0%	2.7%
Penetrating wound of eyeball with FB	89	0	89	9.1%	0.0%	8.5%
Penetrating wound of eyeball without FB	35	0	35	3.6%	0.0%	3.3%
Avulsion of eye (traumatic enucleation) [†]		0			0.0%	
Other injuries of eye & orbit [†]	48			4.9%		
Injury of eye & orbit, part unspecified	33	7	40	3.4%	9.6%	3.8%
Foreign body in external eye						
FB in cornea	180	5	185	18.4%	6.8%	17.6%
FB in conjunctival sac [†]	19			1.9%		
FB in other & multiple parts of external eye [†]	37			3.8%		
FB on external eye, part unspecified	63	7	70	6.5%	9.6%	6.7%
Burn						
Burn of eyelid & periocular area [†]	10			1.0%		
Burn of cornea & conjunctival sac	66	6	72	6.8%	8.2%	6.9%
Burn with resulting rupture & destruction of eyeball	0	0	0	0.0%	0.0%	0.0%
Burn of other parts of eye & adnexa [†]	7			0.7%		
Burn of eye & adnexa, part unspecified	42	12	54	4.3%	16.4%	5.1%
Total	976	73	1049	100.0%	100.0%	100.0%

[†] Case numbers not shown due to small case numbers, see note in data issues.

[‡] These cranial nerves supply the muscles which move the eyeball.

[§] Includes traumatic hyphaema.

FB = foreign body.

Appendix Table 2.8: Condensed principal diagnosis by industry type, for work-related eye injury hospitalisations, in Australia, 2002–2004

Principal diagnosis											Total
Industry type	Superficial injury of eyelid & periocular area	Open wound of eyelid & periocular area	Fracture of orbital floor	Injury of conjunctiva & corneal abrasion, no mention of FB	Contusion of eyeball & orbital tissues [§]	Ocular laceration	Penetrating wound of orbit &/or eyeball	Other injuries of eye & orbit	FB in external eye	Burn of eye & adnexa	
Total cases	15	60	77	31	59	98	152	96	315	146	1049
Agriculture, forestry & fishing [†]		9.9%		4.4%	12.1%	13.2%	14.3%	15.4%	17.6%	7.7%	100.0%
Mining [†]		0.0%	0.0%			0.0%		14.8%	14.8%	44.4%	100.0%
Manufacturing [†]	0.0%	4.9%	4.9%	0.0%			8.6%	4.9%	50.6%	17.3%	100.0%
Construction [†]	0.0%		4.7%		5.4%	13.2%	32.6%	3.9%	21.7%	13.2%	100.0%
Wholesale & retail trade [†]			10.4%		10.4%	12.5%	0.0%	12.5%	12.5%	27.1%	100.0%
Transport & storage [†]	0.0%	18.6%	18.6%			9.3%	0.0%	16.3%	14.0%	0.0%	100.0%
Government administration & defence [†]	0.0%	0.0%					44.4%		0.0%		100.0%
Health services [†]		0.0%			0.0%	0.0%	0.0%		27.8%	27.8%	100.0%
Other specified work for income	1.8%	7.7%	9.5%	3.2%	5.5%	8.6%	13.2%	10.5%	22.7%	17.3%	100.0%
Unspecified working for income	1.3%	3.9%	7.3%	2.6%	4.2%	8.9%	13.1%	7.8%	41.5%	9.4%	100.0%
Total	1.4%	5.7%	7.3%	3.0%	5.6%	9.3%	14.5%	9.2%	30.0%	13.9%	100.0%

[§] Includes traumatic hyphaema.

[†] Case numbers not shown due to small case numbers, see note in data issues.

FB = foreign body.

Appendix Table 2.9: Condensed principal diagnosis for work-related eye injury hospitalisations by mechanism of injury, in Australia, 2002–2004

Mechanism of injury	Principal diagnosis										Total
	Superficial injury of eyelid & periocular area	Open wound of eyelid & periocular area	Fracture of orbital floor	Injury of conjunctiva & corneal abrasion, no mention of FB	Contusion of eyeball & orbital tissues ^s	Ocular laceration	Penetrating wound of orbit &/or eyeball	Other injuries of eye & orbit	FB in external eye	Burn of eye & adnexa	
Total	15	60	77	31	59	98	152	96	315	146	1049
Transport accidents [†]		13.8%	41.4%				0.0%			0.0%	100.0%
Falls [†]	19.0%		42.9%	0.0%				0.0%	0.0%		100.0%
Exposure to inanimate mechanical forces [†]		5.3%	2.8%	3.2%	6.5%	11.9%	20.2%	8.1%	40.2%	1.4%	100.0%
Struck by thrown, projected or falling object [†]		10.6%	8.0%	7.1%	16.8%	15.0%	20.4%	15.9%	5.3%	0.0%	100.0%
Striking against or struck by other objects [†]	0.0%	17.5%	7.5%		10.0%	25.0%	22.5%	12.5%		0.0%	100.0%
Explosion of pressurised device, discharge of firework & explosion of other materials [†]	0.0%	0.0%	0.0%			0.0%	20.0%	24.0%		36.0%	100.0%
Contact with machinery [†]		7.3%			9.1%	29.1%	27.3%	7.3%	9.1%	0.0%	100.0%
FB entering into or through eye or natural orifice [†]		0.0%	0.0%	1.1%	1.9%	3.3%	17.9%	2.7%	72.9%		100.0%
FB or object entering through skin [†]	0.0%	14.8%	0.0%			33.3%	37.0%		0.0%	0.0%	100.0%
Exposure to other & unspecified inanimate mechanical forces [†]	0.0%	9.3%		14.0%	9.3%	25.6%	16.3%	18.6%		0.0%	100.0%
Exposure to animate mechanical forces & contact with venomous animal or plant [†]			37.5%	0.0%	0.0%			25.0%	0.0%	0.0%	100.0%
Accidental poisoning [†]	0.0%	2.7%	2.7%	3.3%			2.7%	13.1%	10.9%	61.7%	100.0%
Assault [†]	10.0%	14.0%	50.0%	0.0%	14.0%		0.0%	10.0%	0.0%	0.0%	100.0%
Contact with heat & hot substances [†]	0.0%		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		81.3%	100.0%
Other & unspecified [†]			0.0%		0.0%				22.7%	40.9%	100.0%
Total	1.4 %	5.7 %	7.3 %	3.0 %	5.6 %	9.3 %	14.5 %	9.2 %	30.0 %	13.9 %	100.0 %

^s Includes traumatic hyphaema.

[†] Case numbers not shown due to small case numbers, see note in data issues.

FB = foreign body.

Fracture of the orbital floor was the most common type of injury in assault (25, 50.0%), falls (9, 42.9%), transport accidents (12, 41.4%) and exposure to animate mechanical forces (6, 37.5%). Foreign body in external eye was the most common type of injury for exposure to inanimate mechanical forces as a whole (40.2%, 286). Burn of eye and adnexa was the principal diagnosis in the majority of accidental poisoning eye related work injury hospitalisations (61.7%, 113) (Table A2.9).

Burn of the eye and adnexa was the most common principal diagnosis grouping in eye injury related work injury hospitalisations that occurred in an institution and public administrative area (26.7%, 8), café, hotel and restaurant (38.2%, 13), mine and quarry (44.0%, 11) and other specified place of occurrence (18.2%, 10). 41.2% of work-related eye injury hospitalisations that occurred in public highway, street and road had a principal diagnosis of a fracture of orbital floor. A penetrating wound of orbit and/or eyeball was the most common principal diagnosis in eye related work injury hospitalisations that occurred at a commercial garage (30.8%, 8). There was an equal split in principal diagnoses for the construction area, between 'penetrating wound of orbit and/or eyeball' and 'foreign body in external eye' (both 29.0%, 18). 'Other injuries of eye and orbit' was the most common principal eye diagnosis for work-related injuries occurring on a farm. All other locations had a foreign body in the external eye as the most common principal eye diagnosis grouping in persons hospitalised for work-related eye injury (Table A2.10).

Length of stay

The majority of persons hospitalised for work-related eye injuries were discharged on the day of admission (51.6%), however, there was variation with diagnosis. 86.0% of persons hospitalised with 'foreign body in external eye' were discharged on the day of admission. In contrast, only 17.3% of persons hospitalised with a work-related eye principal diagnosis of 'ocular laceration' were discharged on the day of admission. The mean length of stay for work-related hospitalisations with a principal diagnosis of an eye injury was 2.2 days (Table A2.10).

Appendix Table 2.11: Length of stay for principal diagnosis by sex and proportion discharged on day of admission, by principal diagnosis, for work-related eye injury, in Australia, 2002–2004

Principal diagnosis	Percentage discharged on same day	Length of stay (days)		
		Males	Females	Persons
Superficial injuries of eyelid & periocular area	60.0%	1.6	2.0	1.8
Open wound of eyelid & periocular area	55.0%	1.3	3.0	1.4
Fracture of orbital floor	20.8%	3.1	5.6	3.4
Injury of conjunctiva & corneal abrasion without mention of FB	45.2%	1.6	1.3	1.6
Contusion of eyeball & orbital tissues [§]	27.1%	3.0	1.7	3.0
Ocular laceration	17.3%	3.7	1.0	3.6
Penetrating wound of orbit & or eyeball	28.9%	2.6	0	2.7
Other injuries of eye & orbit	55.2%	1.8	1.4	1.8
FB in external eye	86.0%	1.1	1.0	1.1
Burn of eye & adnexa	46.6%	2.9	2.1	2.8
Total	51.6 %	2.2	2.2	2.2

[§] Includes traumatic hyphaema.

FB = foreign body.

Appendix Table 2.10: Condensed principal diagnosis by place of occurrence of injury, for work-related eye injury hospitalisations, in Australia, 2002–2004

Place of occurrence	Principal diagnosis										Total
	Superficial injury of eyelid & periocular area	Open wound of eyelid & periocular area	Fracture of orbital floor	Injury of conjunctiva & corneal abrasion, no mention of FB	Contusion of eyeball & orbital tissues ^s	Ocular laceration	Penetrating wound of orbit &/or eyeball	Other injuries of eye & orbit	FB in external eye	Burn of eye & adnexa	
Total	15	60	77	31	59	98	152	96	315	146	1049
Home [†]	0.0%			0.0%			28.6%	0.0%	39.3%		100.0%
Institution & public administrative area [†]		13.3%			0.0%			20.0%	16.7%	26.7%	100.0%
Public highway, street, road [†]		14.7%	41.2%					11.8%		0.0%	100.0%
Trade & service area [†]		4.8%	8.3%		7.6%	7.6%	9.0%	9.7%	32.4%	17.2%	100.0%
Commercial garage [†]	0.0%		0.0%				30.8%	15.4%	15.4%		100.0%
Café, hotel & restaurant [†]			20.6%	0.0%	11.8%		0.0%			38.2%	100.0%
Other trade & service area [†]		4.7%	5.9%		4.7%	8.2%	5.9%	9.4%	49.4%	10.6%	100.0%
Industrial & construction area [†]		3.2%	4.1%		3.8%	7.9%	12.6%	7.9%	38.5%	18.8%	100.0%
Construction area [†]	0.0%				6.5%		29.0%		29.0%	17.7%	100.0%
Factory & plant [†]	0.0%	5.7%			4.7%	7.5%	9.4%	10.4%	36.8%	21.7%	100.0%
Mine & quarry [†]		0.0%	0.0%			0.0%			16.0%	44.0%	100.0%
Other industrial & construction area [†]	0.0%		6.1%	3.4%		10.9%	8.8%	6.8%	47.6%	12.9%	100.0%
Farm [†]		12.3%			7.7%	15.4%	16.9%	20.0%	10.8%	6.2%	100.0%
Other specified place of occurrence [†]	0.0%	7.3%	9.1%	7.3%	10.9%	9.1%	12.7%	12.7%	12.7%	18.2%	100.0%
Unspecified place of occurrence	1.4%	5.4%	7.4%	3.4%	6.0%	11.1%	19.3%	7.1%	29.3%	9.7%	100.0%
Total	1.4%	5.7%	7.3%	3.0%	5.6%	9.3%	14.5%	9.2%	30.0%	13.9%	100.0%

^s Includes traumatic hyphaema.

[†] Case numbers not shown due to small case numbers, see note in data issues.

FB = foreign body.

A1.3 Data issues

Inclusion criteria

Records that met the following criteria are included in this report:

- Australian hospital separations that had a date of separation between July 1st 2002 and June 30th 2004, coded with the third edition of ICD-10-AM. (National Centre for Classification in Health 2002)
- Mode of admission excluding cases where a transfer from another acute-care hospital has occurred (excluding length of stay calculations – see below)
- Eye injury as outlined below (excluding comparison tables of chapter A1) (Table A3.1)
- Cases coded as while working for income (U73.0) (Table A3.2).

Appendix Table 3.1: Case inclusion codes for eye injury hospitalisations

ICD-10-AM code	Diagnosis
S001	Contusion of eyelid & periocular area
S002	Other superficial injuries of eyelid & periocular area
S011	Open wound of eyelid & periocular area
S023	Fracture of orbital floor
S040	Injury of optic nerve & pathways
S041 [§]	Injury of oculomotor nerve [†]
S042 [§]	Injury of trochlear nerve [†]
S044 [§]	Injury of abducent nerve [†]
S050	Injury of conjunctiva & corneal abrasion without mention of foreign body
S051	Contusion of eyeball & orbital tissues, including traumatic hyphaema
S052	Ocular laceration & rupture with prolapse or loss of intraocular tissue
S053	Ocular laceration without prolapse or loss of intraocular tissue
S054	Penetrating wound of orbit with or without foreign body
S055	Penetrating wound of eyeball with foreign body
S056	Penetrating wound of eyeball without foreign body
S057	Avulsion of eye (traumatic enucleation)
S058	Other injuries of eye & orbit
S059	Injury of eye & orbit, part unspecified
T150	Foreign body in cornea
T151	Foreign body in conjunctival sac
T158	Foreign body in other & multiple parts of external eye
T159	Foreign body on external eye, part unspecified
T260	Burn of eyelid & periocular area
T261	Burn of cornea & conjunctival sac
T262 [§]	Burn with resulting rupture & destruction of eyeball
T263	Burn of other parts of eye & adnexa
T264	Burn of eye & adnexa, part unspecified

[§] There were no cases with any of these diagnoses.

[†] These cranial nerves supply the muscles which move the eyeball.

Codes are from the third edition of ICD-10-AM (National Centre for Classification in Health 2002).

Appendix Table 3.2: Selection criteria for eye injury hospitalisations, in Australia, 2002–2004

Records occurring from 1 July 2002 to 30 June 2004	Males	Females	Persons
Records with an ICD-10-AM 'While working' (U73.0 & U73.1)	64 978	21 559	86 537
Records with an ICD-10-AM 'While working for income' (U73.0)	47 099	8393	55 492
Records with an ICD-10-AM 'While working for income' (U73.0) & excluding cases transferred from another acute care hospital	43 822	7956	51 778
Records with an ICD-10-AM 'While working for income' (U73.0), excluding cases transferred from another acute care hospital & with a 'eye injury' [†] in any diagnosis field	1310	114	1424
Records with an ICD-10-AM 'While working for income' (U73.0), excluding cases transferred from another acute care hospital & with a 'eye injury' [†] in the principal diagnosis	976	73	1049

[†] Only includes the codes as outlined in Table A3.1 above.

Exclusion criteria

Codes not specific to injury have not been included (e.g. the M codes).

Small case numbers

Case numbers of four or less have been suppressed in order to protect confidentiality and due to difficulty in interpretation of small case numbers. Percentages calculated from small case numbers have also been suppressed. Sometimes the total and other cells are also suppressed so that small case numbers cannot be calculated.

Length of stay

Mean length of stay has been calculated by dividing bed days (including inward transfers) by the case count (excluding inward transfers). Including inward transfers for the numerator allows a more accurate estimation of length of stay to be calculated.

References

National Centre for Classification in Health (NCCH) (2002) The International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification, (ICD–10–AM), third edition: University of Sydney.

National Health Data Committee (2003) National Health Data Dictionary, Version 12. AIHW cat. no. HWI 43. Canberra: Australian Institute of Health and Welfare.