CHAPTER 1 - INTRODUCTION

1.1 Introduction

The aim of this thesis is to examine what injuries and illnesses occurred over the course of a year at three of Sydney's largest stadia. The results of this study will be used to more efficiently plan the medical care services at mass gatherings, therefore ensuring quality care to the public.

This chapter defines mass gatherings for the purpose of this thesis and examines the reasons as to why mass gathering study is important. It also discusses what types of research have been previously conducted on the topic. The differences with this study are explained to show why this study is important and how it will add to the body of knowledge about injuries and illnesses at mass gatherings – hence being able to make recommendations to improve medical care at large events for the public.

1.2 What are mass gatherings?

Mass gatherings, as defined by Sanders et al. (1986, p.517), are events that attract more than 1,000 people. Mass gatherings occur throughout the world on a regular basis.

Mass gatherings are, generally speaking, organised and include sporting events either held in stadiums (rugby, soccer, cricket etc) or in the open air (fun runs), over wide areas. Events may go over a number of days (fairs and exhibitions). In Australia, mass gatherings include such events as New Year's Eve celebrations, Mardis Gras, or any number of events and concerts organised and held in bounded (or fenced) stadiums or arenas, or spread out over an unbounded (or unfenced) area such as the City to Surf fun run or a large fair.

The mass gathering, if not planned properly or well controlled can turn into a riot, thus changing the nature and response required for the event. This has happened on a number of occasions, most notably in South Africa in 2001, as widely reported in the press. A riot occurred at Ellis Park Stadium involving large numbers of spectators resulting in many injuries and some deaths.

1.3 Overview of past literature

Much of the literature on mass gatherings has come from the United Kingdom and United States of America. There has been little formal study of mass gatherings in Australia and the medical problems that occur at such gatherings. The most comprehensive study was recently completed by Arbon et al. (n.d.) from data collected by St John Ambulance (Australia).

Overall, a review of past literature indicates that when dealing with mass gatherings there are a number of key issues which must be addressed. These are:

- the location of the gathering and whether it is in a bounded (or defined) area;
- the time of year and the impact of weather (rain, cold, sun or high humidity);
- the type of event and the crowd numbers expected;
- performance of a risk analysis for patient numbers for types of injuries; and
- the medical staffing required and plans to evacuate injured persons to hospital.

Most of the published literature on mass gatherings are studies of what injuries and illnesses occur at a particular stadium or event. However, much of the published literature appears to have been collected in an unsystematic manner and it is not always clear how patient data has been coded. This in turn makes it difficult to distinguish whether the same types of patients have been coded in a similar manner, and whether the severity of their injuries can be compared across studies. Chapter two further describes differences in data collection procedures between various studies.

This study differs from the past literature in that:

- data is collected in a defined systematic manner using a primary source of patient medical records;
- patient injuries and illnesses are coded using recognised coding methods; and
- the urgency of patient treatment is coded using a nationally recognised triage system;

The systematic use of published coding and data collection means that comparison with other mass gathering events in the future will be possible. In addition, this study also provides a baseline for future Australian studies into mass gatherings with regards to coding and determining treatment urgency.

1.4 Purpose of the study

The primary purpose of this study was to determine what injuries and illnesses are occurring at bounded (or fenced) stadium mass gatherings in Sydney, Australia with a view to examining the adequacy of current medical staffing and to provide recommendations for future mass gathering events.

The secondary objective of this study was to recommend data collection standards to be used for mass gathering data coding. Recommendations on what data should be collected to ensure that coding of injuries and illness can be undertaken at mass gatherings, ensuring events can be compared with confidence will be given as part of this thesis.

1.5 Significance of the study

Cities are building larger stadiums and holding events that attract greater numbers of people. Builders are creating structures that reach higher and seat more people than ever before. The potential for major incidents is therefore increasing. Appropriate planning for events, including the provision of multidisciplinary on-site medical care is becoming more important. This study will hopefully improve planning, and care, by providing a greater understanding of the number and types of injuries that occur at mass gathering events. Understanding what injuries occur at mass gatherings has implications for planning on-site medical care. If on-site multi-disciplinary medical teams prevent significant numbers of injured spectators requiring hospitalisation then it could be worthwhile to expand the number of events where such medical teams are used.

Past research shows that the classification of injury and disease from mass gathering events has not been completed in a uniform manner, in the way that hospital in-patient statistics are generally collected. The use of a standard injury and illness classification (coding) system if adopted in the future, would allow for meaningful comparison between events both within Australia and internationally.

1.6 Source, collection and review of data

Two patient report forms were the source of coding data for this study. These forms provided patient demographic information, presenting problem and medical treatment information. One private company providing medical services to three of the Sydney's largest stadiums, the Sydney Football Stadium, Sydney Cricket Ground and Stadium Australia, was chosen as the information source. The company, Immediate Assistants Pty Ltd provided their standard patient report forms for each patient over the calendar year 2000.

Access to the patient report forms, and hence patient data, was possible because they must be kept for legal reasons, primarily as a source of patient information should litigation result. A review of the types of injuries and classification into common groupings was undertaken using three published coding systems. The first was the International Statistical Classification of Diseases and Related Health Problems (Australian Modification, Version 10 (ICD-10-AM)). The second, the National Data Standards for Injury Surveillance (NDS-IS) was utilised to assist in coding injuries and to act as a comparison to ICD-10-AM. Finally, the Australasian National Triage System (NTS) was used to determine the urgency of patient treatment required, based on the patient's diagnosis.

1.7 Conclusion

This introductory chapter has given an overview of what a mass gathering is, as well as defining the mass gathering for the purposes of this study. In addition, the source of data and a brief introduction to how this study compares with past literature has also been discussed. Chapter two further discusses the findings from past literature on mass gatherings, and how this is related to the current study.

In chapter three methods of coding injuries and illness are explored in more detail. The detail of each system is discussed as well as how each differs from the other and why each can be used in the mass gathering situation. A list of coding parameters suitable for mass gatherings is then developed and discussed. This list of parameters then defines what data was collected as part of this study in chapter four. Chapter four also discusses the limitations of data collection.

The results of this study are presented in Chapter five. The chapter is divided into three main areas, namely event information, patient information and injury information. The final chapter, Chapter six, brings together the results and the literature review and relates the two to ensure that the reader has an understanding of how this study has made a significant contribution to the study of mass gatherings in Australia.

CHAPTER 2 - LITERATURE REVIEW

2.1 Introduction

The issues surrounding mass gathering events go far beyond simple provision of first aid and putting band-aids on the injured spectator. As the editors in the *British Medical Journal* stated, emergency care 'at these events has been criticised as haphazard at best and dangerous at worst' (Hodgetts & Cooke 1999, p.957).

The literature review identifies critical issues such as access to patients, extrication, level of medical care required for the ill patient and what security precautions are needed for special spectators and players when planning a mass gathering event. To appropriately plan a response to these issues requires an examination of past events.

This chapter examines the available literature on mass gatherings in terms of how they operate, the medical requirements and what planning mistakes have been made. In addition, this chapter will also examine how mass gatherings have been examined in the past and what methods have been used to generate data.

2.2 Planning for mass gathering events

The aim of a mass gathering plan is:

> the prevention of injury, suffering or death that may occur as a result of poor planning or preventable misadventure at public events (Emergency Management Australia 1999, p.xiv).

Planning for mass gathering events goes far beyond simply placing some first aiders at the event site and equipping them with some basic medical equipment, and the means to call an ambulance if required. Emergency Management Australia (1999, p.xi) recognises that a healthy event depends on issues such as water, sanitation and food control. They make the point that the incidence of illness and injury at a mass gathering event will be 'greater than that naturally occurring in a population of the same size' (1999, p.45). Emergency Management Australia (1999, p.xiii) says that plans should have an emergency management approach involving prevention, preparation, response and recovery.

Medical planning for large events involves many facets. These include, but are not limited to, media management, communications, incident control, staffing, response routes and evacuation and vehicles required. As Butler and Gesner (1999, p.62) highlight, without proper planning there will be an 'EMS quagmire' in the event of emergencies. In addition, Emergency Management Australia makes the point that for many international events which have an international governing body their requirements may have to be included in any plan (1999, p.11).

Bock et al. (1992, p.1205) in a study of the Indianapolis 500 mile motor race found that medical planning was a mix of mass-gathering emergency care, sports medicine and mass casualty incident planning. It was important for this study to understand the many facets of mass gathering planning and what has previously been studied to ensure that all appropriate facets of data were collected. The data collected now allows for baseline comparisons when future study is undertaken.

The overall plan for any mass gathering event must take account of a myriad of factors that will affect expected number of patients and the types of injuries that they have. Arbon et al. (n.d. pp.3-4) in their study on mass gatherings throughout Australia found that 'several features of the event environment influence patient presentation rates.' Features given included the number of people that are expected, whether they are seated, standing in a defined area such as a stadium or spread out. Other features include whether the event is indoor or outdoor, how many people can fit into the area, and environmental factors, such as rain, wind and temperature. If these factors are not taken into consideration at the planning stage, the provision of medical care may be inappropriate.

With stadiums holding more people, and people being transported to events by all manner of means, the organisers of the event must take account of the needs of groups external to the actual event as well as their own logistical requirements. This is no more evident than at Stadium Australia where special buses, trains and parking guidelines for large events are enacted in the area around the actual stadium.

The need to account for external groups means that, as Emergency Management Australia (1998, p.1) say, whenever planning a multi-agency response the plan must dovetail into any State emergency management plan, as well as being simple in its approach. Confirming the importance of ensuring planning consistency, Emergency Management Australia also makes the point that decisions by one group in the planning stage can have significant impacts on another group. Therefore, co-operation is essential (1999, p.xiii) not only during the event but in the lead up to and planning of it.

Whipkey et al. (1984, p.44) found that unless there is an adequate plan for mass gatherings, involving all stakeholders, there is likely to be undue stress on existing medical services including ambulance services and hospitals. The authors identified that direct physician involvement in endeavours involving emergency medical services has been shown to be a key factor in the quality of care provided.

When planning does not take account of external factors and involve external agencies experience shows what can happen. Perry (1996) in her study of events in the United States reports on violence erupting in townships after events have been held. In addition, Perry discusses the mob mentality and what can happen when a group of people have a 'diffusion of responsibility' and 'bystander apathy'. This is where those standing by assume someone else will deal with the situation. Perry (1996) notes that

> Spectators at events are pumped full of adrenaline and are highly aroused, a phenomena that can serve as a foundation to aggression.

Flynn (2000, p.130) in his review of planning for the Sydney 2000 Olympics made the point that the planning was co-operative between Australian States. Whilst most of the planning was undertaken in New South Wales, it involved agencies from all States and Territories of Australia. Co-operative planning was required because of the torch relay that wound throughout Australia, as well as some preliminary events being held interstate.

Community education to ensure people know what services are available and where they are has also been identified as important in the planning process. Whipkey et al. (1984, p.47) found that community education was important in telling the spectators and event participants how and where to get aid should they require it. Ounanian et al. (1986, p.524) found that it was necessary to educate the crowd for the environmental conditions that they were expected to experience prior to the event, as well as during the event.

Thal and Riggs (1988, p.802) in their study of a major political conference wanted to ensure that during the event normal medical services to the population were not disrupted. Thal and Riggs report that the planners also had to consider terrorist activity and found that there were planning problems with dignitaries and working around security restrictions. In a study on the Centennial Olympic Park bombing in Atlanta, Feliciano et al. (1998, p.539) found that

> The presence of large numbers of participants or spectators in geographically limited areas poses unique problems with security, triage, and hospital care should a disaster occur.

In a report on the Atlanta Olympic Games, Visotina (1996, p.iii) found that security and accreditation demands of the Olympic Games 'were often in conflict with efficient delivery of health services.' Visotina also found that co-ordination was essential between all health care agencies, whether they be primary first aid, medical, or allied health such as physiotherapy or laboratory analysis. For the 2000 Sydney Olympic Games a co-ordinated and controlled command structure was implemented.

The age of the crowd has also been found to be important in influencing the number and types of patient presentations. Older crowds have differing medical problems than the young. In the anticipation of trauma, Thal and Riggs (1988, p.802) found that the availability of alcohol was a key factor in the number of trauma injuries. This is further backed up by Hodgetts and Cooke (1999, p.957) who state that alcohol 'probably' increases the number of patients that are likely to be seen. Arbon et al. (n.d. p.10) found that alcohol 'will generate increased numbers of patients.' This has implications for planning the number of staff needed at an event.

2.3 Medical staffing at mass gatherings

There is on-going debate over what constitutes appropriate medical staffing at mass gatherings. Thompson et al. (1997, p.78) quoted in Webster (1996, p.11) found that on site medical services should consist of a hospital standard of care for large gatherings of people. Webster (1996, p.15) goes further to propose that when staffing a mass gathering the worst possible scenario must be considered and plans specific to the event must be implemented. Emergency Management Australia (1999, pp.5-6) point out that different events attract differing crowd demographics and therefore differing levels of medical care may be appropriate.

The review of available literature reveals that authors themselves find it difficult to recommend the number of staff and training required for mass gatherings. Sanders et al. (1986, p.515) found that there was 'great variability and little quality control in the provision of emergency medical services at mass gatherings'. In addition the authors also found that it was difficult to predict how often medical services will be used, or even what level of service to provide. The variability in staffing at mass gatherings is supported by Arbon et al. (n.d. p.4) who, in their Australian study of mass gatherings over 25,000 people, found that there is a high degree of variability in services provided at mass gatherings.

Hodgetts and Cooke (1999, p.957) report that there is 'little guidance on the medical facilities required' for mass gatherings. With a lack of guidance or legislative standards it means that organisers of mass gathering events are reliant upon the medical services to recommend appropriate numbers and type of staff. The organisers may reject such advice, meaning that mass gathering events may at times be understaffed or inappropriately staffed. Hodgetts and Cooke (1999, p.957) go on to recommend that at mass gatherings of more than 2,000 people there should be a doctor, for crowds of greater than 5,000 there should be a defibrillator, and at least one first aider per crowd of 1,000.

Emergency Management Australia (1999, p.47) categorise provision of medical care into a number of levels and conclude that the appropriate level of care should depend on the type of event being conducted after 'preparing for the most critical injury/illness foreseeable'. The levels of care are (from most simple to most advanced):

- basic first aid;
- intermediate first aid (first aid plus intravenous access capability and oxygen);
- advanced care and life support; and
- site hospitals.

Overall, the literature review shows that on-site doctors allow for definitive medical decisions to be made without referring all patients to hospital. Baker et al. (1986) found that medical care at the Los Angles Olympic Games in 1984 was available for athletes, support personnel, and employees for the entire Olympic period, with spectator medical services being available during days of competition. There was medical care provided at 28 Olympic sites with first aid stations being staffed by doctors and registered nurses. There were also volunteer first aid personnel as roving teams. The authors also state that many of the medical problems reviewed by doctors were minor and may have been just as effectively treated by non-doctors.

In deciding what level of medical care was appropriate, the organisers of the Los Angeles Olympic Games, according to Daly and Franz (n.d.) provided a mix of physician and nursing staff in addition to roving first aid staff. The size of the site and number of spectators at the site determined actual staffing numbers.

In a visit to and subsequent report on the 1996 Atlanta Olympic Games, Delprado (1997, p.9) described medical services at event sites. Static aid stations were used to provide basic care and facilities, with more advanced medical services available elsewhere. This hierarchical system makes sense because it avoids duplicating expensive medical resources for the few people that will require them, and ensures that the majority of minor injuries and illnesses can be handled close to where the person is at the time.

Another study by Ounanian et al. (1986) of medical care at the 1982 US festival, a 3-day outdoor rock music festival that attracted 410,000 people, found that the organisers used a multi-tiered approach for medical services which is becoming more common at mass gatherings, not just Olympic Games. The US Festival approach included emergency medical technicians, registered nurses, medical counsellors, and doctors. In the organisation ambulance units were situated with less than a five minute response to any static first aid station, which were scattered around the festival site. As well as the aid stations there was one central major first aid centre and two roving ambulance teams.

There were three levels of care available on site. The first was simple dispensing of aspirin and sunscreen at aid stations, the next evaluation and treatment by registered nurses or emergency medical technicians (ambulance officers) at aid stations or the central first aid centre, and the third evaluation by doctors at the central first aid centre. For those patients that required hospital evaluation there were four hospitals which accepted patients on a rotating system to ensure that none was overwhelmed by patients from the event and thus limit normal care available to the community.

In addition there were also two 'reserve' hospitals should the other four become overwhelmed, either from the event or an external, unrelated major incident or disaster. This demonstrates how in planning the event the organisers dove-tailed into existing state emergency plans. Two of the four initial hospitals were trauma centres. The study concludes that through having a mix of medical staff the event organisers were able to decrease the number of doctors needed on site, as well as avoid sending every patient to the local hospitals, and thus overwhelming them (Ounanian et al. 1986, p.525).

Rave parties present unique challenges to medical staff given the normal extended time of the event, regular illicit drug use, a young crowd, and, depending on the country and/or local area, the possible 'underground' or illegal nature of the event. Russell et al. (1999, p.5) described the level and organisation of care at an organised rave party. One doctor, four nurses and nineteen first aiders were split into mobile and stationary teams for the event which attracted 8,500 dancers. The main medical area was raised and overlooked both dance floors. In addition, a drug counselling service was available.

Outdoor concerts with their unpredictable weather, open terrain, difficulty in controlling crowd movement and access difficulties through ill-defined crowd areas present problems to medical staff. At a two-day outdoor rock concert in Scotland the medical management of the event consisted of two accident and emergency doctors, two general practitioners and four accident and emergency nursing staff (Kerr and Parke,1999, p.11). In addition, at least one ambulance with crew was on site at all times to transfer any patients to the one hospital, which was some distance away.

In contrast to much of the literature reviewed, Thompson et al. (1991, p.385) in a study of the level of care at the Calgary Winter Olympic Games found that doctor based teams were not needed at all venues. The authors found that doctors were not needed at the urban venues, but were required at the rural Alpine ski venue. Thompson et al. did, however, acknowledge that doctors at the site can reduce pressure on the local hospital system. In their study, Thompson et al. found that the majority of patients could have been handled by nurses. Similar to the service provided at the Los Angeles games, medical care was available for athletes, staff and spectators. Most athletes were accompanied by team doctors who worked with the athletes without consultation with other medical staff.

Wong et al. (1999, p.2) described the levels of care at a marathon and walkathon held in Hong Kong. At the marathon emergency medical care was provided along with physiotherapy care. At the walkathon, only medical care was available. The reasons given by the authors for different types of available care included the differing demographics of the participants and the fact that the marathon was a race which put extra strain on the body of each participant. The walkathon, by contrast, was billed as a fun event.

The Vancouver World Expo (Weaver et al. 1989, p.156), unlike many events described in this chapter, did not have doctors on site. Static first aid stations were staffed by registered nurses and paramedics, who worked under the control of a remote doctor who was off-site. Unlike other events, security officers were trained in the use of defibrillators to allow for rapid defibrillation of cardiac arrest patients, whilst waiting for the nurse / paramedic response from the nearest static first aid post. The Vancouver World Expo shows another method of medically staffing an event, using remote doctors. Remote access in the Australian situation is not feasible for most mass gatherings. Legislation in Australia prevents nurses and paramedics giving excessive treatment or carrying out procedures beyond their authorised skill level, even when authorised over the telephone by a medical practitioner.

The medical care provided at an international guide and scout camp was different to most of the situations described in this chapter. Pierce et al. (1998, p.71) described the medical care and injuries that occurred at a residential camp that attracted 2,900 persons (2,500 campers and 400 staff). Medical staff consisted of general practitioners that staffed the camp medical centre 24 hours a day over the camp period. General practitioners were considered more appropriate in this instance because the camp was residential, and over a long period. Therefore, the expectations of the camp organisers were that injuries and sickness were more likely to be of a general practitioner nature, rather than an emergency doctor nature.

In their study of the emergency medical response at the Indianapolis 500 motor race, Bock et al. (1992, p.1206) pointed out that at mass gatherings, 'medical centres' at the site are not designed to serve as 'full service emergency departments.' Rather, they are designed to serve as an 'emergency medical system access point, triage area, and resuscitation station.' Those patients that do need hospital care need to be transferred as quickly as possible to the appropriate hospital for further assessment and treatment. The design of medical stations to not be emergency departments at mass gatherings shows that patient treatment and hence scene time, even where multi-disciplinary teams are present, should be limited to stabilising the patient before transport to definitive care.

Emergency Management Australia makes recommendations on the number of first aid personnel to be provided at particular events, based solely on crowd size. The table below provides an approximate guide for the ratio between crowd size and first aid personnel.

Table 2.1 Guide to the provision of first aid

Patrons	First Aid Personnel	First Aid Posts
500	2	1
1000	4	1
2000	6	1
5000	8	2
10000	12	2
20000	22+	4

Source: Emergency Management Australia, 1999, p.127

This suggested ratio of staffing does not take into account the myriad of other factors that must be considered at mass gatherings. As described elsewhere in this chapter these factors include location, length and type of event. The ratio for first aiders does not provide guidance on what is an appropriate skill level of staff that should be provided at the mass gathering. In a review of the literature, Arbon et al. (n.d. p.4) attempt to use regression analysis to predict patient presentation rates, which are discussed further on in this chapter. What is not suggested is what level of care should be provided for those presentation rates.

What emerges from the literature review is the lack of legislation that details the requirement for appropriate numbers of first aiders or medical staff to be present at events, or the level of skill that staff should have. Whilst there are guidelines set by Emergency Management Australia, organisers are under no obligation to take note of the guidelines.

It is interesting to note that in the majority of studies examined as part of this review there was a mix of paid and volunteer medical staff. In many cases the 'higher' levels of staff providing medical care were paid professionals. In most cases the lowest level of care, basic first aid, was provided for by volunteer first aiders. This raises an interesting query and argument as to whether there is a need to have volunteers at events. Certainly, where a large number of medical staff are required it may be cost effective to use a mix of volunteer first aiders and paid professionals. However, where a relatively small number of medical staff are required it may be more effective to use only professional staff to ensure appropriate care without overstaffing.

2.4 Response times to patients at mass gatherings

An almost universally used benchmark for emergency services is time to respond to the patient to begin treatment. This timeframe, depending on definition can start when the first emergency call is made to when the ambulance arrives, or when the emergency call finishes to when the ambulance arrives. On-scene time, or treatment time before transport to hospital begins, is also used to compare service. Part of the reason for having medical staff on site at mass gatherings in the first place is to reduce response times to patients by not having to wait for off-site assistance. However, in a review of the literature there is limited data that states what response times are, or give recommendations on what appropriate response time at a mass gathering should be.

There are various standards set for ambulance response times to emergencies, for example the British ORCON (Operational Research Consultancy Standard) standards which, from the researchers own experience of working in Ambulance care, are the benchmark in Australia. These standards are also referenced in the majority of Australian State Ambulance Service annual reports where response times are provided. The ORCON benchmark states differing timeframes for ambulance response to injured or ill persons in the community, depending on whether you are in the city or a rural location. There are no comparable standards set for mass gathering events. There are no internationally used standards for judging what an acceptable time on scene is for ambulance crews.

Pons et al. (1980, p.204), in a study of a large (72,000 person) football stadium, found that the response time of the on-site paramedic units was 2 minutes to the most distant part of the stadium. The use of modified golf carts able to accommodate an ambulance stretcher assisted in this response time.

In the only recommended response times for mass gatherings found, Johnson (1991, p.427) states that a goal of emergency medical services at mass gatherings should be basic life support within four minutes, advanced life support within eight minutes and arrival at a trauma facility within one hour, and preferably within thirty minutes of the original injury. According to Emergency Management Australia (1999, p.48) first aid stations should be within five minutes of all sections of the crowd. Again, similar to the lack of detail surrounding what is an appropriate skill mix of medical staff, there is a lack of definition of response times for those staff working at mass gatherings.

2.5 Injuries and illnesses occurring at mass gatherings

It is important to have a basic knowledge of what types of injuries and illness occur at mass gatherings so that appropriate skill mix and number of medical staff can be supplied. Whilst all the literature reviewed here gives an indication of what type of injuries occur at mass gatherings there is no commonality in what information was collected, the way the information was collected, and the way in which information was coded or summarised.

The type of event has an impact on the number and type of injuries seen by medical staff. Bowdish et al. (1992, p.1202) reported from another study by De Lorenzo (nd) that the type of event had an impact on the number of patients and the types of injuries seen. For example, the number and type of injuries at an indoor basketball event was different from the number and type of injuries at a heavy metal rock concert. Medical staff at the heavy metal concert saw a greater number of patients, and more of those patients had drug related conditions than those at the basketball event.

Sanders et al. (1986, p.515), in a review of mass gathering reports, found that most injuries / illnesses were 'lacerations, sprains, headaches, and syncope.' Sanders et al. concluded that by soliciting people to attend mass gathering events, the risk of a person needing medical attention was increased, compared to the same person staying at home. This assertion may be obvious to most people, however, it does highlight the fact that mass gatherings can be dangerous places if the event is not planned thoroughly. Sanders et al. stressed the need for proper planning and event control to ensure that those who do need medical care receive it in a timely manner. This goes back to the issues of planning and response times already discussed earlier in this chapter.

In the study of the 1982 US Festival, a three day outdoor concert event, Ounanian et al. (1986, pp.522-524) found that of the 25 most common diagnoses, the majority of encounters were for minor surgical trauma (44 percent) which included small lacerations, contusions and abrasions. Reactive airway disease, such as asthma, accounted for 13.7 percent of cases. Heat related conditions, such as heat exhaustion, accounted for 7 percent. There were 91 patients transported to hospital which included three severe overdoses, two stabbings, four reactive airway disease complaints and three heat exhaustion patients. The authors conclude that although the majority of injuries and illnesses could easily be handled by emergency medical technicians (ambulance officers) and nurses, it was useful to have medical practitioners on-site.

At the organised rave party studied by Russell et al. (1999, p.8) it was found that anxiety was the most common complaint. Russell et al. also found that alcohol was a contributory factor in over 30 percent of patients and drugs a contributing factor to injury or illness in over 57 percent of cases. Most patients were discharged back to the rave party (62 percent) and no patients required transport to hospital. Of note is the observation made in the study that at an outdoor extended rock concert the majority of injury was trauma, where in this case it was drug related (1999, p.8). This conclusion shows again that different events result in different types of injuries.

To further demonstrate that different events result in different injuries, Bock et al. (1992, p.1204) in a study of the Indianapolis 500 mile race over the period 1983 to 1990 found that there was a mix of medical and traumatic patient presentations. 16.2 percent of treatment cases involved intoxication, 15.4 percent lacerations, 11 percent were pre-existing conditions, 8.5 percent were heat related, as well as four cardiac arrests. The Indianapolis 500 race attracts approximately 400,000 people each year.

The Isle of Man motorcycle event is unique in that seriously injured patients must be transferred by helicopter to the mainland for treatment. In addition, the layout and inaccessibility of many areas of the island mean that a helicopter response to any injured rider is routine, rather than the exception. Omololu and Stevens (1999, p.14) identify that on race day there are nearly sixty doctors and paramedics situated around the racecourse. From 1983 to 1997, four hundred and seventy helicopter flights were recorded during which 444 competitors and 26 spectators were transferred to hospital. Overall there was a survival rate of 79 to 87 percent depending on the severity of injury, as measured by the injury severity score (1999, p.15-16).

In their study of the Calgary Winter Olympic Games, Thompson et al. (1991, p.387) found that there were 3,395 patient visits. Spectators accounted for 796 of visits, 2,099 by officials and staff and 500 by athletes. Of the visits, 87 percent were treated by volunteer medical staff without referral to other medical facilities. Similar to other studies, most visits (70 percent) were for minor conditions including musculoskeletal, skin trauma, viral syndromes and headache. Of the patients referred to other medical facilities, half were discharged to see doctors or dentists in their rooms, and the other half (approximately 225 people) were sent for further assessment and treatment in hospital emergency departments. The authors therefore concluded that at mass gatherings, most problems are non-traumatic, and of the trauma that does occur, it is less severe than every-day situations. Thompson et al. (1991, p.388) found that serious medical problems were 'four times more common than trauma'.

At the 1984 Los Angeles Olympic Games, at the events which housed over 10,000 spectators, Baker et al. (1986, p.187) found that the most common emergencies were a mix of trauma and medical emergencies that included minor musculoskeletal injuries, lacerations, heat affects, minor gastrointestinal complaints and infections. Environmental effects included sunburn, insect bites and heat related illness, accounting for 19.5 percent of patients. Of the medical visits, only 1.6 percent required transport to acute care hospitals. The major reason for transfer was for further treatment of musculoskeletal injuries followed by those patients suffering cardiac emergencies. The number of patients requiring transport is important because, as stated earlier, on site medical teams and centres are not full service emergency departments. If many patients require transport to hospital it could either mean for example, that the event is inherently unsafe, there are unique crowd demographics, the staffing mix requires adjustment, or the diagnostic resources on site are inappropriate.

In her preliminary report on the Atlanta 1996 Olympic Games, Visotina (1996, p.iii) found that the major challenges at venues were management of heat related illness, food safety and disaster preparedness and response. Heat related illness was a major factor because a large number of events were held during daytime, and in outdoor locations. It is interesting to note the inclusion of food safety as a health and safety issue which may have been particularly relevant to the Olympic study because of the extended nature of the event and enormous quantities of food that are eaten at a wide variety of locations. However, food safety is also important to the 'one off' mass gathering held in one stadium or location, as a large number of people with food poisoning could potentially overwhelm an emergency medical and hospital system.

In their study on Australian mass gatherings, Arbon et al. (n.d. p.12) found that minor injuries (cuts, abrasions, sprains) and minor medical problems (headache, sunburn and blisters) account for 80 percent of patient presentations. The authors found that asthma was the most common life threatening emergency, and lacerations were the most common injury requiring 'prompt management'. Unfortunately, as already highlighted earlier in this chapter, the authors do not state what an appropriate level of medical care would be for the injuries seen. In addition the authors only included events with a crowd size of more than 25,000 persons which means that many smaller mass gatherings were not included.

As with all the other studies examined in this chapter, Arbon et al. do not explain how the injuries and illnesses were classified or coded in a comprehensive manner. This could mean, as the data was collected by summary from each event rather than an examination of each medical record, that different injuries were classified in different ways. For example, a laceration requiring a band-aid is minor, however is a laceration requiring sutures minor or major? And in addition what is the timeframe in which such an injury should be seen? Much depends on the interpretation of the person completing the summary sheet and how they are told to code injuries and illnesses.

2.6 Patient presentation rates

Whilst it is important to have an understanding of the types of injuries occurring at mass gatherings, the likely patient presentation rate is also important because it provides a guide to how many medical staff are required. In addition, the types of injuries that are likely to occur will give an indication of the skill mix of staff required, such as first aiders only or medical practitioners. Whilst a mass gathering may have a high presentation rate, if all presentation rates are for minor injuries or illnesses such as headache, event organisers will be able to have far fewer medical staff, of a lower skill mix, than the event that has a low presentation rate, but where the injuries and illnesses are more serious, such as chest pain or lacerations requiring sutures. The reason for the difference is that the more serious incidents require assessment and treatment by higher qualified medical staff more quickly. In addition, the treatment is likely to take a longer time, thus tying up medical staff from treating other patients.

Emergency Management Australia found that rock concerts have a presentation rate of approximately 0.5 to 1.5 percent of concert goers regardless of the type or layout of concert. They also make the point that alcohol and drugs have a major influence on presentation rates and types of presentations at events (1999, p.45).

A study by Wetterhall et al. (1998, p.1465) found that the majority of visits to medical staff and first aid posts during the 1996 Olympics held in Atlanta were by spectators. In total there were over 10,715 patient visits over the course of the Olympic Games with the most common problem being sprains and strains, followed by upper respiratory tract infections. It is interesting to note that amongst the spectator group the most common presentation was for heat related illness. These differences have implications for planning as in the majority of cases, mass gathering medical teams are there to treat the spectators.

Weaver et al. (1989, p.158) found that at the World Expo at Vancouver 95 percent of those seeking medical attention were complaining of minor injuries or illnesses with 'few requiring doctor skills.' There were a total of 22.1 million visitors to the site during the five and a half months of operation. Daily patient loads averaged 524 persons. Most patients required less than ten minutes of treatment. As discussed above, treatment time is important because it determines the number of medical staff required for each event.

In their study on an international Guide and Scout camp Pierce et al. compared treatment loads at an open air rock concert and the treatment load at the camp. At the rock concert Pierce et al. reported a treatment load between 0.7 and 1.7 percent of those attending (1998, p.72). At the camp studied, one percent of the campsite population required medical practitioner attention. However, Pierce at al acknowledges that this figure could be underestimating those suffering from an injury or illness, because simple first aid attendances were not recorded.

Pons et al. (1980, p.206) in a study of a large (72,000 person) football stadium found that patient incidence appeared to be related to the temperature of the stadium. Of the total number of patients seen during the ten games, only 11.7 percent were referred to hospital for further assessment and treatment. There was approximately one life threatening emergency per game. With increased temperature it was found that there were more minor medical problems such as syncope and headache. Pons et al. also found that the availability of alcohol contributed to the number of medical problems.

Cheshire and Gill (1998) studied the activity of a crowd doctor at a London premiership football stadium in England. The authors found that for a total of 21 matches, 38 patients were seen by the doctor with a mean of 1.8 patients per match (1998, p.199). Of those seen, six required transport to the local hospital emergency department. Cheshire and Gill make the point that the football club at which they were working has the eighth highest attendance in the league (1998, p.199). In addition to those patients seen by the doctor there were a mean of 5.8 first aid occurrences per match that were attended by first aiders (1998, p.200). Cheshire and Gill report that the two statistics combined make a total incidence of 0.19 first aid/medical incidents per 1,000 spectators per match (1998, p.200).

Russell et al. in their study of a rave party found that the overall incidence of patient presentations was 9.1 per 1,000 people attending (1999, p.8). The authors concluded that this presentation rate was similar to other rock concerts and festivals which they conclude range between 1.2 and 17.3 per 1,000 spectators. Conversely, the authors also say that the rate of presentation in their study may be an under-representation of the real presentation rate because it is possible that many presentations to the drug counselling team were not recorded. In addition, the authors also make the point that the presentation rate at the same event the previous year was 20 patients per 1,000 participants. The referral rate to hospital, in this case was zero for the year studied. The authors found that other events had referral rates of between 0.5 percent and three percent (1999, p.9).

Wong et al. (1999, p.2) found that at a marathon attracting 900 participants, muscle cramp was the most common specific complaint, and lower limb injuries accounted for most patient presentations. At a walkathon that attracted 80,000 people, the most common complaints were dizziness, contusions and muscle cramp.

In their study of the 1984 Los Angles Summer Olympic Games that included all venues over 10,000 persons, Baker et al. (1986, p.188) found, using international classification of disease codes, that the majority of illness and injury were minor. Usage rates of medical facilities on site ranged from 0.68 to 6.8 patient visits per 1,000 spectators and were highest at locations with 'multiple daily sessions, outdoor events, and events at which spectators could move about.' (Baker et al. 1986, p.189). Of the medical visits, 56 percent were from spectators, 29 percent from employees and 12 percent were athletes.

At the Indianapolis 500 mile race over the years 1983 to 1990, Bock et al. found that the total number of people treated yielded a frequency of 0.4 visits per 1,000 persons (1992, p.1205). More importantly, Bock found that there was a need for consistent nomenclature in data collection to allow other organisers of mass gatherings to plan adequately.

Bock et al. found that spectators accounted for 91 percent of the patient mix, six percent were employees and race drivers and three percent were crew. Average patient care time was 27.6 minutes. Patient care time is important because it allows planners to determine how many medical staff are needed to provide adequate service and how long patients would have to wait for assistance. Of the patients seen Bock et al. found that, 71.9 percent were released, 26.7 percent were transferred to hospital and 1.4 percent refused treatment. The average number of patients per hour ranged from 1.1 to over 20 (1992, p.1205).

In their study of the Calgary Winter Olympics, Thompson et al. (1991, p.388) found that the use of emergency medical services occurred at a rate of 15 per 10,000 spectators. Thompson concluded that this rate was of similar magnitude to the Los Angeles summer games, but slightly lower than the 1986 World Expo held in Vancouver, Canada.

The use of emergency medical services at the World Expo in Vancouver was 4 per 1,000 visitors according to Weaver et al. (1989, p.157). Of the patients seen on site, only 4.4 percent were referred for further assessment and treatment. Of those referred, 2.9 percent were referred to hospital emergency departments, the others being referred to office medical practices. Weaver et al. found that a team of two could evaluate seventy five patients per eight hour shift, and thus 'potentially manage a crowd of 20,000 people, although additional staff would be needed to provide a field response' (Weaver et al. 1989, p.158). The ability of a doctor on scene to refer a patient to their own medical practitioner at a later date is another important reason for having a doctor on-scene. In most instances in Australia ambulance and emergency services are unable to transport a patient to their own medical practitioner without a doctor's order. By having a doctor on-site and assessing the patient as being suitable for treatment by their own doctor, pressure is again taken off the local hospital system.

DeLorenzo et al. (1989, p.378) attempted to predict patient volume based on crowd size. Using an indoor stadium as their base, they examined crowds over a seven year period and correlated crowd size with patient volume. What they found was that there was no increase in patient volume for increasing crowd size when comparing football and basketball matches, however, as crowd numbers increased at concerts so did the patient volume. The study concluded

> Crowd size alone has only a minor influence on patient volume at any given event. Structuring medical services based solely on expected crowd size and not considering other influences such as event type and duration may give poor results (DeLorenzo et al. 1989, p.378).

In their Australian study from summary data at events of over 25,000 people Arbon et al. (n.d. p.13) used environmental factors such as temperature, humidity, crowd size and venue type to construct a regression model for estimating patient presentation rates. The methodology used means that individual patient records were not examined by the researchers and the summary may have been filled in differently by event commanders, depending on their interpretation of the information available. The result is that the coding of some injuries and illnesses may have been completed differently. Arbon et al. found an overall presentation rate across all 201 events of 0.1 per 1,000 spectators. The transportation rate was 0.03 per 1,000 spectators.

According to Arbon et al. 'Presentation rates and that the prediction of patient load at these events is complex and multi-factorial' (n.d. p.3). This admission may explain why, when event data from this study was inserted into the regression model developed the expected patient load was greater than the patient load as actually found in this study. More importantly, this comment highlights the fact that, as found by other authors, predicting patient load at mass gatherings can be difficult.

2.7 The New South Wales mass gathering experience

Emergency Management Australia makes the point that current Occupational Health and Safety Legislation places an onus on event organisers and contractors 'to provide for the safety of the audience, and appropriate care, safety and training of all personnel working at the event.' (1999, p.21). This requirement places a burden on event organisers to ensure that the public and event staff are informed about safety issues at the event, as well as having access to appropriate medical care.

The Ambulance Service of New South Wales (NSW) has planned for mass gatherings for a number of years, and any State run event has an overall organising committee at State Government level with representation from all statutory and volunteer organisations to ensure co-ordination, communication as well as appropriate staffing. In general it has been the responsibility of the Ambulance Service of NSW to plan and provide pre-hospital care for the participants and / or spectators at the largest of these events. Often this is provided in conjunction with voluntary organisations such as St. John Ambulance and the State Emergency Service.

Unfortunately there is little published research on mass gatherings specifically in New South Wales. Notable exceptions are some reports filtering out as a result of the 2000 Olympic Games. However, Olympic Games are not normal in any city and the venues, crowds and level of care provided and the medical facilities available on site cannot be considered cost effective solutions for most mass gatherings.

A notable exception to the lack of information is a study by Fulde et al. (1992, p.820) who describe a mass gathering and the response of St Vincent's Hospital in Sydney, to an open air concert held in Centennial Park. The concert, which attracted 93,000 persons and was fully staffed on an emergency department model with additional roving first aid teams, resulted in a case load of 0.48 percent (n = 450) patients, 36 (0.04 percent) of which were admitted to the main medical area, and seven (0.008 percent) of which required transfer to hospital.

Fulde et al. describe how in the early planning stages, meetings were held with external interest groups and providers to the concert to ensure that all had common aims and would not double up on services provided. This reiterates the need for planning as discussed earlier in this chapter. In addition, practical considerations such as where to base the medical site were discussed. Fulde et al. discuss how the staffing for the event, due to the free tickets given to volunteers, meant that a full emergency department staffing model was available. It must be remembered that full emergency department staffing is not the norm in most mass gathering events. In their study of the event Fulde et al. note that the majority of the patients came from within the crowd at the crush barrier, nearest the stage. The major categories of injury and illness were asthma, dizziness, hyperventilation, and fractures (1992, pp.821-822). Fulde et al. (1992, p.821) also highlight the fact that there 'is a dearth of accurate documentation of caseloads at mass events or Australian disasters.' This comment is backed up in a review of literature which shows most of the studies have come from reviews carried out in the United Kingdom or the United States.

Webster (1996) has published the only wide ranging mass gathering study in Australia that focuses on New South Wales. The report describes a number of mass gathering events in which the NSW Ambulance Service has been involved. These include the Gay and Lesbian Mardis Gras, Eastern Creek Speedway events and the Papal Tour. Webster identified a number of issues that other authors have not mentioned. These involved practical issues to ensure that medical staff can do their job. These issues included access to the site, catering, toileting facilities and rest areas, as well as extra medical supplies.

The Sydney Division Ambulance experience appears to mirror the findings of other authors discussed in this chapter. Whilst the Webster study is to some extent comparable with the overseas experience, like many other studies discussed in this chapter, it does not explain how the data was collected or coded. This means that from one event to another, different injuries may have been classified in a different manner, and may have been assigned differing levels of seriousness.

2.8 Data collection and coding methods used in past research

In many studies it is not clearly explained how data is collected or what the source of patient information is. Data collected in past research does not appear to have been coded or summarised along any one particular standard. What this means is that in the data collection, and then in the analysis phase, various authors may have classified injuries or illnesses in different ways. The differences in collection and coding mean that it is difficult to make firm comparison between studies.

Whilst it may be easy to code injuries and illnesses as cuts, abrasions, abdominal pain etcetera, the ability to compare between studies and set comprehensive benchmarks and standards is reduced if common standards are not used. This could be one reason why there is such wide variation in reported presentation rates and types of injuries and illnesses seen by medical staff at similar events.

2.9 Conclusion

This chapter has summarised past literature surrounding mass gatherings including planning, staffing and the actual injuries that are occurring at mass gatherings. Each of these issues is important because, as discussed, they are used to ensure adequate numbers of staff as well as an appropriate staff skill mix.

As the chapter demonstrates, there is little research from Australia on mass gatherings with most research coming from either the United Kingdom or the United States. In addition, this chapter has briefly discussed some of the limitations imposed on comparing studies. The limitations include a lack of evidence on how data was collected, as well as how the collected data was coded to derive injury trends. The next chapter discusses the methods of data collection and coding, as well as what standards are currently in place.