CHAPTER 5 - RESULTS

5.1 Introduction

In this chapter, the raw data collected is summarised into the various coding categories. From the codes assigned to the raw data results such as patients injuries and triage categories are presented, comparisons between events and stadiums are undertaken where differences or similarities are significant. In addition, where appropriate, comparison to past research is also highlighted.

5.2 Event results

5.2.1 Total Events

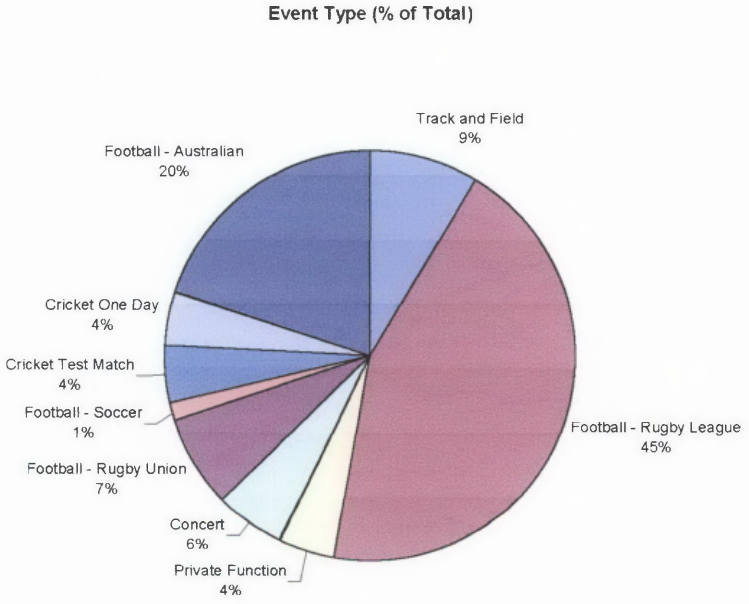
In this study there were a total of 70 separate day events examined where medical cover was provided. This included two days of set up for a concert at the Sydney Cricket Ground. Appendix 8 lists each of the three stadiums and the events that occurred.

In total there was a wide mix of events that included:

- Track and field;
- Football – Rugby Union, Rugby League, Australian Rules and Soccer;
- Cricket – Test match and one day matches; and
- Concerts and private functions.

The types of events that occurred over the study period are presented in Figure 5.1. As evident from the graph, the majority of events were rugby league matches closely followed by Australian Rules football matches. The distribution of events has implications for the study in that there is a slant in the final analysis towards winter sports that do not go for extended time frames such as a summer cricket match would. As discussed in the literature review chapter, the longer the event goes for the more patients that are likely to be seen. A short, focussed mass gathering is likely to have fewer patients than a gathering that goes for an extended time frame. In addition, as alluded to, but not examined in this study, it is likely that different types of events attract a different crowd mix, thus influencing the type of injuries and illnesses that are seen.

Figure 5.1 Percentage of event types included in the study



5.2.2 Total Patients

Total crowd numbers, as supplied by the various stadiums, over the course of the study were in excess of 1.7 million persons. This resulted in a total of 666 patients seen by medical, nursing and first aid staff resulting in a patient presentation rate of 0.04 percent (0.38 patients per 1,000 spectators) across all three stadiums with an average spectator presentation of 9.39 per event. This is similar to Bock et al.'s finding of 0.4 presentations per 1,000 spectators at the Indianapolis 500 race (1992, p.1205). Cheshire and Gill (1998, pp.199-200) found in their study of a premiership football stadium in England that the presentation rate to event medical and first aid staff was 7.6 per match (0.19 per 1,000 spectators). In their study of the US Festival, a 3 day outdoor concert, Ounanian et al. (1986, p.522) found an overall presentation rate of 0.6 percent, somewhat higher than the presentation rate in this study. Baker (1986, p.188) in his study of the 1984 Olympic Games found use of the first aid and medical stations ranged from 0.68 – 6.8 patient visits per 1,000 spectators, again higher than this study. The higher patient presentation rate was experienced at venues where spectators were free to move around. Table 5.1, below, describes the total crowd numbers and total patient numbers in this study.

Table 5.1 Total events, patient numbers and presentation rate

Number	Total
Total Events	70
Total Crowd	1,787,469
Total Patients	666
Total Patients per event	9.39
Total Patients per 1,000 crowd	0.38

There were obvious differences in patient presentation rates between different types of events. Table 5.2 below demonstrates the different types of events and the proportion of patients seen at them. Concerts and private functions have not been included due to substantial working differences with the main events studied, which were sporting. The number of patients seen compares favourably is generally lower than international events as shown on the previous page. As Table 5.2 shows, one day cricket matches had the highest presentation rate of 1.3 patients per 1,000 spectators, more than three times the average for all events combined. Reasons for this could be due to weather, a long event time (as compared to say a football match) and the availability of alcohol. Football matches and other events went for shorter periods of time meaning that patients had a smaller time frame in which to get injured or fall ill. It is interesting to note that football had the lowest presentation rate at 0.24 patients per 1,000 spectators. This compares similarly to Cheshire and Gills' (1998, p.199) study of a premiership football stadium in England that had a presentation rate of 0.19 patients per 1,000 spectators.

Table 5.2 Percentage patient presentation rate by event type

	Percentage of Total Spectators Presenting	**Patients per 1,000 Spectators**
All events	0.04	0.38
Cricket Test Match	0.05	0.50
Cricket One Day Match	0.13	1.33
Football (all codes)	0.02	0.24
Track and Field Events	0.06	0.62

5.3 Patient results

Of the 666 patients seen 655 had their sex recorded. Overall there was an almost identical mix of male and female patients seen by medical and first aid staff. However, when examining individual events there were some marked differences. For example, Rugby League and One Day Cricket had many more males present for medical treatment than females. This situation was reversed for the private functions, which substantially was due to the Pacific Schools Games Opening Ceremony. Table 5.3 demonstrates the number of male and female patients seen at each event.

Table 5.3 Patient presentation by sex and event type

	Total Patients (n=666)				
Event Type	**Male**	**Female**	**Unknown**	**Total**	**Percentage**
Football – Australian	59	49	3	111	16.7
Football – League	96	70	2	168	25.2
Football – Rugby Union	13	15	0	27	4.1
Football – Soccer	0	2	0	2	0.3
Track and Field	16	11	0	27	4.1
Cricket – One Day	82	62	5	149	22.4
Cricket – Test Match	26	24	1	51	7.7
Concert	14	22	0	36	5.4
Private Function	22	69	0	91	13.7
Total	330	325	11	666	100.0

The result that many events had an almost equal mix of male and female patients is interesting given that the majority of events were sporting related, and in particular football codes. There is a common perception that football in particular is a male dominated spectator sport. The result of almost equal male and female numbers of patients has implications for further research to determine whether there are equal numbers of male and spectator at events, or, if there are more males then to determine why women are at a higher risk of requiring medical treatment. Unfortunately no accurate details on the spectator mix was available so no further comment can be made as part of this study.

5.3.1 Patient age

Of the total 666 patients, 514 had their age recorded. The breakdown of those ages by percentage is shown below in Table 5.4.

Table 5.4 Percentage distribution of patients by age seen at each site

Patient Age	Percent of Total Patients (n=514)			
	SCG %	SFS %	Stadium Australia %	Total %
0-9	7.3	18.0	9.0	9.9
10-19	22.5	25.8	45.3	33.5
20-29	21.5	29.2	19.7	22.0
30-39	17.8	6.7	10.3	12.5
40-49	13.1	9.0	5.6	8.9
50-59	9.4	5.6	3.8	6.2
60-69	5.2	3.4	3.4	4.1
70-79	2.6	2.2	2.1	2.3
80+	0.5	0.0	0.9	0.6
Total %	37.2	17.3	45.5	100.0

As table 5.4 shows there were some differences in patient age between the three stadiums. At Stadium Australia there was a high percentage of patients in the 10-19 year age bracket. This was because of the Pacific Schools Games. The second highest percentage of patients came from the 20-29 year age bracket with numbers of patients presenting becoming fewer as patient age increased.

5.3.2 Patient residence

Of the 666 patients, 98 percent (n = 657) had an identifiable place of principal residence. Over 70 percent of patients presenting for medical assistance came from the local Sydney metropolitan area (n=476), which was defined by the area bounded by the Central Coast, Penrith and Wollongong. Lesser numbers of patients were from country New South Wales (21 percent, n=138), interstate (5 percent, n=34) and overseas (1 percent, n=9).

Table 5.5 shows the principal residence of patients presenting for treatment. Interstate patients were lower than expected. One reason for this is because many matches involved local football teams that would not normally attract large numbers of interstate spectators. These included such matches as the Sydney Swans versus the Melbourne AFL clubs.

Table 5.5 Percentage principal residence of patients presenting

	Percent of Total Patients (n=657)			
			Stadium	
Location	**SCG %**	**SFS %**	**Australia %**	**Total %**
Local Sydney Metro	70.0	84.6	67.8	71.5
Country NSW	21.0	10.0	25.3	20.7
Interstate Australia	7.1	2.8	3.7	5.1
Overseas	1.3	2.7	0.8	1.4
% of Total Patients	46.8	16.5	36.8	100.0

5.3.3 Patient treatment time

In total, over the course of the study period medical and first aid staff spent almost 60 hours in direct patient care. Treatment time starts when the medical team reach the patient and ends when the patient is discharged from their care. Whilst total treatment time may seem small compared to total event time over the course of a year, it underlies the importance of having medical assistance available to spectators.

Both the SCG and SFS had similar average treatment times at 8 and 9 minutes respectively. This is not surprising given their similarities in size and structure. The treatment time at the SCG and SFS compares favourably with that of Weaver et al. (1989, p.158) in their study of the World Expo where the authors found an average treatment duration of less than 10 minutes. The average treatment time for patients at Stadium Australia, at 20 minutes per patient, was almost double that for the other two venues. The extra time for treatment could be due to a number of reasons.

One reason is obviously the size of Stadium Australia. The size of the stadium means it takes longer to access patients and then assist them back to the medical room when required. In addition, as outlined earlier in this study, at Stadium Australia there was also St John Ambulance in attendance. This meant that the patients seen by Immediate Assistants were those requiring a higher level of treatment than simple first aid, which, when they were present, was carried out by the members of St John Ambulance. For these reasons medical care provided at Stadium Australia took longer.

Unfortunately, treatment time is only an estimate at best, given that in many instances total patient treatment time was not well recorded on individual patient report forms through the study. This means that the average treatment time cannot be taken as fully accurate, however, the final result of a far longer treatment time at Stadium Australia remains valid.

5.3.4 Patient discharge locations

From the information collected the majority of patients were discharged from medical care back to the event at which they were attending. Over all events (n=70) only seven percent of patients required transfer to hospital.

When compared to other studies the transfer rate to hospital of patients in this study falls somewhere in the middle of international mass gatherings reported. At the Los Angles Olympics, across all venues, Baker et al. (1986, p.187) found that 1.6 percent of patients required transport to hospital. The lower rate in this case may have been due to the higher level of diagnostic equipment available at Olympic Games. By contrast, Pons et al. (1980, p.206) in their study of a basketball stadium found that almost 12 percent of patients were transferred to hospital. The lowest reported transfer to hospital rate was reported by Wong et al. (1993, p.3) in their study of a marathon, where only 0.05 percent of patient presentations required transfer to hospital. There are many reasons for differing hospital transfer rates. These could range from a higher level of diagnostic capability such as X-Ray machines or 12 lead electrocardiograph machines, to a higher level of medical care in the form of doctors and nursing staff being available.

The result that only seven percent of patients in this study required transfer to hospital is significant because it shows the value of having a multi-disciplinary medical team on site at each event. As discussed further on, were only first aiders to be present on site then far more patients would have been transferred to hospital, thus increasing the burden on hospitals near the various stadia.

5.3.5 Patient discharge mode of transport

Not surprisingly, given that each event was made up of a multi-disciplinary medical team and that the overwhelming majority of patients were discharged to back to the event, the majority of patients used their own transport to return from the medical room back to the event. Patient transport to hospital, when it occurred, was by ambulance in the majority of cases. In less than two percent of cases transport to hospital or to another location was undertaken by the Police Service.

5.3.6 Activity when injured

The National Data Standards for Injury Surveillance (NDS-IS) has, as part of its standard, a requirement to collect what the patient was doing when they were injured. The definition of activity when injured relates to whether the injured person was working for income or was a spectator, as opposed to what they were actually doing at the time of injury. For instance walking, running or working up a ladder. The role of the injured person is important in mass gatherings to determine whether there are significant numbers of workers being injured or becoming ill, as well as identifying trends who is actually getting injured. From the information collected in this study, the majority of patients (75 percent, n=497) were spectators which is consistent with the finding of Wetterhall et al. (1998, p.1465) in their study of the Atlanta Olympic Games as discussed in Chapter two. However, Bock et al. (1992, p.1205) in their study of the Indianapolis 500 found a slightly higher spectator presentation rate at 91 percent. Of the other patients in this study, 16 percent were working for an income (n=107) or as volunteers and nine percent (n=62) were sporting participants. It is not surprising that the number of sports people presenting to the medical teams was low. In the majority of cases the participants were professional and many athletes had their own medical and para-professional medical and first aid staff.

The number of people in this study classified as sporting participants (9 percent, n=60) who presented for treatment is slightly skewed, in that the Pacific School Games were held at Stadium Australia. A large number of children participants were treated for a range of minor injuries and illness. At almost every other event the teams participating had their own medical and first aid staff available for players and the contracted medical teams rarely became involved in athlete treatment.

5.3.7 Industry of those patients working for income

Another requirement as part of the NDS-IS standards is to determine, of those patients working for income, in which industry they were working. This is important for mass gatherings because, with a large workforce that may include cleaners, caterers and grounds-staff amongst others, injury trends in particular industries at each location can be monitored.

Unfortunately, as part of this study this information was not recorded in detail. Where an industry could be identified, the majority of staff were identified as being cultural or recreational staff (78 percent, n=123). This category included such staff as ticket collectors, security staff, and crowd control staff. Retail trade and personal staff (19 percent, n=29) were all staff involved in food sales and waiters in private boxes. Of those patients working for income, construction workers (3 percent, n=4) had the fewest patient presentations. This category accounted for maintenance staff, grounds persons and others.

In addition to the industry in which an injured person was working, there is also scope under the National Data Standards to record the sub-industry, to enable even more detailed analysis. For the purposes of this study, whilst this information was recorded, only two sub-industries were considered appropriate. These were sporting and recreation, and libraries, the arts, and entertainment. These two were the only two sub-industries considered appropriate because the only events included in the studies were either sporting or concerts, with a minimal number of private functions. With so few categories, and since no useful conclusions can be drawn from this sub-classification, these results are not presented.

5.3.8 Occupation of those patients working for income

The NDS-IS standards also recommend that the occupation of those working for income be recorded in data collection. This includes professional sporting participants because they are earning while they are playing. Where an occupation could be identified, not surprisingly, the majority of patients were labourers and related workers (79 percent, n=123). This category also includes waiters, shop floor staff and the vast majority of staff who could not be identified into any particular occupation.

Tradespersons, such as plumbers and electricians made up the next highest occupation group (19 percent, n=30), with paraprofessionals (such as general management) and personal service workers making up only 2 percent of workers injured (n=3).

Again, similar to the industry in which people were injured the NDS-IS allows for a sub-occupation to be recorded to further monitor injuries. However, given the poor data in the occupation classification, to further make conclusions based on the sub-occupation data would be inappropriate.

5.3.9 Role of human intent in injury or illness cause

An important factor in examining injuries and illness at mass gatherings is determining how the injury or illness came about. Major classifications include whether the injury or illness was deliberately induced, an accident, or as a result of legal intervention by police or security. The collection of this data means that trends in injury patterns can be monitored. Past studies on mass gatherings have not reported on this factor, possibly because of a lack of uniform coding standards.

There were some difficulties in classifying some injuries. For example, an intoxicated person who presented to medical and first aid staff could either have been recorded and then classified as a result of deliberate self harm (because they set out to become intoxicated) or as a result of an accident (they may have set out to become intoxicated, however, did not intend to become such that they required medical attention). In these cases it was determined the event was an accident.

Another issue was the weather. For example at cricket matches, a large number of spectators required medical intervention for headaches. The cause of the headache could have been either the weather (sitting in the hot sun), or drinking alcohol (self induced) or a combination of both. Again, to keep the coding consistent it was decided to classify these events as accidents, because, again, no one deliberately sets out to have a headache that required medical attention.

The majority of presentations occurred as a result of accidents or non-intentional incidents. These accounted for 99 percent (n=658) of all presentations recorded. Making up the other 1 percent of patient presentations were those as a direct result of legal interventions (n=2) which are those injuries resulting directly as a result of police or security staff intervention, intentional self harm (n=1), assaults (n=4) and one other specified intent that did not fit into any appropriate category.

What this result shows is that the spectators and staff attending mass gathering events, on the vast majority of occasions do not intend to commit self harm or require medical attention. Very few legal interventions resulted in patients requiring medical attention. For example, this could have occurred when an unruly spectator was being ejected from the ground and injured themselves. The stadiums involved in the study are security and safety conscious and this result shows that their plans for security and legal interventions are successful.

5.3.10 Cause and mechanism of injury

As part of the National Data Standards for Injury Surveillance the external cause and mechanism of injury is meant to be recorded. This can include such things as a fall, or a cutting object. Unfortunately in this study the cause of injury was not always well recorded. Where it was recorded the data shows that of those persons injured eight percent (n=54) were due to falls, just under eight percent (n=53) were due to contact with moving objects (such as sporting equipment or knives) and over 70 percent were due to unspecified causes (n=470). As the cause of injury was not well recorded no firm conclusions can be made about cause and mechanism of injury. In addition to the NDS-IS, ICD-10-AM also allows for the recording of cause and mechanism of injury. As the data was being coded from the same medical reports the same problem as identified above was encountered.

What did emerge from the study is that there is no need to code individual patient injuries under both the NDS-IS and ICD-10-AM. When final coding methods are chosen only one method needs to be used. If ICD-10-AM was to be become the coding system for injuries and illnesses received at mass gathering events then one international version should be chosen and used as the standard.

5.3.11 Place of occurrence of injury or medical event

Both the NDS-IS and ICD-10-AM allows for a place of injury to be recorded. This assists in analysing where particular problems arise to prevent future occurrences. In many cases the best classification was that the injury occurred in the spectator area. This is not surprising given the majority of patients were spectators. Over 97 percent of patients (n=617) were either injured or had their medical condition arise in the stadium arena. The other area in which patients were injured was on the oval, on internal stadium roadways, and at stadium bus terminals.

Within the standards there is also the ability to record an injury or illness occurrence sub-location to further define and identify problem areas. The study found that 85 percent (n=572) of patients were injured in a spectator area such as seating or in common walkways. Other areas in which people were injured included kitchens, stairwells, dining areas, the ovals, and roadways around the stadiums. Trends in specific locations were not identified as part of this study.

5.4 What injuries occurred

As stated before there were 666 patients who presented to medical and first aid staff. Of those patients only six (0.91 percent) had more than one complaint and none had more than two complaints. This resulted in a total of 672 diagnostic categories to be coded. Within this analysis nausea and vomiting did not count as separate medical events but were counted as one. An example of two separate classifications would have been a headache and nausea and vomiting that would have been counted as two complaints.

5.4.1 Trauma versus medical incidents

As part of the data collection each patient was identified as either having a traumatic or medical complaint. Trauma is an injury caused by an external influence such as a fall. A medical incident is an internal body event, such as chest pain, not caused by an external influence. Whilst it is acknowledged that some medical complaints may be attributable to external influences these may have been difficult to associate. An example is a headache caused by sitting in the sun at a cricket match. In total there were 271 traumatic (40 percent) and 401 (60 percent) medical presentations.

It is interesting to note the differences in the various stadiums. As Table 5.6 shows at the Sydney Football Stadium patient presentations were split almost 50 percent between medical and traumatic incidents, where as at Stadium Australia there was a higher proportion of medical incidents. This trend was also seen at the SCG where there were a higher proportion of medical patients.

Table 5.6 Percentage of trauma and medical incidents by stadium

	Percent of Total Patients (n=666)			
Type of Incident	**SCG**	**SFS**	**Stadium Australia**	**Total**
Trauma	36.1	51.0	41.0	40.3
Medical	64.0	49.1	59.1	59.7
Total Patients	46.6	16.4	37.1	100.0

The reasons for the number of traumatic and medical incidents could be many and varied. It is not a primary aim of this research to identify reasons for the various injuries that occurred, however the following comments are made. The SCG had the highest proportion of events that went for long hours, such as one-day cricket. Other stadiums had more events but they went for shorter time frames. In addition some events, such as the cricket, resulted in more medical incidents such as headaches.

As discussed in Chapter two, other authors have found differing levels of medical and traumatic patient presentations. In this study it was found that there were more medical than trauma incidents at both Stadium Australia and the SCG (59% and 64%) whilst there was an almost equal mix of medical and trauma incidents at the SFS (49% and 51%). The literature review found that when trauma does occur it is mostly minor. Ounanian et al. (1986, p.522) found that the majority of patient presentations at an outdoor rock festival were minor surgical trauma, 44 percent of patients seen. In contrast, at a rave party studied by Russell et al. (1999, p.8) it was found that the majority of patient presentations were medical and drug related. Thompson et al. in their study of the Calgary Winter Olympics found that serious medical problems were four times more likely than trauma (1991, p.368). The three stadiums studied in this thesis had different events. The SFS catered mainly for different football codes, and the SCG mainly for cricket events. Stadium Australia also had a majority of football events and private functions. Whilst more research and analysis is needed, the result of differing medical and trauma numbers indicates that different events may produce different types of injuries or illnesses.

5.4.2 Diagnostic category of injury or illness

As discussed in Chapter three there are 23 major diagnostic categories into which Casemix classifies each injury or illness. Table 5.7 shows the percentage of presenting injuries and illnesses corresponding to the 23 major diagnostic categories.

Table 5.7 Percent of major diagnostic categories of injuries and illnesses by stadium

Major Diagnostic Category	Percent of Total Patients (n=666)			
	SCG	SFS	Stadium Australia	Total
Nervous System	47.1	31.9	16.7	33.6
Skin, SC Tissue and Breast	22.3	37.3	19.2	23.6
Musculoskeletal System and Connective Tissue	10.2	5.5	20.0	13.0
Digestive System	4.6	3.6	13.9	7.8
Circulatory System	3.7	7.2	8.6	6.1
Respiratory System	2.8	7.3	7.0	5.0
Eye	4.0	3.6	2.0	3.2
Burns	1.6	3.6	2.0	2.8
Injuries, Poisoning, and Toxic Effect of Drugs	3.1	0.0	0.4	1.6
Endocrine, Nutritional and Metabolic	0.0	0.0	2.7	1.0
Infectious and Parasitic Diseases	0.0	0.0	2.5	0.9
Kidney and Urinary Tract	0.0	0.9	0.8	0.4
Mental Diseases and Disorders	0.6	0.0	0.4	0.4
Female Reproductive	0.0	0.9	0.4	0.3
Hepatobiliary System and Pancreas	0.0	0.0	0.4	0.2
ENT	0.0	0.0	0.0	0.0
Male Reproductive	0.0	0.0	0.0	0.0
Pregnancy, Childbirth and Puerperium	0.0	0.0	0.0	0.0
Newborn and neo-nates	0.0	0.0	0.0	0.0
Blood Diseases / Disorders	0.0	0.0	0.0	0.0
Neoplastic Disorders	0.0	0.0	0.0	0.0
Alcohol and Drug Use & Alcohol/Drug Organic Mental Disorders	0.0	0.0	0.0	0.0
Factors Influencing Health Status and Other Contacts	0.0	0.0	0.4	0.0
Total Systems Involved (%)	47.64	16.22	36.14	100.00

Whilst table 5.7 is somewhat detailed all 23 Major Diagnostic Categories have been shown because they provide a useful summary of what medical specialities are included in the coding standards, as well as providing information in what specialties patients present. The specialty has implications for staffing events to ensure that staff are appropriately trained in those injuries and specialties which patients present most commonly, namely the nervous system, primarily due to headaches (34 percent, n=228), skin, sub-cutaneous tissue and breast (24 percent, n=160) and musculoskeletal and connective tissue injuries (13 percent, n=88).

It is interesting to note the number of eye injuries (three percent, n=22). The number of eye injuries could be as a result of the type of ground that has dust and other material on it. A disturbing number of burns (three percent, n=22) occurred and almost all of the patients involved staff members working with food and drink. The high number of burns highlights the requirement for good occupational health and safety preparation and vigilance to identify trends and correct problem areas.

As can be seen from Chapter two other authors have not included the major diagnostic categories in their reports on mass gatherings. Each author has determined their own categories for reporting and thus each may differ slightly in what injury goes into what classification. In their study on Australian mass gatherings, Arbon et al. (n.d. p.12) found that the majority of patient presentations were of a minor nature and included such injuries and illnesses as headache, sunburn and blisters, similar to the results in this study. Ounanian et al. (1986, p.522) found that the majority of patient presentations at an outdoor rock festival were for minor surgical trauma (44 percent) which were mainly skin related. This is somewhat higher than the results in this study and could be explained by the outdoor nature and field type setting in which the event was held.

Used in combination with the Australasian Triage Scale, discussed further on, the MDC's can provide a good indication of the injuries and illnesses occurring at mass gatherings and the urgency of treatment required for patients at this 'high' level of analysis. Information such as this can assist planners to appropriately staff and train medical and first aid staff for mass gatherings.

5.4.3 ICD-10-AM sub-category or injury or illness

ICD-10-AM allows for a definitive diagnosis category, which is more detailed than the Major Diagnostic Category, to be recorded for each injury or illness (National Centre for Classification in Health, 1998b). In total there were 99 different diagnoses recorded across the three stadiums. These ranged from cardiac arrest to contact with wasps and bees, hypothermia, to fractures, dislocations and sprains. The top 15 diagnostic categories, as coded using the ICD-10-AM codes are reproduced below in Table 5.8. The full list of diagnostic categories of injury are detailed in Appendix 9.

Table 5.8 Total patients by 15 most common diagnostic categories of injury and illness coded by ICD-10-AM

Diagnostic Category	Total Patients (n=666)
Headache	193
Nausea and vomiting	48
Open wound of wrist and hand	44
Syncope and collapse	33
Superficial injury of ankle and foot	23
Superficial injury of head	19
Superficial injury of wrist and hand	17
Asthma	16
Open wound of head	12
Foreign body in eye	12
Dislocation, sprain and strain of knee	11
Burn of shoulder and upper limb	11
Burn of wrist and hand	11
Dislocation, sprain and strain of joints and ligaments at ankle and foot level	10
Abnormalities of breathing	9

As Table 5.8 shows the majority of diagnoses were headaches, nausea and open wounds followed by syncope (a faint) and collapses. None of these are, in themselves, immediately life threatening. However, the underlying causes to syncope and collapses could well be. The advantage to a patient of having a multi-disciplinary medical team on site means that they can be quickly assessed by professional staff and, if necessary, have immediate advanced medical care begun.

It is difficult to compare these ICD-10-AM coding results with other studies, as discussed in Chapter two, because each study classifies and collates injuries and illnesses in different ways. The best comparison can be made under the heading of Major Diagnostic Categories, which are broader than individual ICD-10-AM categories.

As Table 5.8 and appendix 9 demonstrate the level of detail in ICD-10-AM may be too great to report on the injuries and illnesses occurring at mass gatherings. For example the classification of open wounds of the wrist and hand, whilst informative, is too great a detail for the mass gathering planner. What is of greater interest is the total musculoskeletal injuries that can be expected to present at a gathering. This is where the use of the Major Diagnostic Categories, as shown in Table 5.7, can be of use. With only 23 MDC's, this limited number provides a manageable number of codes into which each injury or illness can be classified, whilst still providing useful information to the mass gathering planner. If more detail is required, individual ICD-10-AM codes and classifications can then be consulted.

5.4.4 Nature of injuries and illnesses

The National Data Standards for Injury Surveillance allow for the overall nature of injuries to be identified. The Standards identify 37 different injury types. Within this study there were 16 different injury types identified (n=271), and one category where there was no injury identified. This category is used when a patient complains of an injury, yet on examination the medical and first aid staff are unable to determine that an injury is present.

Table 5.9 shows the percentage of each injury classified under NDS-IS as part of this study. The full table is reproduced in Appendix 10. What Table 5.9 does not show are the medical presentations, therefore this information has limited use in analysing the overall mass gathering situation. However, this type of information is useful in assisting to plan for injuries that occur at mass gatherings. All the major injury classifications under NDS-IS have been included in table 5.9 to provide an overview of the type of coding that can occur and the type of injuries were not seen as part of this study.

Table 5.9 Percentage of patients by nature of injury coded using NDS-IS

Nature of Injury	Percent of Total Injuries (n=666)			
	SCG	SFS	Stadium Australia	Total
Superficial (incl bruise)	43.8	29.1	30.4	36.0
Open wound (excl eye)	27.3	41.8	15.7	26.0
Sprain or strain	8.3	3.6	27.5	14.4
Burn or corrosion	8.3	3.6	12.8	9.0
Foreign body in external eye	5.0	3.6	3.9	4.3
Fracture (excl tooth)	1.7	3.6	3.9	2.9
Dislocation	0.0	1.8	3.9	1.8
Foreign body in soft tissue	0.8	1.8	1.0	1.1
No injury detected	1.7	1.8	0.0	1.1
Injury to blood vessel	0.8	1.8	0.0	0.7
Poisoning or toxic effect	0.0	3.6	0.0	0.7
Injury to muscle or tendon	0.0	1.8	0.0	0.4
Injury to internal organ	0.0	0.0	1.0	0.4
Eye injury (excl f.b. incl burn)	0.8	0.0	0.0	0.4
Foreign body, other/unspecified	0.8	0.0	0.0	0.4
Intracranial injury (incl. Concussion)	0.0	1.8	0.0	0.4
Other specified nature of injury	0.8	0.0	0.0	0.4
Total Patients	43.5	19.8	36.7	100.0

As the table demonstrates, the majority of injuries were superficial (36 percent, n=100). It is likely that these injuries could well be treated by a first aider. Open wounds (26 percent, n=72) would also most likely be treated by either a first aider or ambulance officer. However, the benefit to the patient (or spectator in the majority of cases) is that where uncertainty arises as to the level of wound closure required then a doctor is quickly on hand to provide advice, administer tetanus toxoid vaccine if required or if necessary carry out suturing procedures. This again takes pressure off the local hospitals and provides a higher level of medical care to the patient.

Sprains or strains accounted for 14 percent (n=40) of injuries and these more than likely result from the steep stairs and narrow seating that many stadiums have. Many of these injuries were the result of falls, or trips down stairs.

When examining both medical and trauma classifications burns accounted for 2.8 percent of overall patient presentations. However, when burns are examined solely as part of the trauma sub-classification, then the number of burns suffered by patients, at 9 percent, is high.

5.4.5 Body location of injuries and illnesses

The body location of injury is recorded as part of the NDS-IS. Whilst it primarily relates to injury, to identify trends in body location it was decided to code body location of medical incidents as well as injury to determine what body region the majority of patients were complaining about. Table 5.10 shows what part of the body the majority of complaints were about.

Table 5.10 Body location of injury or illness by stadium coded using NDS-IS

	Percent of Total Patients (n=666)			
Body Location	**SCG**	**SFS**	**Stadium Australia**	**Total**
Head (excl face)	52.8	40.0	24.1	40.3
Face (excl eye)	1.2	2.7	3.7	2.4
Neck	0.6	0.9	0.8	0.7
Thorax	3.1	10.0	9.4	6.5
Abdomen	4.4	3.6	16.7	8.7
Lower back (incl loin)	1.2	0.0	2.9	1.6
Pelvis (inc perineum, anus genital area, buttock)	0.0	0.9	1.2	0.6
Shoulder	0.0	0.0	1.6	0.6
Upper arm	0.0	0.0	0.0	0.0
Elbow	0.6	0.0	0.8	0.6
Forearm	4.0	1.8	3.3	3.4
Wrist	0.3	0.0	2.0	0.9
Hand (incl fingers)	11.5	24.6	6.9	12.0
Hip	0.0	0.0	0.4	0.2
Thigh	0.0	0.0	2.0	0.7
Knee	1.9	4.6	4.1	3.1
Lower leg	0.9	3.6	3.3	2.2
Ankle	1.6	0.0	6.1	3.0
Foot (incl toes)	4.0	4.6	1.2	3.1
Unspecified body location	1.9	0.9	0.8	1.3
Multiple injuries (more than one body location)	0.0	0.0	0.4	0.2
Body location not required	9.9	1.8	8.2	8.0
Total Patients	47.6	16.3	36.2	100.0

As the table clearly shows the major area complained about was the head (40 percent, n=273), which is not surprising given the number of patients presenting with headaches. The hands and fingers (12 percent, n=81) were the next area of the body most frequently injured, which mainly related to cuts and abrasions of the hand. The abdomen (9 percent, n=59) was the third most common area complained about because of the number of people presenting with nausea and vomiting. Finally the thorax (6 percent, n=44) was the next most complained about area of the body due to the number of patients presenting with shortness of breath, chest pain or other chest complaints such as coughs. Again, similar to the results in ICD-10-AM it is difficult to compare these results with overseas studies because the body location of injury is not discussed in past literature.

5.4.6 Australasian National Triage Scale for injuries and illnesses

The Australasian National Triage Scale, as discussed in Chapter 3, categorises injuries or illnesses into a triage category from one to five depending on the maximum amount of time the patient should wait for medical treatment. Table 5.11 demonstrates the triage category the 666 patients were classified under.

Table 5.11 Percentage triage category of patients

	Percent of Total Patients (n=666)			
Triage Category	**SCG %**	**SFS %**	**Stadium Australia %**	**Total %**
1	0.0	1.8	0.4	0.5
2	1.6	5.5	4.1	3.2
3	17.7	14.6	35.1	23.6
4	24.1	21.0	34.3	27.3
5	56.6	57.3	26.1	45.5
Total Patients	46.7	16.5	36.8	100.0

As table 5.11 demonstrates the majority of patients (46 percent, n=303) fell into triage category five, which means they should be seen within two hours as per the Australasian College for Emergency Medicine triage guidelines as discussed in Chapter three. Twenty seven percent of patients (n=182) fell into a triage category four, which means they should be seen within one hour as per the standards. These two categories include minor cuts and abrasions and simple headaches. There is an argument that these two categories of patients could have been competently assessed and treated by an appropriately trained ambulance officer, first aider or nurse.

Triage category three had 24 percent of patients (n=157). Category three patients include those with potential fractures or abdominal pain. Many of these patients were treated on site and able to return to the event. Had a doctor and nurse team not have been present it is likely that many of these patients, if not all, would have required assessment and treatment in hospital. By having an appropriately trained medical team at the stadium both ambulance services and hospitals had pressure taken off them.

Triage categories two (3.2 percent, n=21) and one (0.5 percent, n=3) are those patients with life threatening emergencies requiring immediate medical intervention. In this study the patients in category one had cardiac arrests (n=2), and a head injury (n=1). Those in category 2 included those patients with uncontrolled seizures unresponsive to normal medication, respiratory distress, unrelieved chest pain, open head injury or unresponsive collapse. Within these triage categories all patients would have, and did, require hospital treatment with transport via ambulance. The advantage to these patients of having a multi-disciplinary medical team on site meant that advanced medical treatment could begin early and having a doctor on site meant a wider range of medications was available to assist the patient earlier. Relating the importance of this back to the time spent with patients meant that extended extraction times (for example from the top tiers of Stadium Australia) meant that a doctor was with the patient implementing advanced treatment well in advance of their arrival at hospital.

There were two cardiac arrests, both at the Sydney Football Stadium, during the data collection period. On both occasions rapid intervention and medical treatment including intubation and drug therapy meant that both patients were resuscitated with a cardiac output prior to departing for hospital. Unfortunately both patients died in hospital. Whilst this outcome was unfortunate, the availability of medical assistance on site can help in stabilising patients and reducing complications associated with life threatening events.

Of all the category two patients (3.2 percent, n=21), which included patients with uncontrolled seizures, severe respiratory distress and an open head wound, none died. This is an excellent result given the life threatening situation that these patients found themselves in and demonstrates the benefit of having a medical team on site, as opposed to basic first aiders.

As discussed in Chapter three, Emergency Management Australia provides an estimate of the number of patients within each triage category that will present at mass gatherings,. Whilst Emergency Management Australia only include a triage scale of one to four, the results from this study found that there are a higher number of patients presenting for triage categories one, two and three compared to the Emergency Management Australia estimates.

Emergency Management Australia (1999, p.47) estimate that at mass gathering events triage category one will have a presentation rate of 0.02 percent, where as this study found a rate of 0.5 percent. In category two, Emergency Management Australia estimates an expected rate of 1.10 percent, where this study found a rate of 3.2 percent, which is more than double. These two triage categories are important because it is in these two categories that patients require the most expedient medical practitioner care.

Category three, into which a large number of patients presenting at mass gatherings would normally require medical practitioner assessment, according to Emergency Management Australia can expect a presentation rate of 12 percent. This study found a presentation rate of 24 percent. This result is significant when examining the staffing of mass gatherings because all of these patients could be expected to require doctor assessment, even if not suffering immediate life threatening conditions. By having a doctor (or doctors) on site the local hospital is saved from having to assess and treat these patients, the majority of which, as was previously shown, are returned to the event after assessment and treatment.

Categories four and five are expected to have a presentation rate of 87 percent according to Emergency Management Australia. This study found a presentation rate of 73 percent, which accounts for the higher presentation rates in triage categories one to three.

Unfortunately it is difficult to hypothesise why the presentation rates in the first three triage categories were so much higher in this study compared to the estimates given by Emergency Management Australia. One reason could be that the Emergency Management Australia estimates include all mass gathering events, not just those in stadiums. It could be that the estimate is based on overseas studies. What the higher rate in this study does show is that there is a need for further research into mass gatherings to find out the severity of injury and illness to ensure appropriate staffing at events.

5.5 Conclusion

This chapter has presented the results from this study, and, where appropriate, highlighted differences and similarities with other studies as described in Chapter two. This study found a range of injuries and illnesses occurring at mass gatherings, and found that most are minor in nature with the majority being of the nervous system speciality that manifest in headaches.

This chapter allocated a triage score to each patient based on the Australasian National Triage Scale. The triage score for each patient allows for an examination into the urgency of treatment required, and this study found that the estimates of patient numbers presented by Emergency Management Australia were underestimates for the more serious injuries and illnesses. Limitations of the study, principally treatment time were discussed. In the next chapter conclusions from this study are discussed. The conclusions, based on the results as discussed in this chapter provide a basis for future research recommendations.

CHAPTER 6 – CONCLUSIONS

6.1 Introduction

In the previous chapter the results of individual patient records collected, summarised and then analysed as part of this study were presented. In this chapter conclusions, drawn from the data collected, are given. As a result of the conclusions from this study recommendations for mass gatherings and future avenues for research are identified. The collected data in this study showed that whilst the majority of injuries and illnesses occurring at mass gatherings were minor, serious injury and illness did occur. The previous chapter found that patient estimates within each triage category, as defined by Emergency Management Australia were an underestimate in the more serious triage categories when compared to patients presenting in this study.

6.2 Importance of the study

Appropriate planning for events, including the provision of multi-disciplinary professional on-site medical care is becoming more important. This study gives a greater understanding of the number and types of injuries that occur at mass gathering events thus enabling better planning.

As discussed in Chapter one, mass gatherings, defined by Sanders et al. (1986, p.517) as an event that attract more than 1,000 people, occur throughout the world on a regular basis. In Sydney, mass gatherings may include such events as New Years Eve celebrations, Mardis Gras, or any number of events and concerts organised and held in bounded stadiums or arenas. Mass gatherings can be spread out over an unbounded area such as the City to Surf fun run or a large fair. Wherever large numbers of people congregate there is the potential for injuries and illnesses to occur, and the results of this study showed that the number of people being injured at mass gatherings lies somewhere in the middle of previous research completed.

Determining what injuries occur at mass gatherings has implications for planning on-site medical team staffing. If the presence of on-site multi-disciplinary medical teams result in injured spectators and participants taking fewer resources from hospital emergency departments, then it may be worthwhile to either expand the number of events where medical teams are used, or at least continue with current patterns of stationing medical teams at particular events.

The primary purpose of this study was to determine what injuries and illnesses are occurring at bounded stadium mass gatherings in Sydney, Australia with a view to ascertain adequacy of current medical staffing and putting forward recommendations for future mass gathering events.

6.3 Results

A review of past literature on mass gatherings showed that most research has come from the United Kingdom and the United States of America. There has been little formal study into mass gatherings in Australia and the medical problems that occur at those gatherings. The most comprehensive study was completed by Arbon et al. (n.d.) from data collected by St John Ambulance (Australia). The literature reviewed showed that there is a need for further study into mass gatherings in Australia.

As the literature review demonstrated, there has been debate over the medical staffing, timing, logistics and other factors associated with mass gatherings. This study, by using international coding standards sets a benchmark for classifying patients to enable comparison with injuries occurring at future mass gatherings. This study adds to the body of knowledge held about mass gatherings. Through information gathered on the types of injuries and illnesses occurring this study enables more informed discussion about the need for multi-disciplinary medical teams at mass gatherings.

Past research shows that the classification of injury and disease from mass gathering events has not been completed in a uniform manner, to the same standard that hospital in-patient statistics are generally collected. This study used standard injury and illness classification (coding) systems, the International Statistical Classification of Diseases and Related Health Problems – Australian Modification (Version 10) (ICD-10-AM) and the National Data Standards for Injury Surveillance (NDS-IS). If standard coding is continued, it would allow for meaningful comparison between events and across borders.

The results of this study concur with the findings of research conducted in other countries, *viz*, people present to medical staff with a range of injuries and illnesses at mass gatherings. However, because much of the published literature appears to have coded patient data in different ways, this means that the reader cannot accurately compare injuries and illnesses between studies in case they have been coded using different definitions.

The systematic use of published coding and data collection in this study means that future comparison with other mass gathering events will be possible. In addition, there will now be a baseline set for future Australian studies into mass gatherings with regards to coding and determining treatment urgency. This means that, based on numbers of people presenting, the types of injuries and illnesses occurring, and treatment urgency, the appropriate numbers and types of medical staff for various mass gathering events can be determined.

This study included data on 666 patients seen at over 70 separate events through the calendar year 2000. In all there were over 1.7 million people that attended the events. Results showed that of the people presenting to medical teams almost 50 percent were male. The majority of those persons presenting for medical treatment were aged in the 20 to 30 year old age bracket, possibly representing the common age group of people who attend mass gathering events. The presentation rate for this study was 0.38 patients per 1,000 spectators which overall meant that 0.04 percent of spectators presented to medical staff. Consistent with international studies the majority of presentations were for medical problems (sixty percent) such as nausea and vomiting as shown in Table 5.8. The 40 percent traumatic injuries were mainly musculo-skeletal injuries as shown in Tables 5.8 and 5.9.

Of the patients seen by medical staff, only seven percent required transport to hospital. The vast majority of patients were able to return to the event after being assessed by a multi-disciplinary medical team that included a doctor (where appropriate). The low transfer rate to hospital also meant that local hospitals were not overwhelmed by patients who did not require hospital admission, however required doctor assessment. The transfer to hospital rate as described in Chapter five has implications for staffing mass gatherings as discussed in Chapter two. If patients can be returned to the event, thereby keeping pressure off the local hospitals, service to the community remains uninterrupted. Where hospitals are stretched or even overwhelmed then a rethink on staffing mass gatherings will be called for.

On average, treatment time per patient was approximately ten minutes. At Stadium Australia the treatment time was considerably longer due to the stadium size and distance to transport patients back to the medical room for further treatment when required.

One issue that the literature review did reveal is that there is a lack of legislation governing medical provision at mass gatherings. As some recent, well publicised, tragic cases highlight, when the medical plans at gatherings are not organised properly people can end up seriously injured with possible fatal consequences. A lack of government legislation is one reason, as is the lack of accountability for event organisers. It is likely that insurance companies, rather than government or public pressure, will ensure that, in the future, minimum compulsory standards for medical care at mass gatherings are implemented. This has already occurred in the United Kingdom.

Emergency Management Australia provides a guide to the expected numbers of patients that will present to medical staff at mass gathering events within the various triage categories. This study found that the actual presentation rates were three times the expected number in triage categories one and two. These patients are suffering serious life threatening emergencies. It is unknown on what basis Emergency Management Australia determined its figures. However, it is recommended that Emergency Management Australia re-examine the expected numbers of patients within various triage categories with a view to possibly having a separate table for bounded events.

This study, as discussed in Chapter five, found a large number of patients requiring expedient medical care. In addition it was found that a large number of patients benefited from doctor assessment on site, which meant that not only could they return to the event rather than being transported to hospital, it also meant that local hospitals were not burdened with extra patients requiring doctor assessment but not admission to hospital.

6.4 Recommendations

This study collected data on what injuries are occurring at mass gatherings in Australia, specifically within a stadium setting, or a bounded area. Based on the numbers of people presenting to the multi-disciplinary medical team, their main complaint and treatment urgency, this study demonstrated that there is a benefit to the patient by having multi-disciplinary medical team on site. This team included doctors, nursing staff, advanced life support staff and first aiders.

The literature reviewed revealed there are limited Australian studies and the majority of mass gathering research has originated from the United Kingdom and United States of America. It is recommended that further research into Australian mass gatherings using primary source materials occurs. The reasons for various injuries occurring at mass gatherings also warrants further investigation. Whilst it is important to know what is occurring to appropriately plan to deal with the injuries and illnesses, it is more important to understand why certain events, or stadia have particular injuries or illnesses. Research in this area could also include why certain areas or events result in particular injuries and illnesses based on crowd demographics.

Based on the numbers of patients presenting to medical staff and the injuries and illnesses they present with it is recommended that for mass gatherings of over 5,000 persons a hierarchical team of doctor, nurse, paramedical and first aid staff be employed to ensure optimal patient care. This medical staff mix will ensure neither professionals nor volunteers are over-run with inappropriate medical cases which are out of their scope of expertise. A mix of volunteers and professional staff will also mean that costs for event organisers are kept to a minimum.

It is recommended that the number and skill mix of staff should be appropriate to treat expected patient numbers and their presenting problems at the event site based on past experience. If this information is unavailable, numbers and skill mix of staff should be based on similar events conducted elsewhere under similar conditions. It is further recommended that the staff employ a model of roving and static first aid teams, with a doctor based in a suitably located and equipped first aid room. Based on a worst case scenario of a patient cardiac arrest occurring at the event, which was shown to occur at events as part of this study, it is recommended that there be enough staff to ensure basic life support with oxygen and semi-automatic defibrillation within 3 minutes, and advanced life support including intubation, drug therapy and intravenous therapy within 5 minutes to any patient in the event area.

As a result of this study, and after examining the amount of data that can be collected at mass gatherings in a timely manner without compromising patient care, it is recommended that the Level 1 detail, as determined by the National Data Standards for Injury Surveillance, be collected as a baseline for mass gathering events. Whilst this study shows it is not necessary to code by both NDS-IS and ICD-10, the NDS-IS provides a framework for data collection that can be used for mass gatherings for coding under ICD-10-AM. The collection of data includes patient name, address, place of injury, mode of injury and actual injury presentation.

Further, it is recommended that an internationally recognised coding system, such as ICD-10-AM be used for coding injuries and illnesses occurring at mass gatherings. This will allow comparison across events and across countries in the future. It is recommended that patient report forms be designed to ensure that minimum standards of patient information, based on the Level 1 standards of NDS-IS, are recorded for future planning and comparison with other events.

There is the opportunity to conduct research into public expectations of level of care available at mass gatherings. The results of public expectations, coupled with evidence of what injuries and illnesses occur at mass gatherings could then be used to assist in shaping government policy.

There is a need to conduct economic analysis of the care provided at mass gatherings. Based on the information collected as part of this study an examination of the cost savings by keeping and assessing patients at the site rather then sending them to hospital should be conducted. Economic analysis would then give an indication of savings to the general health system through external provision of medical teams. The opportunity cost of overwhelming or creating extra burden on the health system through not having medical teams on site could also be examined.

Finally there is a need to rethink government policy and ensure that appropriate legislation is passed to ensure the public can expect a minimum level of care at mass gatherings. As the literature review showed there are no clear standards on the numbers and skill mix of medical care required at mass gatherings. Whilst some stadiums employ an appropriate level of care, there is always room for improvement. Research such as this study will assist policy makers in setting appropriate standards to ensure optimal medical care to the public.

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