THE FEASIBILITY OF IMPROVED DATA COLLECTION METHODOLOGIES FOR SPORTS INJURIES

Project funded by
National Sports Research Centre
and
Victorian Health Promotion Foundation
THE FEASIBILITY OF IMPROVED DATA COLLECTION METHODOLOGIES FOR SPORTS INJURIES

by

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January 1995

Report No. 69

ISBN 0 7326 0069 3
Title and sub-title:
The feasibility of improved data collection methodologies for sports injuries

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Type of Report & Period Covered:
General, 1989-1994

Sponsoring Organisation(s):
National Sports Research Program, Australian Sports Commission
Victorian Health Promotion Foundation

Abstract:
Sports and recreational injuries are a cost burden on both individuals and society with respect to the duration and nature of treatment, the amount of sports and working time lost, permanent damage and disability, reduced quality of life and monetary costs. Their prevention must be a major public health goal. Whilst there has been an increased awareness of the occurrence of sports injuries, and some successful countermeasures have been used to prevent a limited number of such injuries, the picture in Australia remains fragmented. In particular, there is a lack of data about the circumstances of injury and potential points of intervention in the chain of events leading to injury. Furthermore, comprehensive information on participation rates and player hours is needed to determine the relative risks of injury in various sports and to target interventions.

Given a framework for injury prevention, it is important that a system of sports injury surveillance is developed. The current lack of clear, coherent and relevant data for Australia makes this a priority. This report therefore provides the results of a feasibility study of improved data collection methodologies for sports injuries for Australia.

This study summarises the existing data collections that provide information on sports injuries within Australia and overseas, including their limitations. The results of a survey of key sports and other relevant professional bodies are also presented to describe the current barriers to sports injury data collections. Together, these form the basis for determining the feasibility of establishing improved data collection methodologies for sports injury in Australia.

Recommendations include the identification of a lead agency, collaboration between the health and sports sectors, increased involvement of sports bodies in data collection activities, provision of infrastructure support for these activities, enhancement of government data collections, development of standardised data collection procedures and coding systems and improved training.

Key Words:
injury, data collection, surveillance, sport, recreation, sports participation

Disclaimer:
This report is disseminated in the interests of information exchange. The views expressed are those of the authors, and not necessarily those of Monash University.
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This project would not have been so successful without the high level of enthusiasm and support for the project from all of the sports bodies consulted. The authors would like to give particular thanks to all respondents to the study survey.

Terry Sanders is thanked for arranging for the authors to present the project at a Sports Medicine Australia Council meeting.

The assistance and advice provided by the Project Advisory Committee members is acknowledged with thanks. The Committee members were:

- Dr Peter Brukner, Olympic Park Sports Medicine Centre
- Mr Peter Bunter, Department of Health and Community Service, Victoria
- Ms Kay Copeland, Sports Medicine Australia, Victorian Branch
- Ms Anne-Marie Harrison, VICSPORT
- Ms Donna Harvey, National Sports Research Centre
- Prof Bill Morrison, Victoria Institute of Technology
- Mr Ron Pengelly, Sport and Recreation Victoria
- Assoc Prof Terry Nolan, Royal Children's Hospital
- Prof Hugh Taylor, Royal Victorian Eye and Ear Hospital
- Mr Peter Thompson, VicHealth

The authors would also like to thank Irene Brumen for performing the data management and analysis of the results of the postal survey and to Giulietta Valuri for assistance with the analysis and collation of the injury surveillance system data. The National Injury Surveillance Unit, particularly John Oolinas, is thanked for providing the Australia-wide data from emergency department presentations. Dr John Langley, from the Injury Prevention Research Unit in New Zealand, provided the New Zealand injury data.

Prof Peter Vulcan (MUARC), Assoc Prof Terry Nolan (Royal Children's Hospital), Kay Copeland (Sports Medicine Australia, Victorian Branch), Terry Sanders (Sports Medicine Australia) and Ian Smith (Department of the Environment, Sport and Territories) are thanked for their particularly useful comments on the report.
EXECUTIVE SUMMARY

1 INTRODUCTION

The Monash University Accident Research Centre was funded by the Australian Sports Commission and the Victorian Health Promotion Foundation to undertake a feasibility study of establishing improved data collection methodologies for sports injury in Australia. This report presents the results of this feasibility study.

2 RATIONALE

Sports and recreational injuries are a cost burden on both individuals and society with respect to the duration and nature of treatment, the amount of sports and working time lost, permanent damage and disability, reduced quality of life and monetary costs. Their prevention must be a major public health goal.

Whilst there has been an increased awareness of the occurrence of sports injuries, and some successful countermeasures have been used to prevent a limited number of such injuries, the picture in Australia remains fragmented. In particular, there is a lack of data about the circumstances of injury and potential points of intervention in the chain of events leading to injury. Furthermore, comprehensive information on participation rates and player hours is needed to determine the relative risks of injury in various sports and to target interventions.

Given a framework for injury prevention, it is important that a system of sports injury surveillance is developed. The current lack of clear, coherent and relevant data for Australia makes this a priority. This report provides the results of a feasibility study of improved data collection methodologies for sports injuries for Australia.

3 PROJECT AIMS

- To determine the feasibility of establishing improved data collection methodologies for sports injury in Australia.
- To identify currently available collections of sports injury and sports participation data.
- To provide a summary of the existing data collections that provide information on sports injuries within Australia and overseas, including their limitations.
- To make recommendations on the development of prioritised models for the implementation of sports injury data collection methodologies.

4 METHODS

- Wide consultation with key sports bodies and sports medicine professionals.
- A survey of over 100 key sporting and sports medicine organisations and individuals in Australia.
- A review of the international literature and relevant conference papers.
- Determination of the availability and quality of existing databases in Australia.
• Analyses of existing data from Victoria to provide an example of the usefulness of these in describing the sports injury problem.
• Discussions with relevant authorities to determine the status quo and potential for improvements to current data collection systems and the development of new systems.
• Involvement of sporting and sports medicine organisations in the project to ensure "ownership" and commitment to the outcomes of the project.

5 SPORTS INJURY AS A PUBLIC HEALTH PROBLEM

Data about the incidence of sports injuries and the factors associated with their occurrence is important for a number of reasons:

• It is critical for sports injury prevention research.
• To identify potential points of intervention in the chain of events leading to injury.
• It helps to identify priority areas for research in terms of particular sports and levels of participation.
• It provides the basic information needed to inform the conduct of injury prevention activities and research across the broad spectrum of sports medicine disciplines.
• To determine priorities for prevention activities.
• To evaluate the effectiveness of interventions to prevent injuries.
• For the planning of medical coverage of sports events.
• As the basis for planning of resources needed to treat and manage injuries.
• As the basis of mass education campaigns and specific sports injury prevention training programs.
• For sports bodies to demonstrate their commitment towards providing a safe sports environment for their participants.

Unfortunately, the current situation is very limited with regard to information about the incidence and factors associated with sport injuries in Australia. The success of any injury surveillance system and its wide-scale applicability is dependent upon valid and reliable definitions of sports injury, injury severity and sports participation. A number of possible definitions are discussed in Chapter 2.

6 INJURY SURVEILLANCE

Injury surveillance is the ongoing systematic collection, analysis and interpretation of health data needed to plan, implement and evaluate public health programs. One of the major problems with sports injury surveillance in Australia is that a broad range of personnel is involved at the range of places where injured sports participants present for treatment. An injury surveillance system implemented in Australia therefore needs to be as simple as possible and designed specifically for a range of health professionals and community participants.

A sports injury surveillance system should collect information about the epidemiology of sports injuries and their outcomes in a form that is of relevance across a broad range of potential users of the data: sports participants themselves, sports administrators, sports
bodies, coaches, trainers, sports physicians, sports medicine professionals, government, industry, researchers, media, sports equipment manufacturers, etc.

7 SPORTS INJURY DATA SOURCES

The following data collections have been identified as potential sources of sports injury data:

- Hospital-based data collections (admissions and presentations to emergency departments)
- Mortality data collections (Coroners’ records and ABS data)
- Sports medicine clinics
- Medical coverage services
- Sports-based injury surveillance systems
- Sporting-body data collections
- Special purpose surveillance systems - event specific
- School-based surveillance
- Workers compensation statistics
- Insurance records
- Community surveys
- Population-based surveillance
- Longitudinal studies of athletes and sports participants
- Surveys of sports participants.

Chapters 6 and 7 describe these databases, including their limitations, in detail.

8 SPORTS PARTICIPATION DATA

The data sources that contain information about the numbers and types of sports participants include:

- Surveys of physical activity levels in the Australian population
- Australian Bureau of Statistics data collections, including the National Health Survey
- Market research surveys
- The statistical framework for Australia
- Sport-specific databases
- State Department of Sport and Recreation specialist collections
- Research studies
- The Australian Coaching Council Database
- Sports Medicine Australia database of accredited Sports Trainers

These data sources are discussed in detail in Chapter 8.
9 INFORMATION AND INFRASTRUCTURE PRE-REQUISITES FOR SPORTS INJURY PREVENTION

Both an information and an infrastructure framework are necessary to effectively progress sports injury prevention. Improved data collection methodologies are an integral part of this. The broad information and infrastructure needs are outlined below.

9.1 Infrastructure needs

A lead agency, or agencies, at the National and State levels is needed to prioritise sports injury research needs and, where appropriate, to fund and commission such research. It is likely that the identified lead agency or agencies will not have all of the expertise needed to assess the current research activities or to prioritise them. Sports injury prevention advisory groups should be established within each state and nationally to provide advice and guidance, when needed, to these lead agencies. The functions of a lead agency, or agencies, could include:

• Co-ordination of data collection, research and prevention activities.
• Setting priorities for future activities.
• Policy development
• Establishing and maintaining networks and communication across the full range of sports bodies, sports medicine professionals and injury prevention experts.
• Training of appropriate professionals in the principles and practices of sports injury prevention.
• Provision of funding for injury research and coordination of these activities.
• Provision of funding for injury prevention activities by sports associations.
• Acting as a clearinghouse for sports injury prevention information.
• Consideration of the role of levies, sponsorships, government funding, and sports industry backing for injury prevention activities.

It should be noted that a serious commitment to data collection and sports injury prevention would involve considerable financial support.

9.1 Sports injury and participation data needs

• Overview information about the size and nature of the injury problem.
• Both baseline and ongoing injury data.
• Participation data.
• Information about the long term sequelae of sports and recreational injury.

9.2 Injury prevention strategy needs

• Information on the full range of available countermeasures (interventions).
• Information on the full range of available countermeasure implementation strategies.
• Information about treatment and rehabilitation methods.
• The cost of sports and recreational injury and cost/benefit ratios for implemented countermeasures.

9.3 Research needs to progress injury prevention activities

• Literature reviews
• Data collection activities
• Biomechanical studies
• Epidemiological studies
• Evaluation studies
• Biomedical and basic scientific studies

10 PROPOSED FRAMEWORK FOR SPORTS AND RECREATIONAL INJURY DATA COLLECTION

The feasibility of proposing a fully defined data collection methodology at this time is limited by the general lack of sufficient development to date in sports injury data systems. However, recommendations have been suggested and developed which would vastly improve the current status of data collections.

Based on the identified potential data sources across a range of levels of sporting activities as well as an injury prevention perspective, the most likely framework for sports injury data collection activities in the short term is a composite of Coronial, health sector (expanded and enhanced), sport and recreation department (participation data) and special collections from sporting bodies, sports medicine professionals, medical coverage services and local communities. For the most part, the framework necessarily collects injury and participation data from separate sources. State and national level data is necessary to maintain a perspective on the broader sports injury picture and for relative risk determination of identified factors relating to injury occurrence. On the other hand, time-limited studies will be useful in the short term for the directing of immediate preventive actions and for identifying preventive strategies.

The proposed framework for sports injury data collections in Australia is shown below:

Components of a sports injury data collection framework for Australia

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<th>SPECIFIC AND TARGETED SURVEILLANCE</th>
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<td>Continuous</td>
<td>Periodic sampling schemes</td>
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<td>cover some levels of participation</td>
<td>Specific studies</td>
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This framework is developed fully in Chapter 10.

10.1 Ongoing overview surveillance

Ongoing overview injury monitoring could be achieved by three methods:

1. *Continuous collections to cover all levels of participation*
   - Hospital admissions data
   - Emergency department presentations (continuous at the state level but national sampling)
   - Coronial data
   - Spinal injury register.

2. *Continuous collections to cover some levels of participation*
   - Australian Sports Commission Data
   - Sports medicine clinics
   - The Australian and state Institutes of sport
   - National Sporting organisations
   - Government Departments of Sport and Recreation
   - Insurance records
   - SMA Sports Trainers

3. *Periodic sampling schemes*
   - Regular updates of the numbers of registered sports participants
   - ABS surveys
   - Community surveys.

10.2 Specific and targeted surveillance

Specific and targeted surveillance activities to guide and support injury prevention activities could include:

1. *Time-limited studies*
   - Government Departments of Sport and Recreation specialist collections
   - Sports medicine clinic specialist studies
   - General practitioner data collections
   - SMA medical coverage of sporting events
   - Community-wide surveys of sports participation and injury occurrence
   - State and local sporting clubs and associations.
2. **Specific studies**
   - Commissioned by Government Departments of Sport and Recreation
   - Sports medicine clinic studies
   - State and local sporting clubs and associations
   - Surveys of participants of specific sports or activities
   - Longitudinal follow-up of particular clubs or teams or groups of participants.

11 **GENERAL RECOMMENDATIONS**

Before the framework described in the previous section can be further developed and implemented the following general recommendations need to be addressed:

1. It is essential that both the sports and the health sectors take joint responsibility for sports safety.

2. It is essential that government departments of sport and recreation recognise sports injury as integrally related to sports participation.

3. Government Departments of Sport and Recreation should:
   a) give consideration to collecting data on sports injury at the same time as collection of sports participation data (through surveys, etc.).
   b) give serious consideration to providing funding to sports bodies to encourage their involvement in sports injury prevention activities and sports injury surveillance activities.
   c) give serious consideration to providing funding for sports injury research projects that enhance sports bodies' capacities for injury prevention activities.
   d) should consider establishing a requirement of all sports bodies they fund to provide evidence of participation in sports injury surveillance and prevention activities.

4. Sports bodies should be encouraged to endorse the sports injury strategies contained within the National Health Goals and Targets and implement strategies to address these.

5. Incentive funding should be provided to sports bodies to collect information about sports injury and to establish links with prevention programs at the time of their development, where possible.

6. Direct funding towards non-elite and community level sports injury prevention through a central body - possibly a new focus for the Australian Sports Commission. Funding also needs to be directed towards research, implementation and evaluation approaches.

7. Establish a clearing house for sports injury prevention information.

12 **Specific Data Collection Recommendations**

Specific data recommendations are needed to further develop the above framework:
1. **Establish a lead agency or agencies**

- Identify and establish a lead agency, or agencies, to oversee data collection developments over a five year time-frame.
- Establish a national sports injury surveillance advisory committee.
- Develop a work-plan within an appropriate lead agency, or agencies, to regularly report on sports injury data to the extent possible.

2. **Involve sports bodies**

- Involve sports bodies more directly in data collection activities.
- Trial specific sports association based injury and participation data collections to determine the rate, severity and nature of injuries for particular sports. Also to determine whether this is an appropriate method for obtaining baseline injury rates for ongoing intervention and evaluation studies.
- Support the development of demonstration models of "best practice" for sports bodies to follow.

3. **Enhance Government collections and data collection activities**

- The Commonwealth Department of Community Services and Health and DEST should support the recommendation that sports participation data be collected within the UNESCO Framework for Cultural Statistics.
- Enhance Commonwealth DEST and ABS participation data collections by:
  a) including children
  b) conducting state surveys to supplement the national surveys
  c) collecting injury data in addition to participation data in all remaining quarterly surveys to provide useful numbers. It needs to be recognised, however, that this will still be limited because of small numbers of participants by seasonal sports.
- Future National Health Surveys should collect risk factor data for injury, including sports and recreational injury.

4. **Develop standardised data collection procedures**

- Develop compatible and standardised injury data collection forms across a range of sports. These should incorporate the National Minimum Dataset (Injury Surveillance) specifications, together with agreed demographic data and other sports-specific agreed items.
- Develop associated coding, data entry and analysis software.
- Include a facility for the insertion of modules for specific time-limited studies in electronic data collection programs.
5. **Agree on standardised coding systems and definitions**

- Introduce electronic collection of sports and recreation injury data routinely in hospital emergency departments using the NMDS(IS) and negotiate second level sports injury data collections in at least some hospital emergency departments.
- Improve hospital admission injury mechanism coding through expansion and implementation nationally of ICD 9 CM or ICD 10 sports and recreation codes. For example, these could be adapted from the NSW Health Department’s sport codes.
- Co-ordinate the Orchard system and other sports injury coding schemes with the National Minimum Data Set (Injury Surveillance).
- A workshop to reach agreed national and/or international definitions of sports and recreational injury, sports participation, injury severity, etc. should be conducted. There could be the opportunity to do this during the Third International Conference on Injury Prevention and Control to be held in Melbourne in February 1996.

6. **Collation of information**

- Monitor overseas developments in sports injury surveillance.
- Develop methods for the quality control, centralisation and interpretation of data from different sources.
- Link computerised emergency department and hospital admission data to provide comprehensive sports injury data, including direct costs of treatment.

7. **Establish new data collections**

- Develop an integrated register of fatalities and other catastrophic injuries (including spinal and severe head injury).
- Collect general practice and sports clinic data to develop multipliers for ongoing health sector data collections and to provide estimates of the total numbers and range of sports injuries presenting to the health sector (together with hospital emergency department presentations and admissions) by sport and nature and circumstances of injury.
- Conduct community surveys of sports and recreational injury for defined populations, where health sector data at all levels of severity are potentially available (e.g. Latrobe Valley).
- Conduct epidemiological studies of existing data for at least one state (Vic) to assess the utility of current information for enumeration, targeting and monitoring interventions, etc.

8. **Training**

- Develop a training module on the methods and functions of data collections for incorporation into coaching and sports trainers courses including those leading to re-accreditation.
13 INVOLVING SPORTS IN DATA COLLECTION ACTIVITIES

The success of implementing any improved methodology for sports injury data collections will be dependent upon the active participation and co-operation of sporting bodies. It is vital to include sports organisations from the grass roots level upwards in any surveillance activities. For many sports, a major cultural change is necessary to encourage them to participate in specific injury prevention and data collection activities. For others, the sporting bodies are willing to participate in these activities but are seeking guidance on how this could be done.

Some pressure would need to be applied to encourage sports to participate in data collection activities. Rather than a dictatorial approach, or one that is tied to funding, models of good performance could be promoted and performance agreements developed. Alternatively a 5-medal accreditation scheme could be developed through the lead agency, or agencies, to encourage the sports themselves to take leadership.

14 TIME FRAME AND PRIORITIES FOR ACTION

A five year time frame is proposed for the implementation of the above recommendations and to conduct a program of sports injury prevention research, which will provide a firm basis for sport and recreational injury reductions leading to the year 2000 and beyond (Chapter 10).

15 CONCLUSIONS

It is confirmed from this study that information on sports injury in Australia is currently fragmented. However, sufficient information is available to begin to actively address injury prevention in some sport and recreational activities. With our current knowledge base, it is also possible to identify a systematic and strategic approach to substantially increase the potential for both prevention and reduction in severity of sports and recreational injury. Programs will be greatly enhanced by the implementation of improved data collection methodologies and the active involvement of sports bodies.
CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

The promotion of sports and recreational safety has been identified as a key public health issue in several reports [Egger, 1990; Egger, 1991], the Australian National Health Goals and Targets [Nutbeam et al., 1993] and the 1994 Victorian Injury Control Strategy [H&CS, 1994]. Sports injuries are a cost burden on both individuals and society with respect to the duration and nature of treatment, the amount of sports and working time lost, permanent damage and disability, reduced quality of life and monetary costs [Avery et al., 1990]. Their prevention must be recognised as a major public health goal.

Whilst there has been an increased awareness of the occurrence of sports injuries, and some successful countermeasures have been used to prevent a limited number of such injuries, the picture in Australia remains fragmented [Ozanne-Smith et al., 1994]. Where sports-based information does exist, it tends to relate primarily to elite players. Little systematic epidemiological research on sports injury in Australia has been published. In particular, there is a lack of data on the circumstances of injury and potential points of intervention in the chain of events leading to injury. This sort of information has been shown to be essential for the prevention of other types of injury, e.g. road trauma. Furthermore, comprehensive information on participation rates and player hours is needed to determine the relative risks of injury in various sports and to target interventions.

- The Australian National Health Goals and Targets [Nutbeam et al., 1993] include specific issues relating to sport and recreational activities including targets to:
  - Increase the information available on the risk of injury associated with sport and recreation.
  - Decrease the rate of attendance at emergency departments for sports injury.
  - Reduce the rate of attendance at emergency departments for sports-related eye and dental injuries.
  - Reduce the rate of hospital admissions for head injuries associated with horse activity.

Following the release of the National Health Goals and Targets document in 1993, injury prevention has been further developed as a priority public health area. In May 1994, the Commonwealth Department of Human Services and Health held an Injury Control Seminar to seek input into the National Injury Prevention and Control Implementation Strategy. Representatives from the sports and recreation and health sectors were invited to contribute towards the development of the strategy for sports and recreational injury. The national sport and recreational injury prevention strategy includes specific targets to:

- Increase the information available on the risk of injury associated with sport and recreation.
- Decrease the rate of attendance at emergency departments for sports injury.
- Increase the proportion of participants in appropriate sport and recreational activities who wear protective equipment.

The national sports injury prevention strategy also acknowledges that little is known about the detailed epidemiology of sports injuries in Australia and that without this knowledge, effective public health strategies for sports safety education and promotion will be limited.
Similar strategies have been, or are being, developed on a state basis throughout Australia. For example, the sports and recreation injury strategy for Victoria was released as part of the wider Victorian injury prevention strategy "Taking Injury Prevention Forward" in September [H&CS, 1994].

The limited information available on the incidence of sports injuries in Victoria indicates that sport is a common context for injury [Routley, 1991; Routley & Ozanne-Smith, 1991; Langlois et al., 1992; Watt, 1992; Routley & Valuri J, 1993; Ozanne-Smith et al., 1994; Watt & Ozanne-Smith, 1994]. Sports injuries in children aged 10-14 years are the highest cause of injury-related attendance at emergency departments [Ozanne-Smith et al., 1994]. Sports injuries are often moderately severe and account for more than 12% of hospital admissions for unintentional injury amongst 10-29 year olds each year [Watt, 1992]. According to ICD 9 E-coded hospital admission data for Victoria over the period 1986-1991, there were 11,255 admissions because of a sports injury [Langlois et al., 1992]. The average rate of sports injury hospitalisation over this same period was 54.2/100,000 population [Langlois et al., 1992]. These figures are clearly an underestimate of the true magnitude of the health burden of sports injuries because they are based solely on hospital admission data and do not reflect non-hospitalised cases of injury. In addition, the ICD system provides limited scope for the coding of sports injuries and such injuries are often coded under categories where they cannot be identified as being sports-related.

The goal of sports injury prevention must generally be to reduce the incidence of injury without changing the essential nature or appeal of a sport. Experience has shown that many injuries can be prevented by the adoption of appropriate countermeasures such as adequate adult supervision of sport (for children); enforcement or modification of game procedures and rules; the use of protective equipment or clothing; modification of equipment or sporting environments; changing training and preparation practices; or by updating coach/trainer education [van Mechelen et al., 1992; McMahon et al., 1993; Stanitski, 1989].

As stated by Jones [1989] in the context of eye protection during sports "each sport has different requirements for protection, but all have in common the need to take reasonable steps to prevent ... injury". Any preventive approach should begin with the monitoring of the incidence of different types of injuries to obtain data on their variety, severity, associated risk factors and any trends over time [van Mechelen et al., 1992]. In other words, preventive action should be based on the results of epidemiological research and injury surveillance. It is only when this is coupled with research into the biomechanics of sports injuries that information will be available for making sound decisions as to whether alteration of game procedures or rules, modification of equipment, use of protective wear or changing training and preparation practices is likely to be the most effective in reducing injuries for a particular sport or activity [Taunton et al., 1988].

Van Mechelen and colleagues have described the prevention of sports injuries by a four-stage process [van Mechelen et al., 1992]:

- Identification and description of the nature and extent of the problem.
- Identification of factors and mechanisms involved in their occurrence.
- Introduction of measures for reducing future risk and/or severity.
- Evaluation of interventions.

The success of such an approach relies on both an effective sports injury surveillance system and epidemiological studies of aetiological factors that influence the occurrence of sports injuries. Given this framework of injury prevention, it is important that a system of
sports injury surveillance is developed. The lack of clear, coherent and relevant data for Australia makes this a priority.

In 1992, the Victorian Health Promotion Foundation established a Sports Safety Promotion Working Party. This culminated in a number of workshops on sports safety promotion to address and explore possible initiatives that would significantly contribute to a reduction in sports injuries in Victoria. These workshops have had high level representation from a wide variety of professional organisations with a direct interest in sports and sports injuries. They have also highlighted major concerns with the inadequacy of current data on sports safety and injury prevention, in general, and injury incidence and health service patterns, in particular.

The Victorian Health Promotion Foundation Working Party has also identified the need to examine the feasibility of establishing improved data collection methodologies for sports injury to provide sports injury surveillance. Similarly, the Australian Sports Commission's National Sports Research Centre has identified injury surveillance as a priority area requiring immediate attention and funding under the Applied Sports Research Program.

This report provides the results of a feasibility study of improved methodologies for a sports injury surveillance system for Australia, with a large focus on Victoria. The study was jointly funded by the Applied Sports Research Program (Australian Sports Commission) and the Victorian Health Promotion Foundation.

1.2 PROJECT AIMS

The aims of this feasibility study are to:

- Determine the feasibility of establishing improved data collection methodologies for sports injury in Australia.
- Identify currently available collections of sports injury and sports participation data.
- Provide a summary of existing injury surveillance systems that provide data on sports injuries within Australia and overseas, including their limitations.
- Make recommendations for the development of a prioritised model for the implementation of sports injury data collection methodologies.

The methodology used to achieve these aims included:

- Wide consultation with sports bodies and sports medicine professionals.
- A survey of key sporting and sports medicine organisations in Australia.
- Systematic review of the international literature and papers presented at relevant conferences describing sports injury surveillance.
- Determination of the availability and quality of existing databases in all states and territories including specific purpose data collections, sentinel sports injury clinic data collections and data collected by sports bodies and associations.
- Analyses of existing data from Victoria to provide an example of the usefulness of these in describing the sports injury problem.
- Discussions with relevant authorities in each state and territory to determine the status quo and potential for improvements to current data collection systems, or the
development of new systems. These authorities included representatives from the sports, health and education sectors and other interested bodies in each state and territory.

- Involvement of sporting and sports medicine organisations in the project to ensure "ownership" and commitment to the outcomes of the project.

1.3 ABOUT THIS REPORT

This report begins by establishing the sports and recreational injury problem as a major public health issue (Chapter 2). This sets the scene for developing an approach to injury surveillance based on existing models and data structures. The success of any injury surveillance system and its wide-scale applicability is dependent upon valid and reliable definitions of sports injury, injury severity and sports participation. Chapter 2 also introduces some of the definitional issues that need to be considered before any systematic data collection on sports injury can be established.

The ongoing collection of data describing the occurrence of, and factors associated with, injury is known as injury surveillance. Chapter 3 discusses the general principles of injury surveillance systems, including their optimal properties. Chapter 4 provides a literature review of published sports injury surveillance systems. This will assist in extending the relevant experiences from overseas to the Australian setting, where appropriate.

Consultation across a broad range of sporting bodies and sports medicine health professionals was a major component of this project. Chapter 5 describes this consultation process and summarises the needs for injury surveillance systems as identified through this consultative process.

This consultative process was also useful for identifying current sport injury and sport participation data collections within Australia. These are described in some detail in Chapters 6-8. Other major current Australian data collections are also described in detail. Chapter 6, in particular, shows how existing hospital-based data collections can be used to describe the sports injury problem in Australia.

A summary of the findings of Chapters 2-8 is given in Chapter 9. Finally, Chapter 10 draws together the main findings of the consultative process about data collection needs and current practices and makes some key recommendations for future directions.
CHAPTER 2: SPORTS INJURY DATA ISSUES

2.1 SPORTS INJURY AS A PUBLIC HEALTH PROBLEM

Whilst there has been an increased awareness of the occurrence of sports injuries, and some successful countermeasures have been used to prevent a limited number of such injuries, the picture in Australia remains fragmented [Ozanne-Smith et al., 1994]. Recognising this lack of data for head and neck injuries in the football codes, an NH&MRC Expert Panel has recently called for standardised injury surveillance of these injuries [NH&MRC, 1994]. However, there is a wider need to establish a sports injury surveillance system in Australia across a range of sports and levels of play. The extent to which this is possible and practicable is the subject of this report. The first step towards injury surveillance is to establish a standardised injury surveillance and data collection methodology.

Sports injuries are a cost burden on both individuals and society with respect to the duration and nature of treatment, the amount of sports and working time lost, permanent damage and disability, reduced quality of life and monetary costs [Avery et al., 1990]. Their prevention must be a major public health goal. As awareness of the financial and community costs has grown, there has been an increasing concern about the incidence of sports injuries in Australia [Ozanne-Smith et al., 1994]. On the basis of a report to the Better Health Commission, Egger concluded that sports injuries result in direct and indirect costs totalling $1 billion annually. Egger also estimated that 1 million sports injuries occur each year and extrapolated this to a sports injury occurring in 1/17 Australians annually [Egger, 1990]. Fong [1994] has recently estimated that the annual cost of sports-related eye injuries, alone, in Australia is approximately $28 million.

Participation in sports and exercise activities is promoted for a number of reasons [Australian Sports Commission, 1993; Ross & Gidlow, 1994; Skinner, 1994]:

- The development of skills such as coordination, balance, etc.
- The acquiring of socialisation skills.
- Exercise and participation in sport is good for general health and stress relief.
- Enjoyment of participating in sports and exercise activities.
- Participation in some form of physical activity promotes a sense of well-being and belonging.
- Exercise contributes to the prevention of many chronic non-communicable disease such as heart disease, adult-onset diabetes and some cancers.
- National Health Goals and Targets for cardiovascular disease and cancer promote the benefits of participation in some form of physical activity.

However, increased participation in sports and recreational activities increases the exposure to the hazards and risk factors associated with the occurrence of sports injuries. As more people participate in such activities, it can be expected that the number of injuries associated with them also has the potential to increase. The benefits of participating in sport or active recreation therefore need to be weighed up against the risk of severe injury [Nicholl et al., 1991]. A surveillance system is needed to allow the analysis of sport-related injury trends over time to demonstrate whether an increased participation in sports and other activities is accompanied by a change in the patterns of injury [Tenvergert, 1992].
Sports injuries are a major public health problem. Whilst they are incurred during activities generally governed by the sports and recreational industry and government sectors, the costs are largely borne by the health sector. The types of costs associated with sports injuries are summarised below:

- Duration and nature of treatment.
- Time lost from sports.
- Working time lost.
- Permanent damage and disability.
- Reduced quality of life.
- Monetary costs.
- Sports non-participation.

The health and other benefits of exercise and the costs of associated injury with increasing exposure need to be assessed in terms of a cost-benefit approach [Avery et al., 1990; LaPorte et al., 1993; Ross & Gidlow, 1994]. For example, the benefits of the promotion of exercise for the prevention of conditions such as cancer, cardiovascular disease and diabetes need to be weighed up against potential injury risks. It seems inevitable that health promotion activities in this country will change their focus to the promotion of "safe activity" in the not too distant future. For this reason, the extent of the sports injury problem calls for preventive action based on the results of epidemiological research since such promotion activities call for a strong scientific and medical basis.

Data collection activities are needed to identify the incidence and prevalence of injury within specific sports and across a range of sports. These should include the collection of information about [Jones, 1989]:

- The type of injuries incurred.
- The severity of the injuries and their consequences.
- Identified risk factors with in sports.
- Time changes in the incidence of injury.

### 2.2 SPORTS INJURY DATA SOURCES

Data on the incidence of sports injuries is important for a number of reasons:

- It is critical for sports injury prevention research.
- For identifying priority areas for research in terms of particular sports and levels of participation.
- It provides the basic information needed to inform the conduct of research across the broad spectrum of sports medicine disciplines.
- For evaluating the effectiveness of interventions such as the use of protective helmets or introduction of modified rules.
- For determining priorities for prevention activities including specific sports, activities or groups of participants.
- For planning medical coverage of sports events.
- As the basis for the planning of resources needed to treat and manage injuries.
• As the basis of mass education campaigns and specific sports injury prevention training programs.
• For sports bodies to demonstrate their commitment towards providing a safe sports environment for their participants.

Generally, the best place to obtain information about the nature of, and factors surrounding, an injury is from the place of treatment. This is consistent with injury as a public health issue with the costs largely borne by the health sector. Many of the existing data sources are therefore based on hospital data collections since many injured people receive treatment there.

It is generally the case, however, that the availability of injury data is in direct proportion to injury severity and in inverse proportion to case frequency [Harrison, 1994]. This means that considerable information about the relatively severe injuries that result in death or hospital admissions can be obtained but even these data are considerably limited (see Chapter 6). Much less is available about injuries that do not result in hospital admission.

When describing injury as a public health issue, injury prevention professionals often refer to an injury pyramid such as the one shown figure 2.1 [Smith, 1991; Harrison, 1994]. This pyramid has three levels to represent where most of the data about the injuries is available from. The top of the pyramid represents the most severe injuries, namely those that result in death. However, this group of injuries is also the least frequent. As the pyramid widens towards its base, the injuries tend to become less severe (in the medical sense) but more common. Thus injury severity in this pyramid is equated with the source of treatment, with injuries resulting in hospital admissions considered to be more severe than those receiving care at an emergency department. Including community-based primary care in the pyramid would be more representative of the incidence of injuries than the simple injury pyramid shown in figure 2.1. However, it is often not included because data is not widely available from that level of the health sector.

![Figure 2.1: A simple injury pyramid](image)

Data is widely available across a broad range of injuries at all levels of this pyramid. The data is most complete for injuries at the high severity, low frequency end. This injury pyramid has been shown to be a very useful model across a number of broad injury categories such as road trauma and injuries in the home.
The pyramid shown in figure 2.1, however, has limited value for sports injuries because a large proportion of sports injuries do not present to a hospital for treatment. Furthermore, there is no reliable data currently available to estimate exactly what proportion of sports injuries do go to a hospital emergency department for treatment compared with those that present elsewhere out of the hospital system. This means that, by focusing on injuries covered by the above injury pyramid alone, the actual level of under ascertainment of the sports injury problem is unknown.

A sports injury pyramid is shown in figure 2.2. The top segment of this pyramid is the same as that shown in figure 2.1 but the base has been expanded to cover the full range of sports medicine professionals involved in the diagnosis, treatment and management of sports injuries. Once again, the injury data availability is approximately in direct proportion to injury severity (as indicated by the source of treatment) and approximately inversely proportional to injury frequency. For example, there is generally more information available about the range of sports injuries treated by physiotherapists, particularly at specialist sports medicine clinics, than there is about cases attending a general practitioner.

Unfortunately, on a national, community-based level, the only systematic information currently available about sports injuries is from the top three levels of this pyramid. This data and its coverage are described further in Chapters 6 and 7.

It is important that sports injury surveillance is begun at some of the lower levels within this pyramid so that information about injuries across a range of severity levels is obtained. This will provide a more complete picture of the magnitude and nature of the sports injury problem in Australia. This is complicated for sports injuries where a range of treatment sources is utilised including sports medicine clinics, general practitioners, physiotherapists, masseurs, podiatrists, first aiders, etc.

Watson [1993] has stated that “failure to examine the consequences of the clinically less serious types of sports injuries may result in a significant underestimate of the true
incidence of injury in sport and the problems they cause to participants". He argued that injuries that limit the performance of sports participants in their usual training or competing performance are often of great significance to athletes and their coaches. A focus on a purely medical definition of a sport injury and its severity therefore ignores the cost of the injury to the athletes themselves. An injury surveillance system therefore needs to collect information at this lower level of medical severity to fully quantify all costs associated with the sports injury.

In Australia, this sort of data collection may be able to be facilitated by sports trainers, coaches or other community participants. Brukner [1994] has also highlighted that one of the major problems with data collection on sports injuries in Australia is that a broad range of personnel is involved at the range of places where injured sports participants present for treatment. These could include hospital emergency departments, sports physicians, general practices, sports medicine centres, physiotherapists, sports trainers, etc. For this reason, any injury surveillance system implemented in Australia needs to be as simple as possible and designed specifically with a range of health professionals and community participants in mind.

2.3 DEFINITIONAL ISSUES

Considerable attention needs to be paid towards the definition of both risk and exposure factors since the validity and usefulness of the outcomes of research activities, data collection and surveillance systems rely on these. It is important to realise that the definition of a sports injury may vary according to the source of the data e.g. injuries treated at a hospital, injuries treated on field or injuries that lead to insurance claims. For this reason, it may be necessary to adopt different definitions for different surveillance purposes.

Stanitski [1988] has noted that published sports injury reports are often difficult to interpret because there are significant flaws in either the collection or the analysis of the epidemiological data. Standardised data collection methodologies would do much to improve the comparability and interpretation of published data. The areas which Stanitski [1988] considers to be particularly badly documented include:

- The definition of injury.
- Measures of severity.
- Identification of the population at risk.
- Degree of exposure.

Standardised definitions are needed when different sports activities are to be compared or when data from a number of different sources about a given sport are to be collated. For example, Pelletier et al. [1993] have assessed the lack of agreement on the definitions of terms and consistent reporting strategies across different data sources for Canadian intercollegiate ice hockey injuries. These authors have concluded that the differences in the reported injury rates can be attributed to three major factors:

- The relative risk of the injuries.
- The lack of a uniform definition of a reportable injury.
- The validity of the data recording mechanisms.

It is important that specific definitions are agreed upon before injury surveillance is established.
2.3.1 Sport versus recreational activity

When talking about monitoring the occurrence of sports injuries we need to begin by defining what is sport. The Australian Sports Commission (1994) has defined sport to be:

"a human activity capable of achieving a result requiring physical exertion and/or physical skill which by its very nature and organisation is competitive and is generally accepted as being sport."

However, in the community-wide context, this definition has severe limitations in that many participants play "sport" that is:

- Non competitive in nature and social
- Unorganised
- An informal activity
- General physical activity
- An adventure recreational activity.

The National Sports and Recreation Industry Statistical Framework currently being prepared for the Sports and Recreation Ministers Council, plans to develop comprehensive statistics for the sports and recreation categories "organised sport", "active recreation" and "amusement and passive recreation" to overcome some of these problems (Brokensha, 1994a).

LaPorte and colleagues (1993) preferred to use a broad definition of a sport or recreation-related injury and defined it to be any type of injury associated with increased voluntary physical activity that is not occupationally related. Whilst this is an appropriate definition for community-level sport, it appears to exclude sporting activities by professionals who would consider their activity as their occupation.

Sporting activities can also be defined by where they occur, such as in an area for organised sports. However, it is also important to realise that sports and recreational related injuries also occur in other locations such as:

- Areas for transport (e.g. bicycling, horse riding, roller-blading, etc.).
- Areas for general recreation (e.g. ball activities, skateboarding, etc.).
- At home (e.g. general sporting activity, particularly amongst children, etc.).
- School playgrounds or gymnasiums (e.g. school sport, physical education, etc.).

The debate as to what should be considered as sporting activity rather than recreation has continued for many years. In the context of this report, we consider activities participated in for both sport and recreation. Many recreational activities are similar to their formalised sporting counterparts. Furthermore, the potential for prevention of injuries at the competitive levels of play has implications for preventive messages directed at the social or recreational level of play. Because the larger numbers of participants are not involved in organised sport, it is important to consider recreational activities as well. Many of the bodies responsible for the sports sector are also responsible for activities within the recreation sector and could facilitate injury prevention activities in both sectors.
2.3.2 Sports participants

One of the major challenges in epidemiological research into sports injuries is the definition and collection of meaningful participation data, usually called exposure data. For ease of data collection, the most common measures of injury reported have been a calendar period of time over which the data has been collected, e.g. the number of injuries occurring per year or the number of days spent injured per year. However, these measures have well-known limitations in that they do not represent the numbers of injuries per exposure (participation) time nor the number of persons "at risk" of a sports injury.

In order to obtain estimates of injury rates and risks associated with particular sports and sports activities, appropriate population denominators (sports participation) are needed. It is important to take into account participation exposure (e.g. the number of hours during which the person actually runs the risk of being injured) because this affects the risk of injury. Appropriate exposure and risk measures depend on

- The definition of "sports injury" and "sports participation".
- The method used to count injuries.
- The method used to establish the population at risk.
- The representativeness of the sample.

It should also be recognised that sports participation needs to be considered in different contexts including recreation versus competition, organised versus non-organised play, training versus competition.

The rate of sports injuries is often reported in the literature as the number of injuries per 1,000 players. However, when the aim is to compare the injury risk across a number of sports, it is often more meaningful to talk about the incidence of injury per 10,000 player hours, or some other suitable time frame. This is because the incidence rate per 1,000 players may not be appropriate if the actual exposure time, that is the time spent in competition or practice, is greatly different for participants of different sports. The problem with both of these approaches, however, is that neither of these definitions takes into account the seriousness of the sports injury by differentiating between an injury that incapacitates an athlete for weeks compared to a less severe injury with consequences of only 1-2 days. If injury is considered in terms of it being an important issue to the athletes themselves, as it often is, then it may be more relevant to consider the number of days lost from usual sporting activity per 10,000 hours of participation [Watson, 1993]. A good surveillance system that monitors sports participation should allow the potential for each of these types of incidence estimates to be obtained according to the relative importance of the data.

It is also important to quantify exposure to sports injury risk factors in terms of the actual amount of exposure time. For this reason the number of hours played in competition or the number of matches played per week is valuable information. Unfortunately, this information is rarely collected in current information sources (see Chapter 8). Whilst it may be collected by sports physicians and physiotherapists, etc, as part of their medical history of their patients, this sort of information is not readily available and does not tend to be computerised in their databases. There is a need to collect this sort of information on a wider scale, and any sports injury surveillance system should also consider the collection of participation data.

A further refinement of participation data, which should be considered for routine collection, is the position of the player on the field. It is well known from sports such as rugby that this can be a significant risk factor.
There is a range of data sources that contain information about the numbers of sports participants. These include:

- The numbers of registered members with a sporting organisation or club.
- The number of players registered with funding bodies.
- The number of players registered with insurance companies.
- ABS surveys of sports participation levels in the community.
- The Sweeney surveys of sports participation.

The first three of these sources are limited because they refer only to registered players. The last two surveys obtain population-level data about participation in a number of sporting activities but may not be representative of all communities and areas in Australia. Chapter 8 describes these data sources in greater detail.

Methodology needs to be developed to collect additional sports participation/exposure data to complement and enhance that obtained from the above sources. Some suggestions for this are given in later Chapters.

### 2.3.3 Injury severity

Another issue of relevance to sports injury surveillance is the definition of a sports injury itself. The actual definition used will have a major influence on the applicability of the data collected. A number of definitions have been used in the literature:

- Any physical damage caused by a sports-related incident whether or not it results in any incapacity to the participant.
- Any sports injury treated at a hospital.
- A sports injury treated or referred for treatment by a sports trainer or coach.
- An injury referred for medical treatment of any kind.
- An injury claim on sports insurance.
- Time lost from sport.
- An injury that results in the inability to compete or practice as usual.

Any injury surveillance system needs to define the terms “sports injury” and “injury severity” before it can be formally established. This is because data collection procedures may need to be different for sports injuries defined on the basis of attendance at a sports medicine clinic as opposed to those assessed by a sports trainer on field.

In practice, the definition of a sports injury will vary according to the source of the data, e.g. injuries that are treated at a hospital, injuries that are treated on field and injuries that lead to insurance claims. A definition of sports injury based on medical criterion will be biased towards a large proportion of serious, mostly acute injuries and there will be fewer less-severe or over-use injuries represented. Details pertaining to any self-reported sports injuries may be subject to recall bias and to greater subjectivity in assessment of the injury. It is often the less medically severe injuries that are considered to be more severe by the athlete because although they do not require major medical treatment, they still have the potential to severely limit an athlete's performance (e.g. overuse injuries).
Garrick and Requa [1993] state that athletic injury and severity must be defined and viewed in the context of the specific demands inherent in the sporting activity. For example, a sprain that is recorded as a minor injury in medical reporting systems could be career threatening to an elite level athlete just before world-level competition. For elite level athletes, the definition of a severe injury based on one that results in time lost from sport may not be relevant [Watson, 1993]. For such athletes, any injury that limits their performance would be considered as severe, whether or not it also resulted in time lost from their activity.

Two well-known and frequently used definitions of a sports injury are those of the National Athletic Injury Registration System (NAIRS) and the Council of Europe. In the US, NAIRS uses the following definition: "a reportable injury is one that limits athletic participation for at least the day after the day of onset" [Buckley & Powell, 1982]. Injury severity is coded into three levels on the basis of the number of days lost from normal sports participation:

- Minor injuries (1-7 lost days)
- Moderate injuries (8-21 lost days)
- Major injuries (>21 lost days).

The Council of Europe uses the following definition: "any injury as a result of participation in sport with one or more of the following consequences:

- A reduction in the amount or level of sports activity
- A need for (medical) advice or treatment
- Adverse social or economic effects."

A number of other possible definitions of a sports injury, or an assessment of its severity, can be made:

- Nature of injury (e.g. medical diagnosis, need for treatment, etc.).
- Duration and nature of treatment (e.g. what, by whom, costs, etc.).
- Sports time lost, as a measure of the consequences to the individual (e.g. psychosocial costs, etc.).
- Working time lost, as a measure of the financial cost of sports injuries to society.
- Permanent damage and disability.
- Costs, both economic and social.

The problem with using a definition of injury severity that relies solely on the number of games missed is that it may be influenced by subjective factors on the part of the injured participant such as personal motivation, peer influence, coaching staff reluctance or encouragement. On the other hand, a quantifiable definition of sports injury severity is often preferred because it will be less subject to bias than reports of "mild", "moderate" or "severe" injury. For this reason, a definition based on a functional limitation such as the number of days of practice lost is preferred.

There are also indirect costs associated with a sports injury. Whilst athletes may not have their income penalised if they hold a scholarship position at one of the institutes of sport, there will be costs to their club or team if they can not participate as usual. Furthermore, organisers of events may be faced with lost revenue as lost ticket sales and impaired excellence of the event if the injured athlete has a particularly high public profile.
Injury surveillance systems should ideally collect information to quantify as many of these aspects as possible. However, it is recognised that not all systems will be able to record severity or injury outcome details because the long-term consequences of the injury are not known at the time of the recording of the injury. From the perspective of injury prevention, it is particularly important to know the body part injured, the nature of injury and a measure of injury severity.

2.4 SPORTS INJURY SURVEILLANCE NEEDS

2.4.1 Current limitations

The current situation is very limited with regard to information about the incidence and factors associated with sport injuries in Australia. The major factors leading to this are the following:

- Sports injuries are only just beginning to be recognised as a public health problem.
- There has been no "ownership" of the sports injury problem by either the health or the sporting sectors.
- There is currently no national sports injury surveillance system.
- There is little or no incentive to sports bodies or sports medicine professionals, in general, to collect sports injury data.
- There is a need for a standardised data collection methodology (including data collection forms and associated computer database systems) that can be applied across a number of levels.
- There are no agreed definitions and answers to questions such as: what is a sports injury?; how severe must an injury be before it should be considered to be a sports injury?; what is a sports participant?; or how should sports participation be measured?
- Most sports injuries are not treated in, or at, hospitals. However, this is where most of the current data about sports injuries is available from.
- Different sports have different organisational structures making national efforts difficult.
- Reported data on elite or professional players is relatively easy to obtain but little information exists at any other level of play.
- Very little detailed participation data is available, particularly at the community level.
- Sports medicine clinics are only just beginning to systematically collect information about sports injuries and associated medical risk factors but this largely exists in the form of medical records.
- The coding systems for sports injury are medically based and relate only to diagnoses or treatment (e.g. the Orchard system), omitting the circumstances of injury.
- Apart from data collected from emergency department records, little information is available as to how the sports injuries occurred so that factors can be identified for prevention purposes.
- There is no lead agency currently driving progress towards improved sports and recreational injury data collection.
Other key issues were identified during the project's consultation phase and these are described in Chapter 5.

Some of the issues presented here are being addressed by the National Injury Prevention Control Stagey and Victoria's Health Goal and Targets for injury prevention as outlined in the "Taking Injury Prevention Forward" document. For example, links between the Victorian Government departments of Sport and Recreation and Health and Community Services are now being initiated through the Victorian Injury Prevention Committee.

2.4.2 Features of a sports injury surveillance system

A sports injury surveillance system should collect information about the epidemiology of sports injuries and their outcomes in a form that is of relevance across a broad range of potential users of the data: sports participants themselves, sports administrators, sports bodies, coaches, trainers, sports physicians, sports medicine professionals, government bodies and researchers. It is important that any system collects the following information:

- The sports or recreational activity the injured person was engaging in at the time of the injury (e.g. football, netball, horse riding, etc.).
- The location where the injury was incurred (e.g. school sports oval, local cricket ground, golf course, etc.).
- The particular activity initiating the injury (e.g. marking, pitching, teeing-off, watching, etc.).
- What went wrong? (e.g. going for a mark - collided with another player - fell to ground, horse bolted - fell off horse - hit gravel, etc.).
- The level of supervision of the initiating activity (e.g. recreation versus competition, organised sporting event, etc.).
- The nature of the injury (e.g. sprain, fracture, concussion, etc.).
- The body region/s injured (e.g. head, face, ankle, etc.).
- The severity of the injury (e.g. numbers of days of usual activity lost, emergency department treatment versus hospital admission, etc.).
- The characteristics of the injured person (e.g. age, gender, race, etc.).
- The places of presentation and referral for treatment (e.g. hospital emergency department, physiotherapist, etc.).
- Sports participation data (e.g. number of hours spent in activity, competition versus training or other level of play, etc.).
- The use of sports injury countermeasures (e.g. modified rules, protective equipment and clothing, appropriate training, etc.).

It is also important to collect information about how the injury occurred so that the full potential for prevention of further similar injuries can be determined. In the context of general injury prevention, the use of text narratives to collect this information has been shown to be very valuable [Nolan & Penny, 1992]. On data collection forms used by many injury surveillance systems, this text narrative is usually of the form of three or so lines where the events leading to the injury occurrence can be recorded. A text search facility is required in the data analysis program in order to utilise the narrative data. A coding system can be devised to translate this information into relational variables, if needed. However, the main value of the narrative information is that it reduces the disadvantages of relying on
a single code to describe the complex series of events surrounding an injury [Langley & Norton, 1991].

Waller and Clemmer [1993] recommend that this narrative summary of the event should be worked backwards in time. They argue that it is useful to focus first on the injury itself, listing the energy and mechanism of transfer and product or material causing the injury, then describing the injury event just preceding this energy exchange and then recording the activity, its location and product or material in use and persons or animals involved. A similar method, used in the Injury Surveillance Information System (ISIS) data collection coordinated by the National Injury Surveillance Unit, is the collection of data according to the chain of events leading to the injury.

An alternative to the text narrative would be to devise a set of probing questions to draw out some of the relevant information for prevention purposes. For example, Hoy et al. [1993] asked the following set of questions in their study of European soccer injuries in Denmark:

- When did the injury happen, during training or warm-up?
- Did the injury occur during tournament, recreational or school soccer?
- Did the injury occur because the rules of the game were violated?
- Did the equipment, or lack of the same, such as shin guards or appropriate shoes, have any connection with the injury?
- Did any earlier injuries influence the current accident?

Whilst this set of questions can be used to obtain some valuable information, they do not have the potential to highlight other areas of concern because other potentially relevant information is not collected. This ability is one of the features of a text narrative.

For sports injuries it is recommended that both a text narrative and a broad coding scheme describing how the injury occurred be used. A suggestion for such a coding scheme to describe how the injury occurred is the following:

- Collision with other person
- Collision with fixed object (e.g. goal post)
- Struck by person (unintentional)
- Struck by object (e.g. ball)
- Caught in/between people or objects
- Fall on same level (that is, a trip or slip)
- Fall from height
- Equipment failure or misuse
- Overuse, overexertion
- Fainted, exhaustion, fit (including heat exhaustion and dehydration)
- Aggression, fight, violence
- Other (specify).

This should cover most of the contingencies but the “Other” category allows for other activities to be coded should they become apparent at a later stage.
CHAPTER 3: WHAT IS INJURY SURVEILLANCE?

3.1 INTRODUCTION

Before discussing the specifics of sports injury data collection methodologies, it is pertinent to review the general principles of injury surveillance.

Injury surveillance is vital for the study and control of injury. It has been defined as "the ongoing systematic collection, analysis, and interpretation of health data needed to plan, implement and evaluate public health programs" [Graitcer, 1987]. Injury surveillance is thus a vital component in any injury control program through its identification of injury problems and appropriate interventions, and the evaluation of such interventions.

3.2 THE ROLE OF INJURY SURVEILLANCE

The 3 major roles of an injury surveillance system are the following [Harrison & Rogmans, 1994]:

- **Problem identification**

  An injury surveillance system needs to be able to answer the questions: how common is the injury? How severe? Who is injured, in which circumstances (where, when) and how (causal factors, mechanisms of injury)? This information is needed as the basis of priority setting and resource allocation.

  Overview data on the demographics of the injured person, nature and circumstances of injury can be collected by ongoing surveillance and which can then be followed by more detailed studies designed to answer specific injury questions. Problem identification therefore enables a description of the extent and nature of the injury morbidity and mortality problem and the detection of injury event clusters. General information is collected on the chain of events leading to injury through the identification of factors associated with injury.

  This role provides overview data, stimulates further research and supports further research projects through case identification [Muelleman et al., 1993].

- **Monitoring**

  Monitoring involves the detection and following of changes in injury occurrence over time. This includes the monitoring of specific injury targets (e.g. reducing head injuries in football or equestrian sports), sentinel events (e.g. catastrophic injuries) and new and unusual events.

  This role also includes providing data for the evaluation of intervention strategies. Determination of the efficacy of injury control programs requires comparison of pre- and post-intervention data. The methodology for the collection of data at both pre- and post-periods needs to be systematic and consistent.
**Exploratory analysis and hypothesis generation**

An injury surveillance system should provide information to a full range of sports medicine disciplines including biomechanics, basic research, clinical research, epidemiology, injury prevention, training/education, government sectors, etc..

It should be capable of providing more detailed data on the aetiological factors of injury occurrence so that specific issues or injury questions can be answered.

An additional role is that of providing guidance for the development of public health strategies for injury control and prevention. Through its role in the prioritisation of injury problems and the identification of target groups, injury surveillance greatly assists in the development of policies and allocation of resources.

Laporte et al. [1993] relate Graicer's outlined function of an injury surveillance system to the study of sports and recreational injury. The functions thus become: quantitative estimation of the overall sports injury morbidity and mortality; detection of clusters of sports injury events; identification of the circumstances relating to sports injury occurrence; stimulation of epidemiological research to determine the specific factors for control and prevention of sports injuries; and determination of the effectiveness of the sports injury prevention programs [Laporte et al., 1993].

Surveillance systems offer particular advantages over other types of data collections. In particular, they can provide timely data and the ability to identify both short and long term problems. Other attributes such as acceptability, representativeness, sensitivity, specificity, simplicity, usefulness and cost are also vital [Graitcer, 1987].

### 3.3 TYPES OF INJURY SURVEILLANCE SYSTEMS

#### 3.3.1 Continuous surveillance

As the name suggests, continuous surveillance collects data from all cases at a central sampling institution over a continuous period of time. An extensive commentary, including outlining of the strengths and weaknesses, of a number of injury surveillance systems from Canada, USA, Britain, Norway, Sweden, the Netherlands and New Zealand has been given by Moller and Vimpani [1985]. They identified that a particular weakness in some systems was the lack of representative sampling resulting from the specialised nature and/or small numbers of participating institutions. The strengths of continuous surveillance systems include the use of included: longitudinal data on injury costs that could be identified from long term projects; and close links between data collections and injury control programs.

Some examples of major systems of continuous surveillance are the deaths register, catastrophic injury notification, sampling of emergency departments and time to time supplementary collections from general practitioners and sports medicine clinics. In addition, the Victorian Injury Surveillance System (VISS), has been operating since 1988 in Victoria, and is a local example of a current continuous surveillance system. Data is collected on presentations and admissions, for injury, to emergency departments in selected hospitals from metropolitan and rural Victoria. Similar collections are conducted in the other states with national data centralised in the database maintained by the National Injury Surveillance System (NISU). As in other states, the Victorian system, to date, has been a paper-based and labour-intensive system. It is currently undergoing transition to a computerised system. Data will be entered by emergency department staff directly into a computerised an injury data collection module as part of patient registration and injury
assessments. The computerised records will then be forwarded to a centralised database, managed by NISU, for data aggregation and analysis.

3.3.2 Sampling

Gallagher & Guyer [1982] suggest that because emergency department records are rarely computerised, E-coded or provide enough information on the cause of injury, this source may have limited usefulness. However, given the high number of presentations to these emergency departments, sampling a selection of records rather than continuous surveillance of all presentations could suffice [Gallagher & Guyer, 1982]. Thus a detailed examination of a selected sample of emergency presentations could be used to provide a picture of the injuries that are treated at these centres.

With a sample-based surveillance system, however, care needs to be taken to avoid bias resulting, for example, from the timing of sampling leading to seasonal variations in injury occurrence [Moller & Vimpani, 1985]. For example, a detailed examination of emergency department records for presentations for sports-related injury during the month of February will not give any information about injuries related to the “winter sports”.

3.3.3 Sentinel systems

Sentinel systems differ from continuous and sampling surveillance schemes in terms of the data collected and the population covered by the collection. Sentinel systems are designed for the reporting of conditions not normally notifiable by nominated health providers. For example, a sentinel system for sports injury surveillance could be established at chosen sports medicine clinics. In this case, a number of specific clinics or data collection centres are nominated as sentinel sites to provide data.

It is important that sentinel injury surveillance should focus on entirely preventable and easily recognisable specific injury events [Graitcer, 1987].

A sentinel system for general practice has operated in the Netherlands since 1970. Such systems currently operate also in Belgium, France, the USA, Canada, Australia (only limited) and New Zealand. The National Health and Medical Research Council has, since 1986, recommended that State & Territory sentinel systems for surveillance of non-notifiable conditions be established. Since 1990, such systems have operated in South Australia and Queensland but they do not include injury [Dunstone et al., 1990].

3.3.4 Reportable injury systems

Mandated reporting of some injuries is advantageous in that information is centralised and prompt recognition and intervention in problems is facilitated. Injuries subject to mandatory reporting should be important health problems, easily recognisable and preventable [Graitcer, 1987]. Reportable injury systems are also known as notifiable condition systems.

The catastrophic head and neck injury registry for football injuries recommended by the NH&MRC [1994] is an example of a reportable injury system.
3.3.5 Time-limited studies

A study of school-based injury reporting rates by participating institutions (hospitals/health centres) in Sweden, found that limited time-limited studies at the local level were more likely than continuous surveillance systems to produce reliable information [Bremberg, 1988]. Moller & Vimpani [1985] also suggested that time-limited studies would be preferable to continuous surveillance in general practice. The disadvantage of these systems is that if they are conducted over too short a period of time, then seasonal factors may influence the interpretation of the results.

A time-limited study of sports injuries, for example, might involve the monitoring of injuries during one season of play.

3.3.6 Passive versus active surveillance

LaPorte et al. [1993] classify surveillance systems as passive or active and argue that these correspond well to the communicable disease and non-communicable disease surveillance models, respectively.

The communicable disease, or passive, surveillance model is characterised by the following features [LaPorte et al., 1993]:

- Public health officials do not actively seek cases. Cases are generally notifiable conditions so they are reported directly to the public health officials or reporting agency.
- It relies on the voluntary reporting of injury events to a central database.
- The coverage is wide but the incidence rates may be questionable because some cases are missed if they are not reported to the central agency.
- It is not possible to tell if an increasing incidence of the condition of interest is a result of improvement in the recording mechanism or a true increase in the incidence.

Active surveillance differs from the passive approach in that [LaPorte et al., 1993]:

- It is often used to monitor non-communicable diseases.
- It is usually based on a population-based registry with aims to accurately monitor the incidence of the condition over time.
- Surveillance is active because cases are sought by the reporting agency and not merely reported to it.
- The limitation of this sort of system with regard to sports injuries is that there are too many sports injuries to record and the data collection should be restricted to only severe injuries.

3.4 DATA SOURCES FOR INJURY SURVEILLANCE

3.4.1 Use of single versus multiple sources

Surveillance systems can be based upon single or multiple sources of data. Often a combination of data sources is used to overcome inadequacies in one or either data source. An example of this is mortality recording in occupational injury, where an American
study showed under-representation of occupational deaths recorded on death certificates with respect to particular industries, occupations and external causes of death [Russell & Conroy, 1991]. The authors noted that the occurrence, and level, of under-estimation was similar to that found in other American studies of occupational injury reporting on death certificates.

Use of multiple data sources can raise problems, however, particularly in the linking and matching of data. Difficulties in data matching can result in cases being included more than once, in increased cost, and in decreased simplicity [Graitcer, 1987]. Ethical issues may also arise because of the need for detailed case identifier information needed to match cases.

3.4.2 Geographic coverage

It has been suggested that local surveillance systems have a particular advantage over larger and national systems in that they allow for the detection of clustering, identification of injury problems specific to the local community, and the evaluation of local interventions although this should also be possible with larger systems [Langley & Norton, 1991]. Another feature is increased motivation on the part of those collecting data [Bremberg, 1988]. However, it is vital that local collections use classification systems that are compatible with other data collections to allow for the possibility of merging and validly comparing local data sets. Merging of data sets may be desirable if it can provide overview data or when larger samples are needed for analysis purposes. Furthermore, merged data sources may facilitate the study of rarer injury causes through a larger sample size.

Compatibility with other data sets is also essential when data from other centres, institutions and localities is to be used as comparison data. Difficulties may arise with attempts at international comparisons as there may be differences in the levels of private and public sector health care; patterns of use of health institutions (e.g. differences in policies for admission to hospital); and legislation (e.g. insurance requirements). However, there are moves in Europe to standardise injury surveillance classification systems [Rogmans, 1991].

3.4.3 Mortality data

3.4.3.1 Death certificates

The use of death certificates as a source of mortality data is often prone to bias. In an American study of the accuracy of information relating to occupational injury on death certificates, under representation, and thus non-representativeness of the data, was found to occur in particular groups: specific industries (mining, agriculture, services); specific occupational groups (farmers, labourers); and certain external causes of death (traffic injuries on the job) [Russell and Conroy, 1991]. The authors noted that the occurrence, and level, of under-estimation was similar to that found in other American studies of occupational injury reporting on death certificates.

Death certificates are often E-coded according to the International Classification of Diseases (ICD) scheme for government records. The E-coding of sports injuries is known to be very limited [Ozanne-Smith, 1994] and so the reliability of government statistics for deaths due to sporting activities is likely to be very unreliable. However, since few sports injuries lead to death, this is likely not to be a major problem for quantifying the overall sports injury problem.
3.4.3.2 Autopsy and coronial records

In Australia, the law requires that any sudden or unexpected death is investigated through the coronial system. Sports injuries and those that occur during recreational activities such as fishing would therefore be required to undergo scrutiny by these authorities. There is the potential, therefore, to obtain information about these fatalities from autopsy and coronial records.

Limitations cited have been that autopsy findings can be inconsistent between pathologists, may not contain sufficient information on the cause of injury, and are often not computerised [Graitcer, 1987]. Coroners’ records in Victoria are currently undergoing computerisation and recommendations have been made for a uniform national system and database [Johnstone, 1991].

For injuries occurring during sports and recreational activities, these records are likely to be more accurate than official statistics because they do not rely only on the E-coding of cause of death.

3.4.4 Sources of morbidity data

Morbidity data are important because of the vastly increased number of cases available for study. It has been estimated that for every death from general injury, there are about 40 hospital admissions, 350 presentations to hospital emergency departments and 1350 other doctor consultations [Harrison 1991]. We have already seen in Chapter 2, however, that these figures may not be representative of the sports injury problem. Through analysis of the causes of the high number of non-fatal injuries, much can be learnt about the causes of injury, thereby contributing to the identification of appropriate interventions [Muelleman et al., 1993]. A number of different sources of morbidity data are available and these are described in the following sections.

3.4.4.1 Hospital records

Hospital records of injuries are available from either hospital admissions and discharge databases or emergency department records.

An American study has noted that although hospital admissions represent only a small (approx. 4%) proportion of injuries, these cases are important given that hospitalisation reflects both greater injury severity and increased treatment costs [Smith et al., 1991]. However, the use of discharge diagnosis data presents problems when attempts are made to estimate the incidence of hospitalised injuries. This results from problems in the definition of injury given that ‘medical injuries’ (such as adverse effects and complications of care) are included in injury diagnosis codes under the ICD-9 classification system. Furthermore, patients may be counted more than once if readmitted for the same complaint or following transfer to another hospital [Smith et al., 1991]. Such problems associated with diagnosis codes in this US study have been overcome, to some extent, in more recent Australian studies as these have focused on E codes rather than N codes and have excluded re-admissions from the analysis [Langlois et al., 1992; Watt, 1992].

Moller & Vimpani [1985] suggest that although the majority of emergency department presentations are not severe, these injuries are very frequent and the high numbers thus make surveillance through emergency departments very efficient. However, a number of limitations to this sort of surveillance system have been suggested: these records are rarely computerised, they often do not provide enough information on the cause of the injury and
they are not E-coded. In addition, given the high number of presentations, it has been suggested that a sampling process rather than continuous surveillance of emergency department records could suffice [Gallagher & Guyer, 1982].

3.4.4.2 General practitioner records

Moller & Vimpani [1985] suggest that the use of time-limited, smaller studies addressing specific questions is preferable to continuous surveillance for the study of injury problems in general practice. These authors suggest that this is largely due to the fact that most general practice occurs within the private sector and thus the question of reimbursement would need to be addressed.

As previously discussed, a sentinel system for general practice has operated in the Netherlands since 1970 and similar systems currently operate also in Belgium, France, the USA, Canada, Australia (limited) and New Zealand. The National Health and Medical Research Council has, since 1986, recommended that State & Territory sentinel systems for surveillance of non-notifiable conditions be established [Dunstone et al., 1990].

3.4.4.3 Other records

Other sources of data for specific injuries or injury causes can also be obtained from:

- Records of specialised health areas: workers' compensation records, specific disease registries such as Trauma and Burns Registries which are useful but have a potential disadvantage in that they may lack representativeness; school & child care centre health logs.
- Emergency services records (e.g. police, fire department).
- Specific organisation collections (e.g. companies, sports clubs, insurance companies, state and federal Road Boards).
- Sports medicine clinics.
- Unconventional health reporting systems such as "lay reporting" in isolated areas.
- Records of litigation from the courts system.

3.5 ISSUES IN THE DESIGN OF DATA COLLECTION SYSTEMS

Ongoing injury data collection needs to be incorporated into an institution's existing computerised system or included in planned computerisation. It is also vital to include a facility for the insertion of modules for shorter-term use so that more detailed data collection on specific time-limited studies can be undertaken as required [Langley, 1992].

Specific features of an injury surveillance system can encourage maximum co-operation by staff involved in data collection. Acceptability is essential and is helped by perceived simplicity of data collection. Forms and software need to be user-friendly, particularly given that the ideal time for data collection is at the time of initial patient registration and history taking [Langley 1992] or when the main priority of treating staff is primary patient care [Moller & Vimpani 1985]. Perceived relevance can be sustained through accessibility to the data by the institution's staff. Staff need to be able to extract data themselves or to receive prompt responses to requests for analyses [Langley, 1992].
In order to reach optimal usefulness, data must be accurate and quality assurance issues need to be addressed. Analysis and dissemination of data needs to be timely, particularly if new hazards and short-term trends are to be recognised. The system must also possess sensitivity and specificity, have the flexibility to change in line with the rapid advances in knowledge about injury and be cost-effective [Moller & Vimpani, 1985]. Data also needs to be compatible with that collected in other systems so that data can be aggregated or compared. Finally, issues of privacy and confidentiality need to be addressed.

3.6 DATA CLASSIFICATION SYSTEMS

3.6.1 The issues

Compatibility with other data collections is an essential component of data for a number of reasons [Langley, 1992].

- Merging of local data sets provides overview data.
- Rarer injury causes can be studied through greater case numbers.
- Combined data sets increase case number for analysis in any study.
- Trend analysis can be undertaken.
- Other centres and institutions can be used as comparison groups.

For this reason, it is often preferable to use general classification systems such as the International Classification of Diseases (ICD), Australian Injury Surveillance Information System (ISIS) and the recently developed National Minimum Data Set Injury Surveillance (NMDS(IS)) for use in Australia and New Zealand, or to ensure that 'stand-alone' systems are compatible with these. This still allows for the collection of information relevant to local needs.

Traditionally, data has been collected on both the nature and severity of injuries. However, for the identification of prevention strategies, information on injury sequencing also needs to be collected and coded. Strengths and weaknesses of four general classification systems are outlined below.

3.6.2 The International Classification of Diseases system

This system provides an internationally recognised system for classifying the nature and site of injury. Although, it does provide some information on the circumstances of the injury event this is quite limited.

Currently, the 9th revision of this system is in wide use. The 10th revision has been released but it will take a few years before it is fully implemented across Australia. The system comprises four schemes and four appendices but it is primarily the N and E coding systems that are most relevant for epidemiological research into injury [Smith et al., 1990].

N codes provide information on the disease or injury itself. The N-codes (N800-N999) relate to injury and poisoning and are a composite description of both the natures of injury (e.g. burn, laceration, fracture, etc.) and the body part affected [Langley & Norton, 1991]. These codes are particularly useful for the study of injury morbidity [Smith et al., 1990; Muelleman et al., 1993].
E codes (E800-E999) are found in the Classification of External Causes of Injury and Poisoning and provide some information on the cause of injury (e.g. motor vehicle accident, assault, etc.). E-codes are thus of some use in the study of injury circumstances [Smith et al., 1990; Muelleman et al., 1993.] However, they provide limited information on injury sequencing and for this reason do not assist the identification of appropriate interventions aimed at prevention.

The ICD system's strengths lie in the areas of compatibility with other data collections, ease of use, good inter-rater reliability and cost effectiveness.

Given its international use, the system has obvious benefits in terms of compatibility with other data collections. Its codes are now also able to be converted, through computer software, to the internationally used and recognised Abbreviated Injury Scale (AIS) scores, although there are some limitations of the accuracy of this mapping program. These may be overcome with future refinements. ICD codes are widely used by government authorities, such as the Australian Bureau of Statistics (ABS) and international authorities such as the World Health Organisation as the basis of their published health statistics.

The ICD codes are relatively easy to use, particularly after formal training has been given. In a study of the prospective allocation of an external cause of injury code from a list of 60 common causes of injury by triage nurses in an emergency department, it was found that 98% of codes were correctly allocated and in only 1% of cases was the external cause code not completed. The study reported that triage nurses did not consider that significant extra time was required to complete the external cause of injury on the data form [Ribbeck et al., 1992]. Retrospective E-coding presents, however, some problems in that limited recording of detailed information on injury causation in patient records is not uncommon. This is probably secondary to the lack of awareness by primary care providers that medical record data can provide to the area of public health [Smith et al., 1990].

Good inter-rater reliability has been found for the ICD coding scheme. In a study of two groups of coders, agreement between groups was found to be 63% for N codes and 81% for E-codes [Smith et al., 1990]. The authors suggest that this compares favourably, citing the 65% accuracy levels for codes recorded on death certificates found in the study of cancer deaths by Percy et al. [1981]. E coding of hospital discharge patient diagnosis has been widely used in Australia for some years, with studies of injuries in Victoria by both Watt [1992] and Langlois et al. [1992] having utilised such data.

Two broad categories of costs have been identified as required for the inclusion of E-codes in hospital discharge databases: an initial one-off set-up cost (modification of the database, provision of coding guidelines); and the on-going cost incurred from the coding and entry of the additional data. The approximate cost (average), per hospital, for the hospitals included in the Washington study was $600 US [Rivara et al., 1990]. In another American study only 20% of medical records managers surveyed stated that barriers to implementation of E-coding were related to funding. Thirty-six per cent, however, perceived lack of training as an existing barrier and suggested the need for additional training [Ozonoff et al., 1993].

The ICD system's main limitation lies, as previously noted, in its lack of injury sequencing via E-coding. E-coding provides only a summary of the circumstances of injury. Additional information is necessary for injury sequencing [Moller & Vimpani 1985] and separate data needs to be collected on the activity at time of injury, place of occurrence, etc. For example, with ICD 9 E-codes the identification of school, sports and work injuries is extremely limited. Such data items are, however, collected in both the ISIS and NMDS systems described below.

Some of these limitations have been rectified somewhat in the 10th revision of the ICD [Guyer et al., 1990; Langley & Norton, 1991]. In addition, reliance on E-coding means that
one of the most useful tools in injury sequencing, the narrative, is not able to be made use of. The narrative is a brief text description of the incident and can incorporate specific items such as brand names (of products) and building/place names. Extraction of this data can be undertaken by means of a text search. Reliance on E-coding often leads to non-recording of narrative data because it is not considered to be important.

Incidence estimation requires a method of ensuring that each injury is counted once only, and thus that readmissions, transfers and deaths are excluded. E-codes could be restricted to initial hospitalisation for the injury or the allocation of an additional variable to distinguish non-incident injuries [Smith et al., 1991]. Methods have been developed to exclude, or at least account for, such duplication [Watt, 1992].

Unfortunately, the ICD coding system is particularly limited for sports injuries. This will be discussed further in Chapter 6.

3.6.3 Injury Surveillance Intelligence System (ISIS)

This very detailed system has been used in Australia since 1986. Within ISIS, data is collected on both injury sequencing and the injury itself. Data items are coded into both major groupings and into detailed sub groupings [VISS, 1988]

Data is collected on where the injured person was at the time of injury. The detail in the groupings and sub-groups, is vital for the identification of injuries. Four major groups are given for sports and recreational injury. Locations and subgroups cater for detailed differentiation between: sports and recreational activities; public, private and commercial venues; and land and water venues [Langley & Norton, 1991].

Data groupings also allow activities such as school, sports, recreational and work injuries to be readily identified unlike the ICD-9 system [Langley & Norton, 1991]. Sports injury can be identified in terms of the level of organisation (competition/informal) and specific sports.

The data item, 'breakdown', records “what went wrong” to initiate the sequence of events leading to the injury occurring. The 'mechanism' codes how the actual injury to the body occurred and what factors (e.g. other persons, objects, products, etc.) were involved. The detailed list of product type codes was based on National Electronic Injury Surveillance System (NEISS) product codes and National Institute of Occupational Safety and Health (NIOSH) industrial machinery codes and then adjusted to cover local needs [Langley & Norton, 1991]. Some, but not all, E-codes include specification of breakdown and mechanism factors but there is inconsistency in the degree of specificity of the codes [Langley & Norton, 1991].

Any safety precautions (e.g. protective eyewear, helmets, mouthguards, etc.) in use at the time of injury are also recorded and coded. Intent, under ISIS, is allocated a separate code and values for this code also cover suspected cases of intentional injury and cases where intent is not known. The designation of intent in the ICD-9 system is designed to be an integral part of the E-codes but Langley [1992] reports that the creation of a separate code in ISIS results from possible under-reporting of intentional injury with the E-coding scheme.

Separate codes are allocated to the nature of injury, body part injured, treatment and patient disposition. This assessment of outcome is based on short-term impact only.

A brief summary of the injury event in text form is one of the most useful tools for injury research. It allows for the recording of specific brand names (e.g. products), specific place names (e.g. name of company, sports ground) and the storage of data that is not elsewhere codeable. Extraction of this data is done by text searching.
A very similar system has been developed by Waller and Clemmer [1993] for use in the US. However, the authors note a limitation for sports injury surveillance in that they do not have separate codes for specific sports or activities or the level of organisation (e.g. competition/informal). For this information, they undertake text searches of the narrative.

The ISIS system is currently being widely replaced by the shorter National Minimum Data Set which, although it will collect less detail [depending on whether just core items or optional items are also completed], will be very simple, user-friendly and is anticipated to be implemented on a more extensive basis (eventually state-wide in Victoria, NSW and Queensland.)

3.6.4 Minimum data sets for injury surveillance

Although injury surveillance methodologies need to be developed within specific settings, such as organised sport, they should all be based on the same set of core data items determined by basic injury data standards [Harrison & Rogmans, 1994]. The national approach to achieve this is to establish a minimum data set for injury surveillance [Harrison, 1993, NISU, 1994].

Minimum data sets for injury surveillance have been proposed for both Australia [Harrison, 1993; NISU, 1994] and New Zealand [Langley & Norton, 1991]. In Australia, the proposed minimum data set has been designed to enable basic injury quantification, to monitor national injury control targets and to provide some capacity for exploratory analysis, at a relatively low cost.

The features of a minimum data set for injury surveillance are [Langley & Norton, 1991; Harrison & Rogmans, 1994]:

- That it can identify variables and data items that might feasibly be collected and stored in almost any setting.
- That it provides some flexibility and does not preclude the collection of additional data of local relevance.
- Data is collected in a manner suitable to provide the necessary information for injury prevention research.
- Data from a variety of sources can be compared when it has been collected in a similar manner.
- Data can be integrated across a variety of settings (e.g. hospital-based data collections with clinic-based or on-the-field data collections).
- Processing and interpretation of injury surveillance data at a local and regional level can be facilitated if the same minimum data is obtained in a standardised way by all data collection systems.
- It allows information to be put into both a national and international context.
- Standardised data entry and data analysis software can be developed.

Waller and Clemmer [1993] have recently presented a scheme for describing injury events. This system is very similar to that already used by the Victorian Injury Surveillance System (VISS) since 1988 [VISS, 1988]. Waller and Clemmer [1993] propose that an injury surveillance scheme should cover the following eight broad questions covering both the pre-injury and injury phases:

- Where was the person when the injury event occurred?
• What were they doing at the time both in general and specific terms.
• Was the activity being carried out for monetary gain or while travelling to or from a monetary gain activity?
• What actually happened?
• Was contact with any animal or another person involved?
• What product or material, if any, was the person using when injured?
• What product or material, if any, caused the injury?
• What type of kinetic energy was involved and how was it applied?

They acknowledge that a number of additional questions would need to be added to this list for the surveillance of sports injuries. Both VISS and the system proposed by Waller and Clemmer [1993] consider that an essential part of the data collection is a two or three line text narrative of the event.

3.6.5 The Australian National Minimum Data Set (NMDS) for Injury Surveillance

The National Minimum Data Set for injury is based partly on ISIS, which it is currently replacing. It is a very simple and user-friendly system and involves less detailed collection of data. It has been designed so that it can be more extensively implemented with data being collected by staff involved in initial registration and treatment of the patient. It is anticipated that the system will be implemented imminently in Victoria, NSW and Queensland as emergency departments undergo computerisation.

Classifications are given for core and optional items and, where appropriate, are compatible both with the ICD 9 and 10 coding systems. General and demographic details will be extracted from patient registration modules. The essential core items are as follows: the main 'external cause' of injury; the type of activity at the time of injury; the place and time of injury; the main injury sustained; and a text description of the circumstances of the injury. There is provision for the completion of optional items, which are more detailed classifications of core items.

3.6.6 Combining surveillance systems

Frequently there are two or more independent sources of data describing the incidence of injuries. Each source may only collect information about some of the injuries and so does not have complete ascertainment of the injury problem. For example, Coroner’s data will contain information about injuries that result in death whereas hospital admission databases will have data about the injuries that result in hospitalisation, whether or not death subsequently occurs. However, as this example shows, there may be some overlap of cases from the various data sources.

LaPorte et al. [1993] have shown that two independent data sources can be combined to obtain a very accurate estimate of the actual number of injury cases. They have applied the statistical technique of capture-mark-recapture to take into account the underascertainment in the combined data sources.
3.7 DATA ACCESS AND DISSEMINATION

Accessibility to data is essential if it is to make an optimal contribution to injury reduction. Prompt availability is one of the major criteria for accessibility of data and such timeliness is a strong feature of injury surveillance systems. Timeliness is particularly vital in the assessment of new product safety which is particularly relevant to the sports injury prevention area. Timeliness is promoted by ensuring that systems for data collection, coding, computer entry and retrieval of data are simple, acceptable and user-friendly [Graitcer, 1987]. Langley & Norton [1991] note that it is easier for users to access their data from a centralised database, than it is for the users to access their data at the institution where the data was collected. The authors suggest this results from the facility for downloading of data from a centralised database to personal computers.

Dissemination of data is vital so that injury problems can be identified and public health strategies for injury control and prevention can be effectively guided and evaluated. It has been suggested that the most stable and successful injury surveillance systems are those that have the strongest links with injury control programs. Furthermore this linkage should be considered at the time of establishment of an injury surveillance system. Prompt dissemination of data also allows health professionals to understand the relevance of their collection of data and promotes their ongoing co-operation [Langley, 1992].

The issues of privacy and confidentiality have become increasingly important with advances in information technology and it is vital that their safeguarding be addressed. In Australia, there are specific guidelines to deal with these issues. The National Health and Medical Research Council Guidelines for Epidemiological Research outline the issue of confidentiality in medical research [NH&MRC, 1988]. These guidelines cover areas such as storage of data, storage of personal identifiers and release of data in aggregate form only.

3.8 FUTURE DIRECTIONS

Surveillance of injuries in the future is likely to be greatly assisted by the increasing linkage of data within hospitals. For example, data collected in emergency departments will be linked with inpatient discharge diagnosis data thereby enabling far more detailed information to be available on the outcome of injury and on the cost of treatment of injury.

Furthermore with increasing activity towards establishing minimum data sets for injury data that are both nationally and internationally compatible, the comparison and combination of data collections will be more reliable.

It is likely that many injury surveillance systems established over the next couple of years in Australia will conform to the National Minimum Dataset for Injury Surveillance. It is anticipated that this will also be the case for sports injury surveillance.
CHAPTER 4: LITERATURE REVIEW OF SPORTS INJURY SURVEILLANCE SYSTEMS

4.1 INTRODUCTION

Mueller and Blyth provide a review of forty years experience of monitoring fatalities in tackle football [1987]. They argue that the annual surveys of football fatalities conducted by the American Football Coaches Association have been the basis for football rule changes and equipment improvement over the years in which this game has been played. These authors conclude that:

"Data collection plays an important role in the prevention of injuries. ... There is no question that the beneficial changes are the result of reliable data collection and the publication of the results in the athletic and medical literature. Persistent surveillance of sports injury data is mandatory if progress is to continue in the prevention of fatalities. Continuous data are needed in order to observe the development of specific trends, to implement in-depth investigation into areas of concern and to carry out preventive measures. If continued progress in sports injury prevention is to be made, reliable data are a must." [Mueller & Blyth, 1987]

The lessons learnt from the experience of tackle football in the US are valuable ones that should be translated to other sports and the Australian context. This Chapter provides a review of the various implemented sports injury surveillance systems from around the world. It is appropriate that we build on these national and international experiences in developing a standardised data collection methodology specifically for the Australian context.

It is worthwhile noting that the Australian sporting structure is somewhat different to that in many other countries in that it has a strong community basis. This means that injury surveillance schemes developed overseas are not necessarily suitable for the Australian context. Brukner [1994] has also highlighted that one of the major problems with data collection on sports injuries in Australia is that a broad range of personnel is involved at the range of places where injured sports participants present. These could include hospital emergency departments, sports physicians, general practices, sports medicine centres, physiotherapists, sports trainers, etc. For this reason, any injury surveillance system implemented in Australia needs to be as simple as possible and designed specifically for a range of health professionals and community participants. Nevertheless, much can be learnt from the overseas experiences and these can guide the directions in Australia.

The sports injury pyramid described in Chapter 2 indicated that sports injury data is potentially available from a broad range of levels across the health sector. Injury surveillance systems are often specific to particular levels of health care delivery because of the ease of data collection and coordination. This Chapter therefore groups implemented sports injury surveillance systems according to the health sector levels they address.

4.2 HOSPITAL-BASED DATA COLLECTIONS

Hospital-based collections of sports injury data are generally based on emergency department presentations [Routley, 1991; Routley & Ozanne-Smith, 1991; Routley & Valuri,
Hospital-based data collections in Australia identify sports injuries only in an aggregated manner for admissions, and more detailed emergency department data is collected in relatively few hospitals [Ozanne-Smith et al., 1994]. The hospital admission information is particularly limited because it is based on the existing ICD 9 E codes which identify general sports injuries only as either E886.0 (fall on same level from collision, pushing or shoving, by or with other person in sports) or E917.0 (striking against or struck accidentally by objects or persons in sports). This means that specific sports activities or mechanisms of injury cannot be readily obtained. Accidental drowning and submersion that occur during sports and recreational activities are assigned to E910.0 (accidental drowning and submersion while water-skiing), E910.1 (accidental drowning and submersion while engaged in other sport or recreational activity with diving equipment) or E910.2 (accidental drowning and submersion while engaged in other sport or recreational activity without diving equipment). Once again, information about the particular sporting activity is not available except for in a few limited instances. Whilst hospital-based data collections are a very important means of identifying some sources of severe or acute injury they have obvious limitations.

One way to overcome the limitations of the ICD E-coding scheme would be to examine death certificates or hospital records for information about the person's activity and to recode the causes of injury to reflect that activity. However, this would be both a costly and time consuming activity.

The limitation of the ICD E-code diagnosis for sports admissions has also been noted by Dixon [1993] in New Zealand. In New Zealand, hospital discharge records are supplemented by a free text narrative description of the circumstances leading to the injury. Dixon found the use of this text narrative invaluable in overcoming the limitations of the E-codes for describing sports injuries [1993].

The municipality of Falköping in Sweden has had a systematic registration of accident cases since 1978 [Lindqvist, 1989]. Sports injury cases were identified from both in- and outpatient care facilities throughout the municipality over a twelve month period from September 1983. Sport injuries were defined as those occurring during games or physical training, whether for recreation or competition. Over the follow-up period, 933 sports injuries were identified.

The results of the study by Lindqvist [1989] are very useful in that they help to quantify the range of ICD codes that would be assigned to sports injuries. Table 4.1 gives the proportion of sports injuries that would have been assigned to specific E codes, based on the 1965 revision of ICD codes. This table clearly shows the potential for underestimation of the sports injury problem if ICD codes for sports are used solely to define them. For example, 5% of all sports injuries would have been coded as a traffic accident according to the ICD system and ignored as true sports-related injuries.

The National Electronic Injury Surveillance System (NEISS) is coordinated by the Consumer Product Safety Commission in the US [NEISS, various reports]. NEISS is an active surveillance system that is based in hospital emergency departments and the sample of hospitals included in this scheme is representative of hospitals and emergency departments in the US. NEISS records the most severe diagnosis listed on the emergency department record and uses data from the participating hospital to project national injury estimates.

The purpose of the NEISS system is to record all injuries associated with the use of consumer products, including sports equipment, that are treated in an emergency department. The disadvantage of this data collection methodology for sports injuries is that
It will miss all cases that did not involve a consumer product. However it is very useful for some types of activities such as horse back riding where one of the product codes (1239) is defined as "horseback riding (activity, apparel or equipment)" [US Department of Health and Human Services, 1990].

Table 4.1 ICD codes assigned to 933 sports injuries in Falköping, Sweden.

<table>
<thead>
<tr>
<th>Type of injury event</th>
<th>E-codes ICD 1965 revision</th>
<th>Proportion of all sports injuries %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic accidents</td>
<td>807-846</td>
<td>5.0</td>
</tr>
<tr>
<td>Poisoning</td>
<td>859-877</td>
<td>0.5</td>
</tr>
<tr>
<td>Falls</td>
<td>880-887</td>
<td>30.1</td>
</tr>
<tr>
<td>Fire and environmental factors</td>
<td>890-909</td>
<td>2.4</td>
</tr>
<tr>
<td>Drowning, near-drowning, choking</td>
<td>910-913</td>
<td>0.2</td>
</tr>
<tr>
<td>Ingestion of foreign body</td>
<td>914-915</td>
<td>0.1</td>
</tr>
<tr>
<td>Falling objects or blows</td>
<td>916-917</td>
<td>30.5</td>
</tr>
<tr>
<td>Crushing</td>
<td>918</td>
<td>1.7</td>
</tr>
<tr>
<td>Physical exertion</td>
<td>919</td>
<td>28.7</td>
</tr>
<tr>
<td>Cutting or piercing objects</td>
<td>920</td>
<td>1.0</td>
</tr>
<tr>
<td>Other accidents</td>
<td>921-939</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Hoy et al. [1992] reported an epidemiological study of the occurrence of European soccer injuries in a well-defined geographic region of Denmark. This region is served by one hospital and soccer injuries were identified from all cases presenting to the emergency department of this hospital during a two year period. One of the limitations of injury surveillance systems for sports injuries is the inability to collect information about the severity of the injury. This is because the severity is often best described in terms of the time absent from sport, the length of hospitalisation or medical treatment, time absent from work or monetary costs to the individuals and these can only be measured some time after the initial injury. Hoy et al. [1992] were able to conduct follow-up interviews of 82% of their initial cohort some 1-4 years after the initial treatment at the hospital to determine the outcomes of each injury. The fact that the study group was a geographically-defined population was the major feature that enabled this study to achieve such a high follow-up rate.

A study of 1000 consecutive sports injury cases seen at the Accident and Emergency Department of Western Infirmary Hospital, Glasgow found that injured people preferred to refer themselves to hospital rather than attend their own GP for treatment of a sport injury [Pickard et al., 1988]. Sanders et al. [1989] also found that many sports injuries in the community present to a major hospital casualty department. They found that 41% of all sports injuries reported during a two week community survey in the ACT were treated at hospitals. Pickard et al. [1988] note a limitation of sports injury surveillance based on attendances at a hospital accident and emergency department. Whilst this sort of system is good for general community level sport surveillance, professional sports often have adequate first aid and medical back-up services. This could result in reduced referral to a hospital for treatment amongst professional athletes.

Tenvergert et al. [1992] defined sports injuries to be any kind of injury caused by a sport that was treated in the trauma department of the University Hospital of Groningen in the
Netherlands, over the period 1982-1988. Other studies have shown that hospital-based data collections and reviews of medical records are very useful for the surveillance of injuries that occur during a particular type of physical activity such as horse-riding [McGee et al., 1987; Barone & Rodgers, 1989; Silver et al., 1991].

Specialist hospitals and hospital clinics, have also provided valuable information about specific types of sports injuries. In these studies, sports injuries have generally been identified through patient registers and full details of the injury from case reports. For example, Fong [1994] has recently reported a prospectively-collected cross-sectional survey of all eye injuries treated at the Royal Victorian Eye and Ear Hospital during a two year period. Information was collected from both outpatients and inpatients by a standardised patient questionnaire that sought information about the type of sport played, the venue and the type of eye protection worn, if any. Clinical and other data was documented by the attending doctor. Because this injury surveillance system collected information about the use or non-use of protective equipment, it was able to make specific recommendations for the promotion of appropriate protective eyewear across a wide range of ball sports. Similar surveillance of eye injuries in sport has also been reported at the Manchester Royal Eye Hospital, UK [Jones, 1988], Helsinki University Eye Hospital [Punnonen, 1989], Massachusetts Eye and Ear Infirmary, USA [Larrison et al., 1990] and Wellington Hospital, NZ [Aburn, 1990].

4.3 MORTALITY DATA

Kraus and Conroy [1984] discuss the limitation of using the ICD classification of coding of cause of death for the identification of sports injuries. These limitations arise because of the limited codes for sports and recreational injuries available in the ICD scheme. They argue that the only way to tell whether a death is associated with a sports or recreational activity is to do a complete audit of death certificates to establish a better coding system.

Table 4.2 lists the assumptions that Kraus and Conroy [1984] made about what proportion of deaths from each activity should be considered as being related to sports and recreational activities when analysing mortality data. For example, they suggest that three quarters of all pedal cyclist fatalities should be considered as being related to sport or recreation, even though the ICD system would regard them all as motor vehicle accidents.

Table 4.2 The proportion of all deaths from selected E-code categories that can be attributed to sport and recreational activities. Source: Kraus and Conroy, 1984.

<table>
<thead>
<tr>
<th>Broad E-code categories</th>
<th>Proportion of deaths that should be considered as being related to sport or recreational activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedal cycle</td>
<td>75.0</td>
</tr>
<tr>
<td>Motor vehicle accidents - non traffic</td>
<td>75.0</td>
</tr>
<tr>
<td>Animal drawn/ridden</td>
<td>50.0</td>
</tr>
<tr>
<td>Watercraft (occupant of small boat)</td>
<td>100.0</td>
</tr>
<tr>
<td>Occupant of unpowered aircraft</td>
<td>100.0</td>
</tr>
<tr>
<td>Falls from different level</td>
<td>10.0</td>
</tr>
<tr>
<td>Falls same level/collisions in sports</td>
<td>100.0</td>
</tr>
<tr>
<td>Natural - environmental factors</td>
<td>1.5</td>
</tr>
<tr>
<td>Drowning (recreational)</td>
<td>100.0</td>
</tr>
<tr>
<td>Struck by/against object</td>
<td>1.2</td>
</tr>
<tr>
<td>Firearms</td>
<td>10.0</td>
</tr>
</tbody>
</table>
Horse-riding is one of the few sports and recreational activities that can be identified through the ICD E-code system. The relevant code is E828: Transportation - animal being ridden, and this corresponds, in the main, to horse-riding. This means that surveillance of fatal horse-riding activities has been able to be identified through government mortality statistics based on ICD codes of death [Ingemarson et al., 1989]. Horse-riding fatalities have also been identified through examination of coroners’ reports [Pounder, 1984].

4.4 SPORTS MEDICINE CLINICS

Limited data has been published about the broad range of sports injuries treated at sports medicine clinics, rather than at a hospital. Dixon [1993] cites anecdotal evidence from the Dunedin Sports Injury Clinic to suggest that 80% of the injured people seen there are not referred to a hospital emergency department even though their injury is severe enough to require some medical treatment. This supports the contention that sports injury statistics based on hospital attendances alone are likely to seriously underestimate the true magnitude of the sports injury problem.

Elite and professional levels of sport are well serviced by sports medicine clinics and as such they have provided the basis for a number of studies of the aetiology of sports injuries amongst competitors at the high levels of play. For example, the sports medicine unit at the Australian Institute of Sport has been used to survey injuries that have occurred during netball and basketball [Purdam, 1987; Crawford & Fricker, 1990], tennis [Fricker & Maguire, 1986] and gymnastics [Dixon & Fricker, 1993].

A study of ankle and knee injuries in elite and recreational netballers and basketballers used major sports medicine clinics as their source of injury surveillance data [Oakes et al., 1993]. In this study, injured basketball or netball players presenting to one of the seven major sports medicine clinics in Melbourne were asked to complete an injury questionnaire. The limitations of this method of surveying sports injuries is that it depends upon the goodwill of the sports medicine clinics to recruit the injured basketballers and netballers to the study. Furthermore, not all injured participants of these sports would attend a sports medicine clinic for treatment.

Reports from sports medicine clinics do not indicate the true incidence or prevalence of sports injuries in a community. For information about sports injuries in the general community, it is necessary to examine hospital-based data collections or general practitioner records. However, data from sports medicine clinics can indicate the main problems in practical sports medicine. They also serve as a good basis for studying the various factors involved in the aetiology of these injuries.

4.5 MEDICAL COVERAGE SERVICES

Only a small number of reports from medical coverage services providing injury surveillance at large sporting events have been published internationally. Typically they relate to disabled athletes [Hoeberigs et al., 1990], special Olympics [McCormick et al., 1990] or to state games events at the amateur level in the United States [Noble et al., 1988; Brodersen, 1992]. These reports have all shown the positive benefits of participating in these games and the value of using a medical coverage service to attend to any injuries. They also illustrate how medical coverage services can be used to facilitate sports injury surveillance.
Lee-Knight and co-workers argue that "one aspect of quality health care that must be considered when organising medical services for major athletic events is the availability of accurate medical information regarding the participants" [1992]. This means that medical coverage services have the potential to play a role in sports injury surveillance. This has been demonstrated by surveillance of dental injuries that occurred during the 1989 Canadian Games [Lee-Knight et al., 1992]. During these games, medical records were created for every athlete prior to the games and basic injury report forms were completed for each athlete treated at the main clinic or one of the venue clinics.

Medical coverage was provided by volunteer and student doctors and physiotherapists during the 1991 World Student Games in Sheffield [Hannay et al., 1993]. This medical coverage service was used to establish an injury surveillance system to record all injuries that occurred during these games. Injury surveillance was of two forms. Minor incident logs were maintained at the village medical centre, village physiotherapy room and competition venues. These were used to record minor incidents that did not require medical treatment or physiotherapy beyond minimal first aid and contained a brief description of the incident. These records were not computerised because the major emphasis of the injury surveillance was to record all injuries requiring medical attention. This was achieved through standardised medical and physiotherapy records that were designed for computer entry purposes and collected detail about the patient, their medical history, the medical examination, treatment, further investigation and follow-up. Thus whilst this system provided a lot of detail about the injury itself and the treatment required it did not collect information about the circumstances leading to the injury. This meant that it was of limited value for injury prevention purposes.

Unfortunately, published reports of injury surveillance by medical coverage services in Australia do not exist in the international literature. Farquharson (1989) prepared a report for the Australian Masters Games held in Adelaide in October, 1989 but this has not been published in the literature. This report indicated that 357 injuries were reported to the ASMF sports medical coverage service from a total of 7,744 participants. This corresponds to an injury occurring in 4.6% of the Masters Games participants.

A prospective collection of all injuries sustained by members of the South Sydney professional rugby league football club was facilitated by a standard injury card which was used specifically for the recording of injury data [Gibbs, 1993]. Medical coverage was provided to the club at all games by the author of this study who was personally responsible for attending to, and treating, all injuries sustained.

Egger [1993] has suggested that sports trainers, as part of a coverage service, have the potential to contribute injury surveillance activities throughout Australia, at least for the Australian Football and rugby codes where they are commonly used.

4.6 SPORTS-BASED INJURY SURVEILLANCE SYSTEMS

One example of a standardised sports injury surveillance system based on data collection during sporting events is that of the National Collegiate Athletic Association (NCAA) in the United States [NCAA, 1993]. Annual data is collected from a random sample of the NCAA member institutions. According to the definition of LaPorte et al. [1993], the NCAA system is a passive surveillance system.

A separate injury report form is completed for each injury by an athletics trainer. Each injury is described in detail in terms of the following factors: type of injury, body part injured, severity of injury, field type, field condition and whether special equipment was being worn. Exposure data is also collected on a one page report submitted weekly. This records the number of practices and games, the types of playing surfaces and the numbers of
participants. This system is particularly useful for injury prevention purposes because it collects information about the circumstances of the injury. For the contact sport soccer, for example, this is coded as [NCAA, 1993]:

- Contact with another competitor
- Contact with playing surface
- Contact with apparatus/ball
- Contact with other environment (wall/fence)
- No apparent contact (rotation about planted foot)
- No apparent contact (other)
- Other.

For general field sports, the NCAA uses the following classification of injury events:

- Contact/collision with another player
- Contact with ball
- Contact with bench or bleachers
- Contact with goal
- Contact with surface
- No apparent contact
- Other.

Another sports injury surveillance system is the Fysion Blesreg system used in Holland (de Bruijn & Keizers, 1991). This system was developed in conjunction with several sports organisations and unions. The Fysion Blesreg registration system collects data in three ways: pre-injury data, including personal and anthropometric data on all participants; teamcard data, including information about participation; and injury record forms. The system is a very simple one and has been demonstrated to be able to be used by a range of sports medicine professionals and sports trainers.

4.7 SPORTING-BODY DATA COLLECTIONS

The United States Pony Clubs (USPC) Association is an organisation interested in horse activities across the US [USPC Inc]. It represents 400 clubs active in 49 states of the US. The USPC maintains a passive injury surveillance system of horse riding injuries that relies on the USPC District Commissioner to report each injury event of potential concern using a standardised form. This form records information about the rider (age, sex, years of riding experience, level of knowledge, skill level) and their injury (type and location, treatment given). Each of the clubs send their injury record forms to the National office for data entry and central storage.

4.8 SPECIAL PURPOSE SURVEILLANCE SYSTEMS - EVENT SPECIFIC

Surveillance systems have sometimes been devised specially for particular events. For example, an injury surveillance program was established for the 1988 National Boy Scout Jamboree which was attended by approximately 30,000 people over a nine day period.
[Wetterhall & Waxweiler, 1988]. The authors developed a standardised injury report form to record details on all injured cases referred to the central hospital. Information collected included the time and date, the nature of injury, the site of injury and the activity at the time of the incident. Unlike many other surveillance systems, a particular feature of this surveillance scheme was the collection of data about scout participation from the daily scout census. This enabled event-specific injury rates to be calculated for the organised activities.

Wetterhall and Waxweiler [1988] concluded that the process of injury surveillance used at the Boy Scout Jamboree was very successful in that:

- It was capable of detecting the health outcomes of interest.
- It was simple to operate.
- It is adaptable and inexpensive.
- It was sensitive in the sense that it was able to identify an unanticipated safety hazard.

Ferrara and Davis [1990] conducted a one year injury recall study at an elite wheelchair athletics training camp. The major limitation of this study was the long period of time for which detailed information about the circumstances surrounding an injury (both pre-event and treatment) was to be collected. Response was a further problem for this study with only 19 out of a total of 65 athletes responding to the survey.

4.9 SCHOOL SURVEILLANCE

School-based surveillance of sports injuries has been reported in the Netherlands [Backx et al., 1989; Backx et al., 1991]. Data collection was facilitated by a detailed questionnaire that was completed by the students during physical education classes. Where necessary, teachers and/or parents helped to complete the questionnaire. This surveillance system collected data retrospectively about all sports activities participated in as well as information about any incurred injuries.

An injury surveillance scheme within schools was established by Schelp et al. [1993] to determine the range of injuries sustained by school children. They found that 40% of all school accidents that resulted in pupils being treated by a doctor at a health centre or hospital or by a dentist occurred during physical education. The surveillance methodology included a standardised questionnaire that was used to interview all injured pupils. The authors of this study concluded that adequate surveillance of school accidents leading to injury provides the basis for determining preventive strategies [Schelp et al., 1993].

School sports injuries that resulted in the athlete not being able to return to play on the same day that the injury occurred formed the basis of injury surveillance in a high school in Chicago [McLain & Reynolds, 1989]. This school employed one full-time and one part-time athletics trainer who were responsible for treating and diagnosing the sports injury. The trainers were also responsible for maintaining an injury evaluation sheet that recorded information about the sport being played; the date of the injury; the history of the injury, including whether it occurred during competition or practice; the results of the physical examination; the diagnosis; the disposition and whether a physician referral was indicated. The selection criteria for injuries to be included in the study meant that the minor injuries were not recorded.

Davidson [1987] has maintained a surveillance of schoolboy rugby injuries in New South Wales since 1969. A casualty station has been operating during all Saturday interschool rugby matches since 1969 with only one doctor servicing this place of treatment. Davidson
has recorded information about the age of the injured player, the date, diagnosis, treatment, follow-up, grade of play, team position and mechanism of accident for all cases that he has treated at the casualty station. Because he has been the only person servicing the casualty station, there has been consistency in the recording and management of the injuries over the whole time that the clinic has been operating.

Lenaway et al. [1992] utilised the adults administering first aid (teacher, school nurse, athletic coaches, etc.) at schools within the Boulder Valley School District to conduct surveillance of school-related injuries over one school year period. Data collection was achieved by the completion of a standardised injury report form which gave information about the causes and the nature of the injury.

4.10 WORKERS COMPENSATION STATISTICS

Garrick and Requa [1993] reported an examination of ballet injuries that were identified by examining workers compensation records covering a three-year period for a major professional ballet company. An injury was therefore defined as any condition resulting in any financial outlay for medical expenses for which a claim was lodged with the worker's compensation agency. As a surveillance tool, these authors noted a number of limitations of any system based on workers compensation statistics [Garrick & Requa, 1993]:

- Workers compensation records under-represent the actual total medical costs associated with an injury.
- The injured athlete often incurs additional costs that are not met by the compensation system such as self-referral to other health professionals and self treatment.
- Some athletes do not want their organisation to know that they are injured so they will not lodge a claim.

A recent report of sports injuries in the Australian Army was also based on the findings of a four year review of injury reports forwarded to the Army Directorate of Occupational Health and Safety [Rudzski, 1994]. In the army, all sports injuries are considered to be work-related and so are compensated by workers compensation insurance. Rudzski's study was able to identify the four major football codes (Australian football, soccer, rugby league and rugby union) and Touch football as being responsible for the majority of reported injuries. However, the lack of participation data to relate the worker's compensation data to makes it hard to assess the relative risk of injury for participants of these activities, relative to each other and other activities.

4.11 INSURANCE DATABASES

Insurance databases have the potential to contribute much to the knowledge of the costs of sports injuries and some factors associated with the injuries. The Accident Compensation Commission (ACC) database in New Zealand has been shown to be of value in providing data that can lead to the prevention of sports injuries [Milne, 1992]. Switzerland also has a number of insurance databases that can provide information on the epidemiology of sports injuries in that country and these have been reviewed in detail by de Loës [1992].
4.12 COMMUNITY SURVEYS

Nicholl et al. [1991] conducted a pilot study that used a postal questionnaire sent to a random sample of people drawn from a geographically-defined population. They concluded that the validity of a survey to assess the incidence of sports injuries in a community based on a mailed-out questionnaire will depend upon:

- The return rates achieved - high response rates are desirable.
- The content validity of the questions, that is are the questions obtaining the sort of information they are intended to collect. This could be verified by interviewing a sub-sample of respondents to validate their response.

Sanders et al. [1989] conducted a pilot sports injury data collection survey of the general sporting community in the ACT during 1988/89. The survey provided a very important trial of data collection methodologies that could be extended to a national surveillance in the future. Data was collected during a two-week period from a range of sources (major public hospital casualty wards, general practitioners, physiotherapists, sports medicine practitioners and podiatrist) about all sports injuries encountered by these sports professionals over the data collection period. A standardised data collection form was prepared and definitions of a recordable sports injury given.

On the basis of their pilot survey, Sanders et al. [1989] concluded that the data collection form for any sports injury surveillance system should be as simple as possible. Furthermore, it should be accompanied by documentation providing explanations of the terms used on the form and the procedures to be followed in completing it. They also recommended that similar surveys should be carried out over a longer period of time and in both summer and winter to account for seasonality influences on sports participation and sports injuries.

4.13 POPULATION-BASED SURVEILLANCE

Falköping is a municipality in Sweden with an injury surveillance system that records every emergency visit to a physician within this region. This population-based surveillance system has enabled a study of the costs of sports-related injuries within the total population [de Loës, 1990]. An advantage of this study is that it has been able to related the total medical treatment and the services required for the sports injuries to be related to the total consumption of medical care in the community.

4.14 LONGITUDINAL STUDIES OF ATHLETES AND SPORTS PARTICIPANTS

Longitudinal studies of sports participants are used to follow the injury experience of a well-defined group of sports participants over time. This sort of study design is known as a cohort design and whilst known to be very powerful in the epidemiological sense, it has not been widely employed in studies of sports injuries. One of the major reasons limiting the widespread use of cohort studies is their great expense and running costs.

A recent study has reported a two year follow-up of child elite athletes participating in the sports of soccer, gymnastics, tennis and swimming [Baxter-Jones et al., 1993]. The 453 children who participated in this study were recruited over the period 1987-1990 and were followed up over two years. Data about injuries that occurred during the follow-up period
were collected by an annual medical examination and a semi-structured interview with the children.

McMahon et al. [1993] conducted a prospective study of Australian rules football injuries in children and adolescents. They employed volunteer coordinators chosen by the club or clinic to perform the study duties which included the following: maintaining a diary of player football exposure (actual time spent by player participating in football games or training); maintain injury record forms, including environmental conditions; maintaining player forms which recorded individual player characteristics. This is one of the few studies that has collected both detailed injury and exposure data allowing meaningful injury risks to be computed.

Surveillance of football injuries during football at the elite level has also recently been reported [Seward et al., 1993]. Team doctors were used to record details of all injuries that occurred. The authors noted that a problem with the data collection method related to the fact that some teams had paid doctors whereas others acted in honorary positions. This has the potential to affect the quality of the data collection since some doctors may be more motivated than others.

4.15 SURVEYS OF SPORTS PARTICIPANTS

Some authors have found that the best way to determine the range of sports injuries that participants incur is to survey them directly. This methodology is particularly appropriate when a focus is on only one sport at a particular level of play. O'Brien [1992] conducted a survey of 23% of the total senior rugby population in the Leinster province of Ireland. He administered a questionnaire to these players to collect information about the type and site of injuries that these players had received whilst playing rugby over the previous three seasons.

Kolt and Kirkby [1993] described the epidemiology of women's gymnastics injuries amongst a group of elite and non-elite gymnasts who had been identified by the Australian Gymnastic Federation as potential candidates for the national team. A questionnaire to assess personal, training and injury history details was distributed to all gymnasts to complete at home. Questionnaires were distributed during a training session and were collected from the athletes at the next training session. The study had an 82% response rate but was limited by the fact that retrospective information about injuries that had occurred during the previous 12 month period was collected. The authors concluded that this might have lead to an over-reporting of past injuries by some gymnasts to account for their recent performance problems.

4.16 COMBINING DATA SOURCES

Hahn and colleagues [1993] attempted to describe the epidemiology of injuries occurring to Australian Sport and Recreational Anglers. They found that no single data source provided an adequate description of the range of injuries and that a combination of a number of existing sources was more complete. This is consistent with the sports injury pyramid developed in Chapter 2.
CHAPTER 5: THE CONSULTATION PROCESS

5.1 INTRODUCTION

An important component of this feasibility study involved consultation with key sporting bodies and sports injury professionals. The aim of this consultation phase was to obtain information about existing data sources and sports injury data collection activities throughout the country that had not yet been published. In addition, views from key sports and sports injury organisations on the potential for improving current data collections in the future were sought.

The consultation process was achieved through a number of means:

- Wide distribution of a survey questionnaire to over 110 sports and sports injury organisations and individuals.
- Face to face interviews with selected key sports and sports injury organisations and individuals.
- A forum of Victorian sports bodies.
- Discussions at other key national meetings.

It is the purpose of this Chapter to describe the consultation process, and to summarise the views expressed during this exercise. Recommendations based on this consultation process are included in Chapter 10.

5.2 MAIL-OUT SURVEY QUESTIONNAIRE

An Australia-wide survey of sporting bodies was conducted to determine the feasibility of, and resources required for, sports-based injury surveillance. Discussion with relevant authorities in most states and territories was also used to determine the status quo and potential for improvements to current data collection systems or the development of new systems.

It is important that this study represents the current practices and views of the key individuals and organisations currently involved, or likely to become involved, in collecting and using sports injury and participation data. A questionnaire seeking these details was therefore developed and sent to key sports administration bodies, coaching and sports trainer associations, national sporting organisations, sports medicine bodies, government bodies, sports insurance companies and researchers. Information collected in this survey was also used to summarise existing sports injury surveillance systems throughout Australia, including their limitations and strengths.

Recommendations for improving data collection methodologies for sports injury and participation rates should be applicable both nationally and at a state level. For this reason, the survey questionnaire was widely circulated throughout Australia. Data collections must be relevant to the end users of the data including coaches and trainers, sports medicine professionals, policy makers, researchers and the sports participants themselves. Questionnaires, seeking views from each of these groups on how current data collections could be improved and what they should focus on, were therefore sent to representatives.
from each of these sports sectors. The circulation list for distribution of the questionnaire was developed following consultation with several key bodies.

5.2.1 The questionnaire

A questionnaire was developed for circulation to a wide range of sporting bodies. A copy of this questionnaire is given in Appendix 1, and the covering letters accompanying it in Appendix 2.

This questionnaire sought information from a number of key areas:

Section 1: Organisation details. This section collected information about the nature and type of organisation responding so that a profile of bodies interested in sports injury data could be obtained. This profile is presented in Section 5.2.2

Section 2: Sports and recreational participation data. Participation data is necessary for population denominators so that injury risks and rates can be determined and various activities compared. This section therefore sought information about current data collections of sports participation data. Because the questionnaire was circulated to a range of organisations with different foci on sports participation, this section of the questionnaire was divided into two parts:

Section 2a: Participation data for organisations (e.g. club membership).

Section 2b: Participation data for individuals (e.g. patients attending a sports medicine clinic).

The results of this part of the survey are described in detail in Chapter 8.

Section 3: Sports and recreational injury data. The purpose of this section was to identify the organisations and individuals that are currently collecting sports injury data. The results of this section of the survey are described in Chapter 7.

Section 4: Other data collections within the organisation. This section of the questionnaire collected supplementary information about other data collection activities conducted by each organisation that were not directly related to sports injury or participation data but which nevertheless give valuable information about the activities of that organisation.

Section 5: Plans for future data collections. This section collected information about potential and future plans for further data collections. These are summarised in Chapters 7 and 8.

Section 6: Recommendations for improved data collection, storage and dissemination. This was the most important section for obtaining views on how to improve data collection procedures in the future. The results of this section of the survey are described in Section 5.2.3. Chapter 10 includes these suggestions in the overall recommendations from this project, where appropriate.
### Table 5.1  Summary of response rates for the survey

<table>
<thead>
<tr>
<th>ORGANISATION TYPE</th>
<th>No. of responding organisations</th>
<th>No. of non-responding organisations</th>
<th>Overall response rate (%)</th>
<th>No. of individuals responding</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SPORTS MEDICINE PROFESSIONALS AND GROUPS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australian Association of Exercise &amp; Sport Science</td>
<td>1</td>
<td>0</td>
<td>90</td>
<td>1</td>
</tr>
<tr>
<td>Australian Sports Medicine Federation</td>
<td>7</td>
<td>1</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Sports Physicians</td>
<td>8</td>
<td>1</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Sports Physiotherapists</td>
<td>3</td>
<td>0</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td><strong>OTHER NON-SPORTS-SPECIFIC PROFESSIONAL BODIES: HEALTH &amp; SPORT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health Professionals</td>
<td>9</td>
<td>1</td>
<td>94</td>
<td>10</td>
</tr>
<tr>
<td>Sports Trainers</td>
<td>1</td>
<td>0</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Other Organisations</td>
<td>7</td>
<td>0</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td><strong>SPORTING BODIES: NON SPORT - SPECIFIC</strong></td>
<td>7</td>
<td>0</td>
<td>100</td>
<td>8</td>
</tr>
<tr>
<td><strong>SPORTING BODIES: SPORT - SPECIFIC</strong></td>
<td>20</td>
<td>0</td>
<td>100</td>
<td>20</td>
</tr>
<tr>
<td>Athletics</td>
<td>1</td>
<td>0</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Badminton</td>
<td>1</td>
<td>0</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Baseball</td>
<td>1</td>
<td>0</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Basketball</td>
<td>2</td>
<td>0</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Boxing</td>
<td>1</td>
<td>0</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Cricket</td>
<td>1</td>
<td>0</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Football</td>
<td>1</td>
<td>0</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Gymnastics</td>
<td>1</td>
<td>0</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Horse-riding</td>
<td>1</td>
<td>0</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Lacrosse</td>
<td>2</td>
<td>0</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Netball</td>
<td>2</td>
<td>0</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Rugby</td>
<td>1</td>
<td>0</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Soccer</td>
<td>1</td>
<td>0</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Softball</td>
<td>1</td>
<td>0</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Squash</td>
<td>1</td>
<td>0</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Swimming</td>
<td>2</td>
<td>0</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td><strong>GOVERNMENT DEPARTMENTS</strong></td>
<td>11</td>
<td>0</td>
<td>100</td>
<td>11</td>
</tr>
<tr>
<td>Education</td>
<td>1</td>
<td>0</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Health</td>
<td>2</td>
<td>0</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Sport</td>
<td>7</td>
<td>0</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Statistics</td>
<td>1</td>
<td>0</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>RESEARCHERS</strong></td>
<td>10</td>
<td>0</td>
<td>100</td>
<td>10</td>
</tr>
<tr>
<td><strong>INJURY SURVEILLANCE SYSTEMS</strong></td>
<td>2</td>
<td>0</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td><strong>SPORTS INSURERS</strong></td>
<td>8</td>
<td>3</td>
<td>73</td>
<td>8</td>
</tr>
<tr>
<td><strong>WORK INSURANCE AUTHORITIES</strong></td>
<td>7</td>
<td>4</td>
<td>64</td>
<td>7</td>
</tr>
<tr>
<td><strong>OTHER</strong></td>
<td>5</td>
<td>0</td>
<td>100</td>
<td>5</td>
</tr>
<tr>
<td><strong>GRAND TOTAL</strong></td>
<td>106</td>
<td>10</td>
<td>91</td>
<td>111</td>
</tr>
</tbody>
</table>

### 5.2.2 Profile of the responding organisations and individuals

The questionnaire was mailed to 116 organisations or individuals with some responsibility for sports participation or sports injury data and issues. These organisations can be broadly grouped into the following categories (Table 5.1):
• Sports medicine professionals and groups
• Other sports professional bodies from the health and sport sectors (not sport-specific)
• Non-sport-specific sporting bodies
• Sport-specific sporting bodies
• Government departments
• Researchers
• Injury surveillance systems
• Sports insurers
• Occupational insurance authorities
• Others.

Up to two reminder phone calls were made to organisations that did not respond to the questionnaire within the stipulated time. For some organisations, responses from more than one individual were received.

Of the 116 organisations that were sent the questionnaire, 106 responded; there was a total of 111 individuals who responded. This corresponds to a response rate of 91%. This exceptional response rate for a mailed-out questionnaire can be attributed to the general high level of enthusiasm and support for the need to improve sports injury data collection from across a wide range of sports bodies across the country.

A small number of organisations (7) felt that they could not contribute information to the overall survey because they did not collect either sports injury or sports participation data. However, they all recognised the importance of this data and contacted us to tell us of this. For this reason, these organisations have been included in the response rates. Appendix 3 gives the name of the responders and the organisations they represented.

The response rates within the various sectors of the sporting community are given in Table 5.1. The 100% response rate amongst sporting bodies is of particular note and signals that these bodies have a strong commitment to promoting safe environments for their participants. Response rates were lowest amongst the insurance sectors. This is probably due to work-based insurers not recognising that sports injuries come under their umbrella, even if sports participants are paid employees. In addition, not all of the insurance companies approached dealt solely with sports injury insurance. Many companies acted as brokers for other insurers and therefore did not recognise the relevance of the survey to their activities because the parent companies they represent maintain the insurance claim records.

Table 5.2 describes the profile of the responding organisations in terms of the type of organisation they represent. A number of responders classified themselves as having a number of roles and so the percentages in this table do not add up to 100%.

The category "other" includes individuals, first aiders, lobbyists, manufacturers of sports protective equipment, workers compensation agencies, community based injury prevention programs, hospital emergency departments and other medical centres and health professionals.

The level of responsibility of these organisations is described in Table 5.3. Many organisations had responsibilities at more than one level and this is shown in the percentages given in this table. Many of organisations had national responsibility and a significant proportion was responsible for sports activities at a community level. Other levels of responsibility included international and tertiary education or research.
Table 5.2  Type of organisations responding to the survey questionnaire

<table>
<thead>
<tr>
<th>Type of organisation</th>
<th>Number of organisations</th>
<th>Proportion of all organisations (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research</td>
<td>25</td>
<td>22.5</td>
</tr>
<tr>
<td>Sporting body/club/association</td>
<td>24</td>
<td>22.0</td>
</tr>
<tr>
<td>Sports medicine</td>
<td>22</td>
<td>19.8</td>
</tr>
<tr>
<td>Community Educator</td>
<td>21</td>
<td>18.9</td>
</tr>
<tr>
<td>Professional Educator</td>
<td>21</td>
<td>18.9</td>
</tr>
<tr>
<td>Government</td>
<td>20</td>
<td>18.0</td>
</tr>
<tr>
<td>Sports administration</td>
<td>16</td>
<td>14.4</td>
</tr>
<tr>
<td>Injury surveillance</td>
<td>9</td>
<td>8.1</td>
</tr>
<tr>
<td>Insurance</td>
<td>7</td>
<td>6.3</td>
</tr>
<tr>
<td>Other roles</td>
<td>21</td>
<td>18.9</td>
</tr>
</tbody>
</table>

Twenty-seven per cent of the responders stated that their organisations had responsibility for particular sports or recreational activities, such as football or basketball. These were generally the sporting bodies themselves. The majority of organisations, however, covered a range of sporting activities.

Table 5.3  Level of responsibility of the responding organisations

<table>
<thead>
<tr>
<th>Level of responsibility</th>
<th>Number of organisations</th>
<th>Proportion of all organisations (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>National</td>
<td>45</td>
<td>40.5</td>
</tr>
<tr>
<td>State</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VIC</td>
<td>38</td>
<td>34.2</td>
</tr>
<tr>
<td>NSW</td>
<td>10</td>
<td>9.0</td>
</tr>
<tr>
<td>QLD</td>
<td>6</td>
<td>5.4</td>
</tr>
<tr>
<td>WA</td>
<td>8</td>
<td>7.2</td>
</tr>
<tr>
<td>SA</td>
<td>5</td>
<td>4.5</td>
</tr>
<tr>
<td>TAS</td>
<td>8</td>
<td>7.2</td>
</tr>
<tr>
<td>ACT</td>
<td>4</td>
<td>3.6</td>
</tr>
<tr>
<td>NT</td>
<td>4</td>
<td>3.6</td>
</tr>
<tr>
<td>Local</td>
<td>17</td>
<td>15.3</td>
</tr>
<tr>
<td>School</td>
<td>8</td>
<td>7.2</td>
</tr>
<tr>
<td>Community</td>
<td>22</td>
<td>19.8</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>4.5</td>
</tr>
</tbody>
</table>

The most commonly reported organisational roles are summarised in Table 5.4. In many instances, organisations had more than one role. The category “education and training” includes coach and trainer education, first aid training and community education. Other roles reported included coach development, coach or trainer education, specific sports medicine professions, representing Olympic or elite level sport and administrating particular sports bodies and associations.
Almost half (46%) of the organisations that returned a completed questionnaire, collected information about sports injuries. Chapter 7 describes these data collections in terms of their coverage, actual data collected and the information they can provide.

Of the 111 individual responders, 28% stated that they collected or collated sports participation data from organisations or clubs. A further 18% collected participation details directly from individuals, e.g. through a sports medicine clinic. A summary of these data collections is given in Chapter 8.

5.2.3 Recommendations for improving sports injury and sports participation data collections

Forty-five of the 111 individual responders provided recommendations for improving data collections. It was widely felt that a major reason for the lack of sports injury data is the general lack of commitment to sports safety across a range of sectors particularly those of government and funding. Table 5.5 lists the major recommendations for improving sports injury data, collection, storage and dissemination provided by the responders to the survey questionnaire.

Other recommendations included the need to be able to distinguish between a registered and a non-registered player and to collect data on a number of specific issues including soft tissue injuries, diet, nutrition and menstrual irregularities and head injuries.

5.2.4 Current barriers to the collection of sports participation and sports injury data

A component of the survey questionnaire sought views about the main barriers towards collecting sports participation and sports injury data. Of the 111 respondents, 79 provided information on barriers to collecting sports participation data. These are summarised in Table 5.6.

Other issues raised included the need for a simple and uniform system to collect this data, that state associations want to act independently of national ones and the large seasonal variation in sports participation. A few responders noted that sometimes a distinction between sports and recreational activities and work is blurred. This is a particular issue for rural communities where horse-riding occurs during both sport and work activities but there is no clear indication as to which sector is responsible for the injury problem.
Table 5.5 Major recommendations for improved data collection, storage and dissemination

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Proportion of all responders (n=45) who gave this recommendation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop a standardised data collection form, coding scheme and computer package that are simple to use.</td>
<td>24.4</td>
</tr>
<tr>
<td>Identification of a lead body to collect and disseminate the information. Coordination on a national level.</td>
<td>20.0</td>
</tr>
<tr>
<td>Improve data collection and reporting through improving training in injury prevention.</td>
<td>17.8</td>
</tr>
<tr>
<td>Collect sports injury data from a representative sample of sports participants and/or communities.</td>
<td>11.1</td>
</tr>
<tr>
<td>Collect data from sports medicine practitioners, general practitioners and other health professionals involved in the treatment and management of sports injuries.</td>
<td>8.9</td>
</tr>
<tr>
<td>Widely adopt appropriate coding schemes such as ICD-10, or the Orchard Sports Injury Classification System for the diagnosis of sports injuries. Develop a national diagnosis scheme for the Australian Coroners' database.</td>
<td>6.7</td>
</tr>
<tr>
<td>Improve the collection of sports participation data and agree upon standard definitions that account for registered/non-registered participants, organised sports versus recreational play, etc.</td>
<td>6.7</td>
</tr>
<tr>
<td>Develop appropriate government policies and increase the media profile of sports injuries.</td>
<td>6.7</td>
</tr>
<tr>
<td>Provide funding incentives to collect and record sports injury data.</td>
<td>4.4</td>
</tr>
</tbody>
</table>

There was a considerable amount of overlap between the barriers cited for sports participation data and the barriers reported for the collection of injury data. Table 5.7 summarises the major perceived barriers towards collecting sport injury data given by 76 of the respondents.

The accuracy of the collected data was also of concern to a number of respondents, particularly regarding diagnosis details. Others noted that some sports medicine practitioners are wary of sports injury surveillance and others are reluctant to share information.

5.3 FACE-TO-FACE INTERVIEWS

Because of the very major role, or potential for such a role, that certain organisations and individuals have in sports injury data collection, personal interviews were conducted with key people from a number of organisations. Many of these organisations also completed the mail-out questionnaire and so the interview provided the opportunity to explore some of the issues further. The organisations and individuals interviewed are listed in Appendix 4. Details of the sports injury data collections maintained by these individuals and their organisations are described in Chapters 7 and 8. The views and ideas expressed by the organisations interviewed contributed to the development of the recommendations from this
study. Their valuable input is acknowledged here and is evident in Chapter 10 of this report.

Table 5.6   Current barriers to the collection of sports participation data

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Proportion of all responders (n=79) who stated this barrier(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of funding and resources. This is related to the fact that collection of this data is not a priority on government agendas.</td>
<td>32.9</td>
</tr>
<tr>
<td>Lack of consistent definitions of what is a sport and different levels of play that should be classified as sport. The variety of sports makes a uniform definition of exposure difficult.</td>
<td>17.7</td>
</tr>
<tr>
<td>The large number of unregistered players and participants in informal sports.</td>
<td>13.9</td>
</tr>
<tr>
<td>Time and workload constraints.</td>
<td>13.9</td>
</tr>
<tr>
<td>Lack of co-ordination and guidelines. In particular, there appears to be little communication between the relevant government authorities.</td>
<td>12.7</td>
</tr>
<tr>
<td>Poor recording practices and the lack of accurate information collected and reported. Self-reported data may be subject to recall bias. There could be a perception amongst sporting bodies that the accurate reporting of numbers of participants could lead to higher fees levied against them.</td>
<td>12.7</td>
</tr>
<tr>
<td>Lack of cooperation from coaches and trainers, etc. and the lack of suitable personnel to collect this information. Often the people best placed to collect this information are volunteers.</td>
<td>11.4</td>
</tr>
</tbody>
</table>

5.4 SPORTS FORUM

A forum of sporting bodies was organised through the Victorian Health Promotion Foundation's network together with key sporting groups and the project researchers to explore a range of issues relating to sports injury data collections. During the forum, open discussion was encouraged on sports injury data issues including data collection systems, participation data, the sports bodies' current practices, future plans for monitoring injuries within sport and views on key issues in the field of sports injuries.

The forum was well attended with the following sporting organisations represented:

VICSPORT
Victorian Badminton Association Inc
Victorian Baseball Association
Victorian Gymnastics Association
Victorian Institute of Sport
Victorian Rugby Union Inc
Victorian Soccer Federation
Victorian Softball Association
Victorian Squash and Racquetball Federation
The Victorian Health Promotion Foundation and the Monash University Accident Research Centre were also in attendance.

### Table 5.7 Current barriers to the collection of sports injury data

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Proportion of all responders (n=76) who stated this barrier (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of funding resources. This is a particular issue for the conduct of community-based surveys to cover a range of sports activities at various levels of play.</td>
<td>23.7</td>
</tr>
<tr>
<td>Poor quality of the available data and recording procedures currently being used. The data currently collected is often not representative across a broad range of sports injuries.</td>
<td>19.7</td>
</tr>
<tr>
<td>Lack of interest in, and understanding of, the need to collect data about sports injuries. Lack of commitment to collect this information.</td>
<td>17.1</td>
</tr>
<tr>
<td>Lack of cooperation with coaches and sports trainers from sports bodies. Poor administration of sports bodies and other organisations.</td>
<td>15.8</td>
</tr>
<tr>
<td>Time constraints</td>
<td>15.8</td>
</tr>
<tr>
<td>There is no standard data collection form to facilitate and guide sports injury data collection.</td>
<td>14.5</td>
</tr>
<tr>
<td>Lack of people with the appropriate skills and knowledge to collect this information.</td>
<td>10.5</td>
</tr>
<tr>
<td>There is no agreed definition of sport, a sports injury, a sports participant or the severity of a sports injury. Standardised diagnosis schemes are also needed. There are also difficulties with quantifying exposure so that injury risks can be accurately determined.</td>
<td>9.2</td>
</tr>
<tr>
<td>The range of possible modalities and places for treatment. This limits the representativeness of sports injury data collections based on just one source of data from a particular place of treatment.</td>
<td>6.5</td>
</tr>
</tbody>
</table>

Each of the sporting organisations contributed actively to the discussion and welcomed the opportunity for their sport to contribute to the study and its recommendations. Discussion was focussed around nine key questions. A summary of the views expressed by the sporting bodies follows:

1. **Are injuries a major focus for sporting clubs and associations?**

   Sports injuries are an important issue because they affect participation in a sport. They are a particular issue when more is at stake such as during national competition rather than local level competition. In relation to this, the sports bodies agreed that it would be useful to get some data about the effects of playing "at all costs".

   Sporting associations would support improving data collection on sports injuries providing that this had no detrimental effect on their sports or other activities. They believed that a focus could be on coaches to take responsibility for the recording of all injuries, particularly since coach education is an important part of injury prevention. There was some concern that injury surveillance could encourage parents and other persons to litigate against them.
2. **What information about sports injury prevention would be useful?**

Data about sports injuries is needed to provide feedback to coaches and other sports association personnel. Data should also be collected about who is doing the coaching and what education they have had in injury prevention.

Raw data is not of much use to the sporting bodies in that they do not always know how to interpret it properly. Any data should be presented in a meaningful and useful way so that it can be directly applied by coaches, trainers and the participants themselves.

Specific information required by sports associations includes data on the benefits of warm-up and warm-down procedures for preventing injuries, how to translate injury prevention strategies from adult and professional participants to children's sports and specific trends in the use of injury prevention strategies including protective equipment.

If data to identify specific injuries were collected at a national level then some impetus might be able to be generated to implement injury prevention strategies, such as rule changes, within sports. The state sports bodies are generally responsible to a national body. Without the sanctioning of the national body, they find it very hard to implement what they see as important injury prevention strategies.

3. **Would a uniform sports injury data collection form be useful?**

Having a uniform data collection form was widely accepted as a good thing. However, a major limitation of its widespread use relates to its users. The closer to the grass roots level that the data collection becomes, the more important it is to have a standardised form because of the different levels of knowledge and expertise amongst those likely to use it.

Some sports associations thought that the person providing the initial treatment of the injury should be the person to complete the data collection form. Others agreed that sports trainers could collect the data providing it required little effort on their part. In some instances, the injured person may be able to complete the form themselves. This is justification for keeping the data collection form as simple as possible. Furthermore, a uniform core data form would need to be capable of incorporation into a sport specific data collection because each sport has different requirements. For example, for some sports, such as gymnastics, a very simple form would not be acceptable because of the potential for litigation and the need to provide as much information as possible about the injury and its circumstances. There may not be such an obvious need for such information in other sports.

All the sports associations emphasised the need to ensure that the forms are filled out correctly so that the collected data is valid. This issue of the validity of the diagnosis information was raised in particular. Some sports bodies questioned whether there would be some deliberate misreporting at the professional levels of play and whether a data collection system would be able to account for this.

There was general agreement that it would not be feasible to go from the current state of no data collection to a large scale sports injury data collection through sporting associations in the immediate future. A staged approach would be preferable since any data collection process would need to get all relevant parties committed and involved in it to ensure the accuracy and validity of the data collection procedures.
4. **Would sporting clubs enter the data into a computer if a simple package were available?**

There was general agreement that this would not be feasible at this stage. Some sporting organisations would be able to do this sooner than others but there would need to be a good deal of education about the benefits before this could be implemented, particularly at the local level.

Sports clubs, rather than associations, would often be better positioned to collect the data; in addition, there are no funds available for the collection of data. However, sports clubs are often run by volunteers and it is hard enough for sporting bodies to keep up with the other paperwork they have to do, let alone computerised injury data entry.

5. **Who should have responsibility for collecting sports injury data?**

All sports associations agreed that this would depend upon the volume of data to be collected and the proportion of coverage of all sports injuries and levels of play required. Other major factors include where the data is to be collected from and by whom? This has implications for the definition of a reportable injury and the depth of detail required about each injury.

Some sports associations thought that the players themselves could report the injury rather than the clubs who already have an excessive paper work load. There was a general opinion that sports trainers are not trained to fill in forms and that this may not be very useful solution in the short term. Another suggestion was to use St John's Ambulance service personnel.

All agreed that some information on sports injuries and their occurrence was needed because of the potential for litigation.

6. **Which sports would be interested in collecting injury data?**

All the sports represented at the forum said that they would be interested this. Furthermore, all the sports associations said that they would like to be doing more to prevent injuries but that they did not always know the best approach to take. They felt that more research should be directed towards this aspect of prevention and that there should be a commitment to feed this information back to the sports associations in an easily understood and useable form.

7. **What are the barriers to collecting data?**

A number of important barriers were identified:

- A lack of time and resources.
- Parents and sports participants consider it an imposition.
- The general attitude towards sports injuries and their prevention.
- There are not so many injuries at the higher levels of play compared with the local levels. This means that professional level sports may not see injury prevention as a priority. Often the professional level dictates, or has a great influence on, what happens at the lower levels of play.
- Delayed diagnosis of the nature of injury so data cannot necessarily be collected in the field. This is a particular problem for overuse injuries.
• The number and range of different types of treatment modalities and health professionals who attend to a sports injury.

8. **What incentives are needed?**

The sporting associations identified the following possible incentives for data collection:

- Specific and targeted funding of clubs.
- Making it as simple as possible.
- Perhaps injury data could be recorded on the same paper as the results and score sheets during competition matches. However, this process would not be able to collect information from non-competition play.
- A phased approach in which a sample of clubs could be involved in a pilot test project. This could then demonstrate "best-practice" and provide impetus for other sports bodies.

9. **Would clubs implement safety measures if they were available?**

The sports associations said that they would implement sports safety measures if:

- They were told to or if they were made compulsory by the associations, particularly at the National level.
- A funding body such as VICHealth supported them or required them to do so.
- Appropriate equipment was available. For example, there are currently no standards for baseball helmets. This makes it hard to recommend them to players.
- The utility of protective equipment clearly outweighed its costs.
- They had information about what could be done. Most sporting associations felt that there was not enough information available for them to make informed decisions.

5.5 **OTHER CONSULTATION**

During the project several other opportunities to meet with sporting and sports injury organisations to discuss the issues raised above were taken advantage of. One of the co-authors of this report (J O-S) presented a paper entitled "Sport injury: what we know, what we need to know" during the National Health Goals and Targets Injury Control Seminar held in Melbourne in May 1994. This opened lively discussion during the meeting and contributed to the subsequent formulation of the draft sports injury control strategy that arose out of that meeting.

The annual meeting of the Australian Sports Medicine Federation's (ASMF) National Council meeting was also attended. This enabled discussion with representatives from each of the national and state branches, and has since led to considerable follow-up action.
CHAPTER 6: HOSPITAL-BASED SPORTS INJURY DATA COLLECTIONS IN AUSTRALIA

6.1 INTRODUCTION

Apart from a limited number of studies in progress, little systematic epidemiological research has been undertaken on sports injury in Australia. In particular, there is a lack of data on the circumstances of injury and potential points of intervention in the chain of events leading to injury. The only wide-reaching surveillance of sports and recreational injuries in Australia is through hospital-based data collections of hospital admissions and emergency department presentations.

Some information about sports injuries can be obtained from hospital-based data collections that identify sports injuries only in an aggregated form for hospital admissions. More detailed emergency department data is collected in relatively few hospitals but these data collections can provide valuable information.

Hospital-based sports injury data collections are therefore very useful for describing data on the more severe and acute sports injuries. However, only a proportion of all sports and recreational injuries will present at a hospital for treatment and so these systems underestimate the true magnitude of these injuries as a public health problem in Australia. Unfortunately, the extent of under-ascertainment cannot be estimated from the available data.

This Chapter aims to demonstrate the strengths and limitations of existing major health sector data systems with regard to sports injury data. A detailed examination of data from some of these is presented to demonstrate the utility of these hospital-based collections. This Chapter also aims to demonstrate how their utility can be maximised by comparisons between systems.

6.2 EVIDENCE FROM PRESENTATIONS AT HOSPITAL EMERGENCY DEPARTMENTS

The National Injury Surveillance Unit (NISU) maintains a national collection of injury surveillance data collected from hospital emergency department attendance records at more than fifty hospitals around Australia. This data collection is designed specifically to collect injury data, including that resulting from sports and recreational activities, and is an injured person-based data collection system. The fundamental role of the database is to identify local injury patterns within areas of each state and territory based on local data collection systems in hospital emergency departments. Each state is responsible for its own data collection but contributes its data to the national collection maintained by NISU.

The surveillance system does not provide comprehensive coverage of whole states. Over the period 1989-1992, seventy-four hospitals and other medical centres contributed to this injury surveillance scheme. These included seven paediatric hospitals and forty regional centre hospital emergency departments. Not all of the hospitals and medical centres contributed data over the full five year period, 1989-1993, however. There were only seven hospitals to do so and they were from Victoria and Queensland. However, the large number of records accumulated from around Australia can facilitate description of the less common categories of injuries and their associated factors. Inter-state differences can also be determined from the national data.
The injury surveillance in hospital emergency departments is facilitated by a standardised data collection methodology throughout Australia, although each state is responsible for its own data collection. This includes a standardised data collection form which is slightly modified to meet the needs and systems of the participating emergency departments. A copy of the data collection form used by the Victorian Injury Surveillance System is given as an example in Appendix 5. The first part of the form is completed by the injured person, or their parent, and includes a description of the circumstances associated with the incident resulting in injury. This includes the age and sex, time and place of injury, the context, breakdown event and mechanism of injury and associated environmental factors (including the use of safety equipment, activity being undertaken). The breakdown event is defined to be the event that led to the injury occurring and describes what went wrong prior to the injury. The mechanism of the injury describes the way that the injury was inflicted. The treating doctor has the responsibility of completing the second half of the form where diagnosis and treatment details are recorded.

The major advantage of this injury surveillance system is that it is the most comprehensive source of data across a broad range of injuries in Australia, to date. The narrative text description of the incident leading to the injury provides valuable information that can help to identify priorities for prevention at both statewide and community levels. This provides key information about the sequence of events leading to the injury, including details about the circumstances leading to, and surrounding, the injury [Nolan & Penny, 1992].

A further advantage is that the data are very timely and often available as a computerised database within a month of the injury occurring.

The emergency department injury surveillance system does have some limitations, however. The collected data are not suitable for demonstrating the absolute size or scope of the injury problem in the Australian community. Furthermore, the surveillance system does not provide comprehensive coverage of whole states. It should also be noted that the data are generally self-reported by the injured person, with the treating doctor providing diagnosis and treatment details. Because it contains injured cases from only a sample of hospitals in each catchment area, its main value is in providing descriptive information on the nature, causes and severity of injuries. The surveillance data is able to yield information on the frequency of a range of injuries across various activities. Although it cannot provide meaningful data on injury rates (e.g. injuries per thousand player hours) across activities, it can determine the proportions of injury types and associated causative factors.

The injury surveillance system clearly under-estimates the magnitude of the injury problem because it does not cover all hospital emergency departments in each state. Furthermore, not all injuries are treated at such departments. However, it is not possible to quantify the magnitude of this under-reporting. Within the injury surveillance system, rate data can be determined for some specific communities with complete coverage such as the Latrobe Valley in Victoria.

Because of the way that data has been collected from Paediatric and general hospitals, children are defined as being aged less than 15 years and adults as all people aged at least 15 years. Whilst this is not generally a limitation and some information can be obtained by single year of age, this age categorisation may not be appropriate for all circumstances.

6.2.1 Information about sports injuries

In terms of sports and recreational injuries, emergency department records provide useful data including some pre-event information and circumstances of injury in the patients who present at the emergency departments of participating hospitals. The data collection enables the circumstances of each injury to be identified so that the sports and recreational
events and behaviours preceding the injuries can be identified in addition to the actual mechanism of injury. It also provides a high level of detail regarding various types of injuries and allows for specific identification of hazards.

The limited information available on the incidence of sporting injury in Victoria indicates that sports and recreational activities are a common context for injury. The Victorian data is collected through the Victorian Injury Surveillance System (VISS). Data from VISS for the period 1989-90 have revealed that in the 10-14 year age range, for both boys and girls, sport-related injuries in children are the single highest cause of attendance to emergency departments as the result of injury [Routley & Ozanne-Smith, 1991; Nolan & Penny, 1992].

Hahn et al.[1993] have also found that this injury surveillance system data provides the most consistently recorded data available on a national level in their study of sport and recreational fishing injuries in Australia.

Sports and recreational injuries can be identified in a number of ways. Primarily, they identified by the context of the activity being undertaken at the time the injury occurred:

- Sport - Organised competition or practice
- Sport - Informal
- Sport - Unspecified
- Recreation - Playing (general activity)
- Recreation - Recreation or hobby - indoor
- Recreation - Recreation or hobby - outdoor on land
- Recreation - Recreation or hobby - outdoor on water
- Recreation - Other leisure.

The locations, or places, where injuries occur can also be used to identify sports and recreational injuries by choosing those where most injuries are likely to occur:

- Area for organised sport
- School playground
- Other school area (e.g. gymnasium)
- Area of outdoor land-based recreation
- Area of outdoor water-based recreation
- Residential setting
- Public playgrounds and amusement areas
- Area for transport.

Particular sports and recreational activities can be identified from the factor codes and from the narrative text description of the injury. The full range of sports and recreational activity codes used in the computerised database are given in the coding manual provided by NISU. These codes are based on the most frequently reported activities. There are, however, some instances in which a specific code cannot be assigned. For example, when an activity is specified to involve a ball and the sport is specified but it does not have an allocated code, the activity is coded as "other ball sport". When the sport is not stated, the activity with the ball is coded as "unspecified ball sport". A further limitation of this coding scheme is that the sports rugby union and rugby league receive the same code of "rugby".
Bicycling is an activity that is associated with sport and recreational activities but, perhaps more commonly, also as a means of transport. For this reason, bicycling can generally be considered to be a sports or recreational activity if it does not occur in an area for transport such as roads, footpaths, driveways, etc. However, many of professional bicyclists would also use the road for their cycling activities. For example, a survey of cyclists in metropolitan Melbourne in 1986 found that 86% of all adult bicycle use and 88 of all child bicycle use was for sport, exercise or recreational purposes [Spectrum Research, 1986].

As mentioned above, a major limitation of the data is that injury rates across different sports and recreational activities cannot be readily calculated or compared except in isolated geographic areas. However the data can be ranked in terms of:

- The number of injury presentations.
- The number of presentations that result in hospital admissions.
- The proportion of all presentations that result in admission to hospital.

On the basis of these three measures, a crude ranking of the sports and recreational activities leading to the most injury presentations and hospital admissions can be obtained. However, it is important to recognise that just because a particular sport ranks highly in terms of the number of presentations related to it, this does not necessarily mean that this particular activity is the most injury prone. It may just reflect the large number of participants in that sport. The extent to which this is the case cannot be adequately assessed because of the lack of comparable participation data, although crude participation data are available.

Severity of the injury can be determined by using the proxy measure of admission to hospital following attendance at an emergency department. Other injury severity measures could be developed in terms of the number of days in hospital or the incidence of particular injury types.

Sections 6.3 and 6.4 use the national injury surveillance system data for the period 1989-1993 to describe the sports and recreational injury cases that presented to a selection of hospital emergency departments across Australia during that time.

6.3 CHILD SPORTS INJURIES IDENTIFIED FROM INJURY SURVEILLANCE SYSTEMS

Over the period 1989-1993, 51,203 children under fifteen years of age were recorded as presenting for treatment of an injury at one of the NISU emergency departments sustained during sport or recreational activities. This corresponds to 20% of all injury presentations to these emergency departments. Just over 14% of the sports and recreational injured cases were subsequently admitted to hospital for further treatment. The level of underascertainment at hospitals contributing to the system is variable and is not known accurately.

6.3.1 Sports and recreational activities

Table 6.1 lists the top twenty most frequent sports and recreational activities that led to a child presenting with an injury at one of the NISU participating hospitals. Approximately, 92% of all sport and recreational child emergency department presentations are represented in Table 6.1.
Cycling for recreation, exercise or sport accounted for over one-quarter of all sports and recreation-related emergency department presentations. This calculation is based on the assumption that 100% of the non-transport area and 88% of the transport-area related cycling injuries are related to sport or recreational activities. This shows the important role of bicycling as an activity leading to injury.

The sport most often associated with a child sports-injury presentation at an emergency department was Australian football which accounted for 11.3% of all sports and recreation injury presentations. Thus there was 15.4 times as many Australian football-related emergency department presentations than swimming-related presentations.

Table 6.1 Top 20 most frequent sports and recreational activities leading to a child injury presentation at an emergency department in Australia

<table>
<thead>
<tr>
<th>Rank</th>
<th>Sports or recreational activity</th>
<th>Number of presentations</th>
<th>Proportion of all sports and recreation presentations (%)</th>
<th>Ratio of the number of presentations for each activity compared to swimming</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bicycling</td>
<td>13745</td>
<td>26.2</td>
<td>35.6</td>
</tr>
<tr>
<td>2</td>
<td>Australian football</td>
<td>5948</td>
<td>11.3</td>
<td>15.4</td>
</tr>
<tr>
<td>3</td>
<td>Roller skating/blading</td>
<td>3403</td>
<td>6.5</td>
<td>8.8</td>
</tr>
<tr>
<td>4</td>
<td>Basketball</td>
<td>3308</td>
<td>6.3</td>
<td>8.5</td>
</tr>
<tr>
<td>5</td>
<td>Soccer</td>
<td>3148</td>
<td>6.0</td>
<td>8.1</td>
</tr>
<tr>
<td>6</td>
<td>Trampolines</td>
<td>3129</td>
<td>6.0</td>
<td>8.1</td>
</tr>
<tr>
<td>7</td>
<td>Skateboards</td>
<td>2697</td>
<td>5.1</td>
<td>7.0</td>
</tr>
<tr>
<td>8</td>
<td>Cricket</td>
<td>1945</td>
<td>3.7</td>
<td>6.9</td>
</tr>
<tr>
<td>9</td>
<td>Netball</td>
<td>1924</td>
<td>3.7</td>
<td>5.0</td>
</tr>
<tr>
<td>10</td>
<td>Rugby</td>
<td>1910</td>
<td>3.6</td>
<td>4.9</td>
</tr>
<tr>
<td>11</td>
<td>Gymnastics</td>
<td>1244</td>
<td>2.4</td>
<td>3.2</td>
</tr>
<tr>
<td>12</td>
<td>Unspecified ball sports</td>
<td>1146</td>
<td>2.2</td>
<td>2.7</td>
</tr>
<tr>
<td>13</td>
<td>Baseball</td>
<td>936</td>
<td>1.8</td>
<td>2.4</td>
</tr>
<tr>
<td>14</td>
<td>Track and field</td>
<td>799</td>
<td>1.5</td>
<td>2.1</td>
</tr>
<tr>
<td>15</td>
<td>Tennis</td>
<td>587</td>
<td>1.1</td>
<td>1.5</td>
</tr>
<tr>
<td>16</td>
<td>Hockey</td>
<td>566</td>
<td>1.1</td>
<td>1.4</td>
</tr>
<tr>
<td>17</td>
<td>Horseback riding</td>
<td>544</td>
<td>1.0</td>
<td>1.4</td>
</tr>
<tr>
<td>18</td>
<td>Exercise equipment</td>
<td>493</td>
<td>0.9</td>
<td>1.3</td>
</tr>
<tr>
<td>19</td>
<td>School physical education</td>
<td>446</td>
<td>0.9</td>
<td>1.2</td>
</tr>
<tr>
<td>20</td>
<td>Swimming</td>
<td>387</td>
<td>0.7</td>
<td>1.0</td>
</tr>
</tbody>
</table>

The popular sports of Australian football, basketball, soccer, cricket, netball and rugby each appeared in the top 10 most frequently reported activities leading to an injury presentation. The fact that roller skating/blading, skateboards and bicycling also appear in the top ten highlights the potential for "wheeled" recreational activities to lead to injury because of the speed at which they travel and the surfaces people fall on.

On a state-by-state basis, bicycling is the most common sport and recreational activity leading to presentation at a hospital emergency department for treatment in all areas (Table 6.2). Table 6.2 also shows that Australian football was the second most common reason for presenting to an emergency department for a sports injury in four of the seven Australian states and territories. In Western Australia and Tasmania it was ranked third after bicycling and basketball and it was ranked seventh in New South Wales. This reflects the preference for participation in other football codes in these States.
<table>
<thead>
<tr>
<th>South Australia</th>
<th>ACT</th>
<th>New South Wales</th>
<th>Queensland</th>
<th>Western Australia</th>
<th>Tasmania</th>
<th>Victoria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicycling</td>
<td>Bicycling</td>
<td>Bicycling</td>
<td>Bicycling</td>
<td>Bicycling</td>
<td>Bicycling</td>
<td>Bicycling</td>
</tr>
<tr>
<td>Australian football</td>
<td>Australian football</td>
<td>Rugby</td>
<td>Australian football</td>
<td>Basketball</td>
<td>Australian football</td>
<td>Australian football</td>
</tr>
<tr>
<td>Skateboards</td>
<td>Basketball</td>
<td>Roller skating/blading</td>
<td>Roller skating/blading</td>
<td>Australian football</td>
<td>Trampolines</td>
<td>Trampolines</td>
</tr>
<tr>
<td>Soccer</td>
<td>Soccer</td>
<td>Trampolines</td>
<td>Soccer</td>
<td>Trampolines</td>
<td>Australian football</td>
<td>Australian football</td>
</tr>
<tr>
<td>Netball</td>
<td>Skateboards</td>
<td>Skateboards</td>
<td>Skateboards</td>
<td>Tiger riding</td>
<td>Trampolines</td>
<td>Trampolines</td>
</tr>
<tr>
<td>Basketball</td>
<td>Roller skating/blading</td>
<td>Soccer</td>
<td>Rugby</td>
<td>Skateboards</td>
<td>Cricket</td>
<td>Skateboards</td>
</tr>
<tr>
<td>Cricket</td>
<td>Trampolines</td>
<td>Gymnastics</td>
<td>Australian football</td>
<td>Basketball</td>
<td>Netball</td>
<td>Cricket</td>
</tr>
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<td>Trampolines</td>
<td>Gymnastics</td>
<td>Australian football</td>
<td>Basketball</td>
<td>Skateboards</td>
<td>Cricket</td>
<td>Netball</td>
</tr>
<tr>
<td>Unspecified ball sports</td>
<td>Netball</td>
<td>Netball</td>
<td>Netball</td>
<td>Netball</td>
<td>Gymnastics</td>
<td>Unspecified ball sports</td>
</tr>
<tr>
<td>Roller skating/blading</td>
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<td>Cricket</td>
<td>Cricket</td>
<td>Baseball</td>
<td>Netball</td>
<td>Hockey</td>
</tr>
<tr>
<td>Gymnastics</td>
<td>Hockey</td>
<td>Surfing</td>
<td>Gymnastics</td>
<td>Track and field</td>
<td>Swimming</td>
<td>Unspecified ball sports</td>
</tr>
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<td>Cricket</td>
<td>Gymnastics</td>
<td>Track and field</td>
<td>Gymnastics</td>
<td>Hockey</td>
<td>Horseback riding</td>
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<tr>
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<td>Rugby</td>
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<td>Unspecified ball sports</td>
<td>Unspecified ball sports</td>
<td>Unspecified ball sports</td>
<td>Unspecified ball sports</td>
</tr>
<tr>
<td>Baseball</td>
<td>Track and field</td>
<td>Baseball</td>
<td>Track and field</td>
<td>Exercise equipment</td>
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<td>Ice skating</td>
<td>Track and field</td>
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<td>Other ball sports</td>
</tr>
<tr>
<td>Hockey</td>
<td>School physical education</td>
<td>Tennis</td>
<td>Martial arts</td>
<td>Rugby</td>
<td>School physical education</td>
<td>Golf</td>
</tr>
<tr>
<td>Golf</td>
<td>Volleyball</td>
<td>Hockey</td>
<td>Diving</td>
<td>Exercise equipment</td>
<td>Surfing</td>
<td>Exercise equipment</td>
</tr>
<tr>
<td>Martial arts</td>
<td>Tennis</td>
<td>Horseback riding</td>
<td>Ice skating</td>
<td>Surfing</td>
<td>Golf</td>
<td>Martial arts</td>
</tr>
<tr>
<td>Exercise equipment</td>
<td>Dancing</td>
<td>Ice skating</td>
<td>Volleyball</td>
<td>Swimming</td>
<td>Dancing</td>
<td>Dancing</td>
</tr>
</tbody>
</table>
The seven sports and recreational activities of Australian football, basketball, bicycling, roller skating/blading, skateboards, soccer, and trampolines appeared in the top ten most frequent reasons for a sports injury presentation at an emergency department in every state and territory. Of these, Australian football, basketball and soccer are generally considered as sporting activities. Cricket was in the top ten in all areas except the ACT and netball as a reason for injury was not in the top ten in Western Australia. Rugby appeared in the top ten reasons for a sport injury presentation in only New South Wales and Queensland.

These differences in the reasons for presenting to hospital emergency departments with a sports-related injury across states presumably reflect the difference in the participation base of each sport in the different states and territories.

6.3.2 Location and context of the activity

The locations of the events leading to sports and recreational injuries in children are shown in Table 6.3. As expected, injuries related to the traditional sports of Australian football, basketball, soccer, cricket, netball, rugby, baseball, track and field and hockey occurred most frequently in an area for organised sports such as an arena or oval. Unspecified ball sports and physical education leading to injury were most frequently participated in at school playgrounds. Bicycling, skateboarding and roller skating/blading injuries were commonly incurred in areas for transport, including driveways and footpaths. They were also significant in residential settings.

Thirteen of the sports and recreational activities leading to injury were most frequently conducted as sports - organised competition or practice (Table 6.4). Trampolining, unspecified ball sports and the use of exercise equipment led to injury most often during general playing activity. Roller skating/blading, skateboarding and horseback riding were most often conducted as a recreational activity outdoors on land. This finding for horseback riding reflects pony club activities being considered as a form of recreation, rather than organised sport. All bicycling-related injuries were classified as occurring during transportation, whether or not they occurred in a place for transport.

Narrative data collected by the injury surveillance system is very useful for identifying the sequence of events that led to the injury. For example, examination of the text narratives for all rugby-related injuries in 1993, indicated that 32% occurred during tackles whereas 26% resulted from collision with another player. A further 19% of these injuries occurred because the person slipped, tripped or fell during play.

6.3.3 Nature of injury

The body regions injured whilst participating in the ten most commonly presented sports and recreational activities is shown in Table 6.5. Some injured children reported more than one injury. The total number of cases shown in Table 6.5 therefore corresponds to the total number of injuries and the remainder of the table shows the distribution of body regions injured, for each sport.

The most commonly injured body regions were generally the upper extremities, the lower extremities and the head/face. Head and facial injuries were most common amongst cricket players and concussion was more common amongst bicyclists. Upper extremity injuries were most common amongst roller skaters/bladers but more than half of all cases with an injury that occurred during Australian football, basketball, skateboarding and netball also had an injury in this region of their body. Soccer and netball were more associated with lower extremity injuries than any other sport.
Table 6.3  Major locations where child sports and recreational injuries occurred in Australia. Figures in the table are the proportion (%) of cases from each activity occurring in the given location.

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>Area for organised sport</th>
<th>School playground</th>
<th>Area of outdoor land-based recreation</th>
<th>Area of outdoor water-based recreation</th>
<th>Residential setting</th>
<th>Public playgrounds and amusement areas</th>
<th>Area for transport</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicycling</td>
<td>1.2</td>
<td>1.5</td>
<td>5.6</td>
<td>0.2</td>
<td>21.7</td>
<td>1.1</td>
<td>61.9</td>
<td>6.8</td>
</tr>
<tr>
<td>Australian football</td>
<td>53.7</td>
<td>16.1</td>
<td>3.1</td>
<td>-</td>
<td>11.3</td>
<td>0.8</td>
<td>2.1</td>
<td>12.9</td>
</tr>
<tr>
<td>Rollerskating/blading</td>
<td>6.1</td>
<td>2.1</td>
<td>2.4</td>
<td>-</td>
<td>21.6</td>
<td>32.2</td>
<td>27.2</td>
<td>8.4</td>
</tr>
<tr>
<td>Basketball</td>
<td>43.2</td>
<td>23.3</td>
<td>0.3</td>
<td>-</td>
<td>12.6</td>
<td>0.8</td>
<td>1.7</td>
<td>18.1</td>
</tr>
<tr>
<td>Soccer</td>
<td>49.4</td>
<td>21.4</td>
<td>3.3</td>
<td>-</td>
<td>8.9</td>
<td>0.9</td>
<td>1.1</td>
<td>15.0</td>
</tr>
<tr>
<td>Trampolines</td>
<td>2.1</td>
<td>1.3</td>
<td>0.6</td>
<td>-</td>
<td>87.1</td>
<td>1.0</td>
<td>0.3</td>
<td>7.6</td>
</tr>
<tr>
<td>Skateboards</td>
<td>2.6</td>
<td>2.8</td>
<td>3.3</td>
<td>-</td>
<td>27.9</td>
<td>8.7</td>
<td>47.2</td>
<td>7.5</td>
</tr>
<tr>
<td>Cricket</td>
<td>33.1</td>
<td>18.1</td>
<td>5.4</td>
<td>0.2</td>
<td>26.6</td>
<td>1.8</td>
<td>3.1</td>
<td>11.7</td>
</tr>
<tr>
<td>Netball</td>
<td>73.5</td>
<td>14.3</td>
<td>0.4</td>
<td>-</td>
<td>1.7</td>
<td>0.2</td>
<td>0.5</td>
<td>9.4</td>
</tr>
<tr>
<td>Rugby</td>
<td>71.7</td>
<td>10.6</td>
<td>1.1</td>
<td>-</td>
<td>3.9</td>
<td>1.1</td>
<td>0.2</td>
<td>11.4</td>
</tr>
<tr>
<td>Gymnastics*</td>
<td>37.0</td>
<td>8.6</td>
<td>1.2</td>
<td>-</td>
<td>11.4</td>
<td>2.4</td>
<td>-</td>
<td>39.4</td>
</tr>
<tr>
<td>Unspecified ball sports</td>
<td>7.2</td>
<td>36.4</td>
<td>2.9</td>
<td>0.5</td>
<td>28.0</td>
<td>4.5</td>
<td>3.6</td>
<td>18.9</td>
</tr>
<tr>
<td>Baseball</td>
<td>50.6</td>
<td>19.9</td>
<td>3.4</td>
<td>-</td>
<td>9.1</td>
<td>1.1</td>
<td>0.8</td>
<td>15.1</td>
</tr>
<tr>
<td>Track and field</td>
<td>42.6</td>
<td>23.4</td>
<td>2.3</td>
<td>-</td>
<td>3.5</td>
<td>0.5</td>
<td>0.7</td>
<td>27.0</td>
</tr>
<tr>
<td>Tennis</td>
<td>38.1</td>
<td>18.9</td>
<td>1.8</td>
<td>-</td>
<td>24.6</td>
<td>-</td>
<td>3.7</td>
<td>11.9</td>
</tr>
<tr>
<td>Hockey</td>
<td>65.9</td>
<td>13.7</td>
<td>1.8</td>
<td>-</td>
<td>5.9</td>
<td>2.2</td>
<td>-</td>
<td>10.5</td>
</tr>
<tr>
<td>Horseback riding</td>
<td>5.7</td>
<td>-</td>
<td>39.3</td>
<td>-</td>
<td>11.9</td>
<td>6.6</td>
<td>13.7</td>
<td>22.8</td>
</tr>
<tr>
<td>Exercise equipment</td>
<td>5.1</td>
<td>16.3</td>
<td>0.8</td>
<td>-</td>
<td>59.4</td>
<td>0.7</td>
<td>2.4</td>
<td>15.3</td>
</tr>
<tr>
<td>School physical education</td>
<td>11.4</td>
<td>58.8</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>29.8</td>
</tr>
<tr>
<td>Swimming</td>
<td>10.8</td>
<td>1.0</td>
<td>11.8</td>
<td>45.8</td>
<td>24.4</td>
<td>1.2</td>
<td>-</td>
<td>5.0</td>
</tr>
</tbody>
</table>

---

* 26.4% occurred at school but not in the playground (e.g. in a school gym or hall)
** 28.3% of these cases occurred at school but not in the playground
Table 6.4  Context under which sports and recreation activities were being undertaken at the time of injury in Australian children. Figures in the table are the proportion (%) of cases from each activity occurring within a given context

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>Organised</th>
<th>Informal</th>
<th>Unspecified</th>
<th>Total</th>
<th>Playing (general activity)</th>
<th>Recreation (or hobby - indoor)</th>
<th>Recreation (or hobby - outdoor on land)</th>
<th>Recreation (or hobby - outdoor on water)</th>
<th>Other leisure</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicycling †</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Australian football</td>
<td>61.6</td>
<td>18.1</td>
<td>11.5</td>
<td>91.3</td>
<td>3.7</td>
<td>-</td>
<td>4.7</td>
<td>-</td>
<td>0.3</td>
<td>8.7</td>
</tr>
<tr>
<td>Roller skating/blading</td>
<td>0.7</td>
<td>1.2</td>
<td>-</td>
<td>2.0</td>
<td>10.2</td>
<td>31.0</td>
<td>46.5</td>
<td>0.2</td>
<td>10.1</td>
<td>98.0</td>
</tr>
<tr>
<td>Basketball</td>
<td>57.6</td>
<td>17.5</td>
<td>14.9</td>
<td>90.0</td>
<td>6.7</td>
<td>0.2</td>
<td>2.7</td>
<td>-</td>
<td>0.2</td>
<td>10.0</td>
</tr>
<tr>
<td>Soccer</td>
<td>59.2</td>
<td>17.4</td>
<td>14.3</td>
<td>90.9</td>
<td>4.8</td>
<td>0.2</td>
<td>3.6</td>
<td>0.5</td>
<td>0.3</td>
<td>9.1</td>
</tr>
<tr>
<td>Trampolines</td>
<td>2.1</td>
<td>1.7</td>
<td>0.4</td>
<td>4.2</td>
<td>59.6</td>
<td>1.3</td>
<td>31.9</td>
<td>-</td>
<td>2.7</td>
<td>95.7</td>
</tr>
<tr>
<td>Skateboards</td>
<td>0.2</td>
<td>0.2</td>
<td>-</td>
<td>0.4</td>
<td>15.2</td>
<td>0.9</td>
<td>73.2</td>
<td>0.3</td>
<td>10.1</td>
<td>99.6</td>
</tr>
<tr>
<td>Cricket</td>
<td>40.4</td>
<td>25.7</td>
<td>11.0</td>
<td>77.1</td>
<td>12.9</td>
<td>0.3</td>
<td>9.1</td>
<td>-</td>
<td>0.5</td>
<td>22.9</td>
</tr>
<tr>
<td>Netball</td>
<td>85.5</td>
<td>5.0</td>
<td>7.2</td>
<td>97.7</td>
<td>1.4</td>
<td>-</td>
<td>0.6</td>
<td>-</td>
<td>-</td>
<td>2.3</td>
</tr>
<tr>
<td>Rugby</td>
<td>83.9</td>
<td>6.4</td>
<td>3.9</td>
<td>94.2</td>
<td>3.0</td>
<td>-</td>
<td>2.7</td>
<td>-</td>
<td>0.1</td>
<td>5.8</td>
</tr>
<tr>
<td>Gymnastics</td>
<td>59.9</td>
<td>6.5</td>
<td>5.9</td>
<td>72.4</td>
<td>18.4</td>
<td>5.8</td>
<td>1.7</td>
<td>-</td>
<td>1.6</td>
<td>27.6</td>
</tr>
<tr>
<td>Unspecified ball sports</td>
<td>19.8</td>
<td>9.7</td>
<td>6.7</td>
<td>36.2</td>
<td>53.9</td>
<td>0.7</td>
<td>8.0</td>
<td>-</td>
<td>0.9</td>
<td>63.8</td>
</tr>
<tr>
<td>Baseball</td>
<td>66.5</td>
<td>10.9</td>
<td>9.2</td>
<td>86.5</td>
<td>8.0</td>
<td>-</td>
<td>4.8</td>
<td>-</td>
<td>0.6</td>
<td>13.5</td>
</tr>
<tr>
<td>Track and field</td>
<td>82.3</td>
<td>6.6</td>
<td>3.6</td>
<td>92.9</td>
<td>4.3</td>
<td>-</td>
<td>2.0</td>
<td>-</td>
<td>0.6</td>
<td>7.1</td>
</tr>
<tr>
<td>Tennis</td>
<td>34.5</td>
<td>16.0</td>
<td>8.5</td>
<td>58.9</td>
<td>29.8</td>
<td>-</td>
<td>8.7</td>
<td>0.7</td>
<td>1.6</td>
<td>41.1</td>
</tr>
<tr>
<td>Hockey</td>
<td>81.9</td>
<td>6.7</td>
<td>3.2</td>
<td>91.7</td>
<td>5.6</td>
<td>-</td>
<td>1.9</td>
<td>-</td>
<td>0.6</td>
<td>8.3</td>
</tr>
<tr>
<td>Horseback riding</td>
<td>3.2</td>
<td>2.0</td>
<td>-</td>
<td>5.2</td>
<td>2.0</td>
<td>-</td>
<td>81.5</td>
<td>-</td>
<td>11.2</td>
<td>94.8</td>
</tr>
<tr>
<td>Exercise equipment</td>
<td>5.8</td>
<td>2.5</td>
<td>-</td>
<td>8.8</td>
<td>68.6</td>
<td>10.5</td>
<td>7.3</td>
<td>-</td>
<td>4.8</td>
<td>91.2</td>
</tr>
<tr>
<td>School physical education</td>
<td>90.8</td>
<td>6.8</td>
<td>1.3</td>
<td>98.9</td>
<td>4.7</td>
<td>2.2</td>
<td>2.2</td>
<td>70.2</td>
<td>-</td>
<td>1.1</td>
</tr>
<tr>
<td>Swimming</td>
<td>8.6</td>
<td>1.0</td>
<td>1.0</td>
<td>10.6</td>
<td>4.7</td>
<td>2.2</td>
<td>2.2</td>
<td>70.2</td>
<td>10.1</td>
<td>89.4</td>
</tr>
</tbody>
</table>

† All of these cases were classified as occurring during transportation: 96.4% were bicyclists and 3.6% were bicycle passengers.
Table 6.5  Body regions injured in children during sports and recreational activities. The number of cases refers to the total number of injuries. The percentages correspond to the distribution of injured body regions for a given sport.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Total Number of Injuries</th>
<th>Body Region Injured</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Head %</td>
</tr>
<tr>
<td>Bicycling</td>
<td>17585</td>
<td>29.6</td>
</tr>
<tr>
<td>Australian football</td>
<td>7075</td>
<td>17.3</td>
</tr>
<tr>
<td>Roller skating/blading</td>
<td>3707</td>
<td>5.9</td>
</tr>
<tr>
<td>Basketball</td>
<td>3722</td>
<td>12.4</td>
</tr>
<tr>
<td>Soccer</td>
<td>3630</td>
<td>12.7</td>
</tr>
<tr>
<td>Trampolines</td>
<td>3547</td>
<td>19.8</td>
</tr>
<tr>
<td>Skateboard</td>
<td>3161</td>
<td>18.4</td>
</tr>
<tr>
<td>Cricket</td>
<td>2345</td>
<td>44.2</td>
</tr>
<tr>
<td>Netball</td>
<td>2165</td>
<td>5.8</td>
</tr>
<tr>
<td>Rugby</td>
<td>2312</td>
<td>21.3</td>
</tr>
</tbody>
</table>
Table 6.6 shows that fractures were the most common type of injury in Australian football, representing 29.1% of all injuries. They were also common in roller skating/blading (34.9%), soccer (29.5%), trampolining (34.7%), skateboarding (53.4%) and rugby (29.1%). Sprains and strains were most common in netball and basketball whereas a large proportion of cricketers suffered bruising. Many of the bicycling-related injuries were lacerations.

6.3.4 Severity of Injury

Table 6.7 lists the twenty sports and recreational activities that most frequently resulted in admission to hospital for treatment following presentation at an emergency department. The admission rates given in this Table are the proportions of all cases presenting to an emergency department that were subsequently admitted to hospital. Thus 45% of the children who present to a hospital emergency department with an injury incurred during a golf-related activity are admitted to hospital for further treatment, compared with 13% of children with a rugby injury. Of the twenty activities given in Table 6.7, eight were also listed in the top twenty ranking of most frequent sports injuries: horseback riding, exercise equipment, trampolines, roller skating/blading, skateboarding, rugby and swimming. Rugby is the only traditional sport that was listed in the top twenty most injurious sports in terms of both injury frequency and injury severity, suggesting that injuries in this sport warrant particular attention.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Proportion of all emergency department presentations resulting in hospital admission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Golf</td>
<td>45</td>
</tr>
<tr>
<td>Minibikes or trailbikes</td>
<td>34</td>
</tr>
<tr>
<td>Horseback riding</td>
<td>34</td>
</tr>
<tr>
<td>Fencing</td>
<td>31</td>
</tr>
<tr>
<td>Water skiing</td>
<td>25</td>
</tr>
<tr>
<td>Exercise equipment</td>
<td>23</td>
</tr>
<tr>
<td>Boats</td>
<td>21</td>
</tr>
<tr>
<td>Go-carts</td>
<td>19</td>
</tr>
<tr>
<td>Trampolines</td>
<td>19</td>
</tr>
<tr>
<td>Bicycling</td>
<td>19</td>
</tr>
<tr>
<td>Roller skating/blading</td>
<td>18</td>
</tr>
<tr>
<td>Skateboards</td>
<td>17</td>
</tr>
<tr>
<td>Weight lifting</td>
<td>17</td>
</tr>
<tr>
<td>Unspecified skating</td>
<td>16</td>
</tr>
<tr>
<td>Diving</td>
<td>14</td>
</tr>
<tr>
<td>Rugby</td>
<td>13</td>
</tr>
<tr>
<td>Squash, racquet or paddle ball</td>
<td>13</td>
</tr>
<tr>
<td>Toboggans</td>
<td>12</td>
</tr>
<tr>
<td>Swimming</td>
<td>12</td>
</tr>
<tr>
<td>Ice skating</td>
<td>11</td>
</tr>
</tbody>
</table>

It is to be expected that activities involving minibikes or trailbikes and horseback riding are very close to the top of the list in Table 6.7 because of the speeds at which they travel and the heights from which riders fall. However, the ranking of golf as the activity leading most often to hospital admission needs explanation. It is in this area that the narrative text
description accompanying each injury record is particularly seen to provide valuable information about this list of sports and recreational activities.

6.3.5 The value of narratives

Examination of the narrative text descriptions of the events leading to and surrounding the injuries sustained by children whilst involved in golf illustrates the reasons for this finding. Three-quarters of all of these injuries occurred when the child was hit by a golf club. Typical narratives include: "Driving on golf range. Stood too close to friend swinging, hit by club."; "Playing golf too close to another child with golf club when hit on forehead". Many of these injuries did not occur on a golf course. However, the narrative text descriptions highlight the need to educate children about standing too close to someone teeing off or swinging a golf club, irrespective of the location of play. In only 9% of cases, was mention of deliberate intention to hit someone with a golf club given. This suggests that spatial orientation is an issue that needs to be addressed with young golfers. Spatial orientation as a means of injury prevention is also important for other sports such as baseball, softball and cricket. The other major reason for a severe golf injury, occurring in 17% of cases, was the child being hit by a golf ball.

This example shows how important a narrative description of the events leading to injury is for prevention purposes. It can provide detailed information about the circumstances within the chain of events leading to the injury that could be targeted by future prevention activities.

6.4 ADULT SPORTS INJURIES IDENTIFIED FROM EMERGENCY DEPARTMENT INJURY SURVEILLANCE SYSTEMS

Over the period 1989-1993, 46,837 persons aged at least 15 years of age were reported as attending a NISU emergency department for treatment of an injury sustained during sport or recreational activities. This corresponds to 18% of all injury presentations to these emergency departments over this period of time. Approximately 8% of the sports and recreation-related injured cases were subsequently admitted to hospital for further treatment, compared with 15% of all injury presentations.

6.4.1 Sports and Recreational Activities

Table 6.8 lists the top 20 most frequent sports and recreational activities that led an adult to present at one of the NISU participating hospitals. These listed sports and recreational activities account for 89.7% of all sports and recreational injuries presenting in this age group. Unlike the situation in children, the traditional sports, rather than recreational activities, make up many of the most common activities that led to an injury.

Together, the three football codes accounted for 37.5% of all sports and recreational injuries in adults. Each of the football codes was also generally associated with more injuries than any other sport or recreational activity. The exception to this was bicycling which was more common than soccer and rugby as a reason for injury, but not as frequent as Australian football. As was the case with children, the sport most often associated with an adult sports-related injury presentation at an emergency department was Australian football which accounted for more than one-fifth of all sports and recreational injury presentations. There was 19.4 times as many Australian football-related emergency department presentations than water skiing-related presentations.
Injuries incurred during bicycling, soccer, rugby, cricket, basketball and netball also accounted for a large proportion of all sports and recreational injuries. This is in contrast to the situation in children where the top 10 most frequent reasons for presenting to an emergency department included a large number of recreational activities. Bicycling activities associated with sport and recreation accounted for 10.0% of all adult sport and recreational injuries. Whilst significantly less than for children, this once again shows the important role of bicycling as an activity being related to injury.

Table 6.8 Top 20 most frequent sports and recreational activities leading to an adult injury presentation at an emergency department in Australia

<table>
<thead>
<tr>
<th>Rank order</th>
<th>Sports or recreational activity</th>
<th>Number of presentations</th>
<th>Proportion of all sports and recreation presentations (%)</th>
<th>Ratio of the number of presentations for each activity compared to water skiing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Australian football</td>
<td>10122</td>
<td>21.6</td>
<td>19.4</td>
</tr>
<tr>
<td>2</td>
<td>Bicycling</td>
<td>4672</td>
<td>10.0</td>
<td>8.9</td>
</tr>
<tr>
<td>3</td>
<td>Soccer</td>
<td>3777</td>
<td>8.1</td>
<td>7.2</td>
</tr>
<tr>
<td>4</td>
<td>Rugby</td>
<td>3636</td>
<td>7.8</td>
<td>7.0</td>
</tr>
<tr>
<td>5</td>
<td>Cricket</td>
<td>3408</td>
<td>7.3</td>
<td>6.5</td>
</tr>
<tr>
<td>6</td>
<td>Basketball</td>
<td>3228</td>
<td>6.9</td>
<td>6.2</td>
</tr>
<tr>
<td>7</td>
<td>Netball</td>
<td>3098</td>
<td>6.6</td>
<td>5.9</td>
</tr>
<tr>
<td>8</td>
<td>Hockey</td>
<td>1219</td>
<td>2.6</td>
<td>2.3</td>
</tr>
<tr>
<td>9</td>
<td>Martial arts</td>
<td>882</td>
<td>1.9</td>
<td>1.7</td>
</tr>
<tr>
<td>10</td>
<td>Dancing</td>
<td>869</td>
<td>1.9</td>
<td>1.7</td>
</tr>
<tr>
<td>11</td>
<td>Roller skating/blading</td>
<td>888</td>
<td>1.9</td>
<td>1.7</td>
</tr>
<tr>
<td>12</td>
<td>Squash, racquet or paddle ball</td>
<td>787</td>
<td>1.7</td>
<td>1.5</td>
</tr>
<tr>
<td>13</td>
<td>Volleyball</td>
<td>776</td>
<td>1.7</td>
<td>1.5</td>
</tr>
<tr>
<td>14</td>
<td>Skateboards</td>
<td>766</td>
<td>1.6</td>
<td>1.5</td>
</tr>
<tr>
<td>15</td>
<td>Tennis</td>
<td>765</td>
<td>1.6</td>
<td>1.5</td>
</tr>
<tr>
<td>16</td>
<td>Baseball</td>
<td>733</td>
<td>1.6</td>
<td>1.4</td>
</tr>
<tr>
<td>17</td>
<td>Horseback riding</td>
<td>614</td>
<td>1.3</td>
<td>1.2</td>
</tr>
<tr>
<td>18</td>
<td>Boats/sail boats/boards</td>
<td>593</td>
<td>1.3</td>
<td>1.1</td>
</tr>
<tr>
<td>19</td>
<td>Surfing</td>
<td>549</td>
<td>1.2</td>
<td>1.1</td>
</tr>
<tr>
<td>20</td>
<td>Water skiing</td>
<td>523</td>
<td>1.1</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Table 6.9 shows that Australian football was the most common reason for presenting to an emergency department for a sports injury in five of the seven Australian states and territories. As might be expected from known participation rates, rugby was the most important reason for attending an emergency department in New South Wales. In New South Wales, Australian football ranked second to rugby.

The data for adults in Western Australia should be interpreted with caution since the injury surveillance system in that state has focussed most of its attention on collecting data in children and there has been no systematic recording of injuries in adults.

In the six states for which data on adults has been collected consistently, the five sports of Australian football, basketball, cricket, netball and soccer ranked in the top ten most frequent reasons for a sports injury presentation at an emergency department in every state and territory. Bicycling, as an activity, was also consistently ranked in the top ten. Rugby was in the top ten in all areas except Tasmania. These differences in the reasons for presenting to hospital emergency departments with a sports-related injury across states.
Table 6.9 Top 20 most frequent sports and recreational activities leading to an injury presentation at a hospital emergency department in adults

<table>
<thead>
<tr>
<th>South Australia</th>
<th>ACT</th>
<th>New South Wales</th>
<th>Queensland</th>
<th>Western Australia</th>
<th>Tasmania</th>
<th>Victoria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian football</td>
<td>Australian football</td>
<td>Rugby</td>
<td>Australian football</td>
<td>Bicycling</td>
<td>Australian football</td>
<td>Australian football</td>
</tr>
<tr>
<td>Bicycling</td>
<td>Bicycling</td>
<td>Australian football</td>
<td>Bicycling</td>
<td>Basketball</td>
<td>Cricket</td>
<td>Soccer</td>
</tr>
<tr>
<td>Netball</td>
<td>Basketball</td>
<td>Soccer</td>
<td>Rugby</td>
<td>Australian football</td>
<td>Bicycling</td>
<td>Basketball</td>
</tr>
<tr>
<td>Basketball</td>
<td>Cricket</td>
<td>Bicycling</td>
<td>Cricket</td>
<td>Boats</td>
<td>Basketball</td>
<td>Bicycling</td>
</tr>
<tr>
<td>Soccer</td>
<td>Soccer</td>
<td>Netball</td>
<td>Soccer</td>
<td>Skateboards</td>
<td>Netball</td>
<td>Netball</td>
</tr>
<tr>
<td>Cricket</td>
<td>Hockey</td>
<td>Basketball</td>
<td>Netball</td>
<td>Fishing</td>
<td>Hockey</td>
<td>Cricket</td>
</tr>
<tr>
<td>Hockey</td>
<td>Netball</td>
<td>Cricket</td>
<td>Basketball</td>
<td>Roller skating/blading</td>
<td>Soccer</td>
<td>Horseback riding</td>
</tr>
<tr>
<td>Rugby</td>
<td>Rugby</td>
<td>Surfing</td>
<td>Martial arts</td>
<td>Swimming</td>
<td>Baseball</td>
<td>Rugby</td>
</tr>
<tr>
<td>Martial arts</td>
<td>Snow skiing</td>
<td>Roller skating/blading</td>
<td>Roller skating/blading</td>
<td>Hockey</td>
<td>Netball</td>
<td>Martial arts</td>
</tr>
<tr>
<td>Tennis</td>
<td>Volleyball</td>
<td>Hockey</td>
<td>Squash/racquet/paddle ball</td>
<td>-</td>
<td>-</td>
<td>Hockey</td>
</tr>
<tr>
<td>Squash/racquet/paddle ball</td>
<td>Baseball</td>
<td>Baseball</td>
<td>Dancing</td>
<td>-</td>
<td>-</td>
<td>Tennis</td>
</tr>
<tr>
<td>Dancing</td>
<td>Skateboards</td>
<td>Skateboards</td>
<td>Volleyball</td>
<td>-</td>
<td>-</td>
<td>Roller skating/blading</td>
</tr>
<tr>
<td>Baseball</td>
<td>Dancing</td>
<td>Water skiing</td>
<td>Baseball</td>
<td>-</td>
<td>-</td>
<td>Volleyball</td>
</tr>
<tr>
<td>Boats</td>
<td>Martial arts</td>
<td>Tennis</td>
<td>Tennis</td>
<td>Surfing</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Water skiing</td>
<td>Squash/racquet/paddle ball</td>
<td>Fishing</td>
<td>Skateboards</td>
<td>-</td>
<td>-</td>
<td>Fishing</td>
</tr>
<tr>
<td>Volleyball</td>
<td>Roller skating/blading</td>
<td>Horseback riding</td>
<td>Boats</td>
<td>-</td>
<td>-</td>
<td>Baseball</td>
</tr>
<tr>
<td>Skateboards</td>
<td>Tennis</td>
<td>Boats</td>
<td>Hockey</td>
<td>-</td>
<td>-</td>
<td>Tennis</td>
</tr>
<tr>
<td>Fishing</td>
<td>Water skiing</td>
<td>Squash, racquet and paddle ball</td>
<td>Water skiing</td>
<td>-</td>
<td>-</td>
<td>Squash/racquet/paddle ball</td>
</tr>
<tr>
<td>Lacrosse</td>
<td>Unspecified ball sports</td>
<td>Martial arts</td>
<td>Surfing</td>
<td>-</td>
<td>-</td>
<td>Fishing</td>
</tr>
<tr>
<td>Roller skating/blading</td>
<td>Ice skating</td>
<td>Swimming</td>
<td>ice skating</td>
<td>-</td>
<td>-</td>
<td>Weight lifting</td>
</tr>
</tbody>
</table>
probably reflect the difference in the participation base of each sport in the different states and territories.

6.4.2 Location and context of the activity

The locations of the events leading to sports and recreational injuries in adults occurred are shown in Table 6.10. As expected injuries related to the traditional sports occurred most frequently in an area for organised sports such as an arena or oval. Horseback riding and surfing injuries were commonly incurred in areas for outdoor recreational activity. Areas for transport, including driveways and footpaths, were the scene of the majority of bicycling injuries and a large number of skateboard injuries.

Table 6.11 describes the context under which the sport and recreational activities were being participated in at the time of the injury. Twelve of the sports and recreational activities leading to injury were most frequently conducted as sports - organised competition or practice (Table 6.11). Compared with the figures for children (Table 6.4), a larger proportion of sports and recreational injuries in adults occur during organised competition or practice. All of the bicycling injuries were classified as occurring during transportation, irrespective of the location of the events.

6.4.3 Nature of injury

The body regions injured by adults whilst participating in the ten most commonly presented sports and recreational activities is shown in Table 6.12. Some injured adults had more than one injury and this table summarises the body regions on an injury basis, rather than an injured-person basis.

The most commonly injured body regions were the upper and lower extremities. As a proportion of all injuries, those to the upper extremities were most common amongst bicyclists but were also substantial to participants of Australian football, rugby, cricket and hockey. Netball was more associated with lower extremity injuries than any other sport.

Table 6.13 shows that sprains and strains were the most common type of injury amongst adults participating in Australian football, soccer, rugby, cricket, basketball, netball, martial arts and dancing. This suggests that hospital emergency departments are a preferred place for treatment of sports strains and sprains by some sports participants, despite the wide availability of sports medicine clinics and physiotherapists.

6.4.4 Severity of Injury

Table 6.14 lists the twenty most frequent sports and recreational activities that resulted in adult admissions to hospital for treatment following presentation at an emergency department. The admission rates given in this Table represent the proportions of all cases that are subsequently admitted to hospital. Thus 32% of the adults who present to a hospital emergency department with an injury incurred during hang gliding or sky sailing are admitted to hospital for further treatment, compared with 11% of adults with a rugby injury. Of the 20 activities given in Table 6.14, five were also listed in the top 20 ranking of most frequent sports injuries: horseback riding, bicycling, rugby, roller skating/blading and Australian football. The Australian rules and rugby football codes are the only traditional sports that are listed in the top 20 most injury-related sports in terms for both injury frequency and injury severity.
# Table 6.10 Major locations where sports and recreational injuries occurred in Australia - adults

*(Figures are the proportion (%) of cases from each activity occurring in a given location)*

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>Area for organised sport</th>
<th>Area of outdoor land-based recreation</th>
<th>Area of outdoor water-based recreation</th>
<th>Residential setting</th>
<th>Public playgrounds and amusement areas</th>
<th>Area for transport</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian football</td>
<td>79.7</td>
<td>3.0</td>
<td>0.1</td>
<td>4.2</td>
<td>0.2</td>
<td>0.8</td>
<td>12.0</td>
</tr>
<tr>
<td>Bicycling</td>
<td>2.2</td>
<td>3.9</td>
<td>0.2</td>
<td>4.2</td>
<td>0.7</td>
<td>81.3</td>
<td>7.6</td>
</tr>
<tr>
<td>Soccer</td>
<td>79.4</td>
<td>3.0</td>
<td>0.1</td>
<td>2.3</td>
<td>0.6</td>
<td>0.3</td>
<td>14.3</td>
</tr>
<tr>
<td>Rugby</td>
<td>87.2</td>
<td>0.8</td>
<td>-</td>
<td>1.1</td>
<td>0.3</td>
<td>0.2</td>
<td>10.4</td>
</tr>
<tr>
<td>Cricket</td>
<td>81.4</td>
<td>2.8</td>
<td>0.2</td>
<td>6.0</td>
<td>1.1</td>
<td>0.7</td>
<td>7.8</td>
</tr>
<tr>
<td>Basketball</td>
<td>67.4</td>
<td>0.2</td>
<td>-</td>
<td>4.8</td>
<td>0.4</td>
<td>0.5</td>
<td>26.7</td>
</tr>
<tr>
<td>Netball</td>
<td>92.2</td>
<td>0.2</td>
<td>-</td>
<td>0.4</td>
<td>0.2</td>
<td>0.2</td>
<td>6.8</td>
</tr>
<tr>
<td>Hockey</td>
<td>89.7</td>
<td>0.3</td>
<td>0.4</td>
<td>11.9</td>
<td>5.0</td>
<td>0.5</td>
<td>38.9</td>
</tr>
<tr>
<td>Martial Arts</td>
<td>42.9</td>
<td>0.8</td>
<td>-</td>
<td>21.5</td>
<td>5.6</td>
<td>-</td>
<td>71.2</td>
</tr>
<tr>
<td>Dancing*</td>
<td>1.7</td>
<td>-</td>
<td>-</td>
<td>6.1</td>
<td>53.4</td>
<td>14.9</td>
<td>-</td>
</tr>
<tr>
<td>Roller skating/blading</td>
<td>12.6</td>
<td>2.0</td>
<td>-</td>
<td>21.5</td>
<td>5.6</td>
<td>-</td>
<td>71.2</td>
</tr>
<tr>
<td>Squash, racquet or paddle ball</td>
<td>94.8</td>
<td>-</td>
<td>-</td>
<td>1.2</td>
<td>0.7</td>
<td>-</td>
<td>3.3</td>
</tr>
<tr>
<td>Volleyball</td>
<td>63.5</td>
<td>4.5</td>
<td>0.5</td>
<td>3.7</td>
<td>1.4</td>
<td>-</td>
<td>26.4</td>
</tr>
<tr>
<td>Skateboards</td>
<td>5.3</td>
<td>2.9</td>
<td>-</td>
<td>17.4</td>
<td>17.6</td>
<td>42.8</td>
<td>14</td>
</tr>
<tr>
<td>Tennis</td>
<td>80.7</td>
<td>1.0</td>
<td>-</td>
<td>7.5</td>
<td>-</td>
<td>0.5</td>
<td>10.3</td>
</tr>
<tr>
<td>Baseball</td>
<td>78.2</td>
<td>2.6</td>
<td>-</td>
<td>3.9</td>
<td>0.5</td>
<td>0.6</td>
<td>14.2</td>
</tr>
<tr>
<td>Horseback riding</td>
<td>14.7</td>
<td>42.3</td>
<td>-</td>
<td>6.6</td>
<td>5.0</td>
<td>10.2</td>
<td>21.2</td>
</tr>
<tr>
<td>Boats/sail boats/boards</td>
<td>0.7</td>
<td>9.7</td>
<td>71.1</td>
<td>3.9</td>
<td>0.6</td>
<td>8.5</td>
<td>5.5</td>
</tr>
<tr>
<td>Surfing</td>
<td>-</td>
<td>58.4</td>
<td>39.9</td>
<td>0.9</td>
<td>-</td>
<td>-</td>
<td>0.8</td>
</tr>
<tr>
<td>Water skiing</td>
<td>1.5</td>
<td>4.1</td>
<td>89.3</td>
<td>-</td>
<td>1.8</td>
<td>-</td>
<td>3.3</td>
</tr>
</tbody>
</table>

* 48.9% of these injuries occurred in commercial premises (eg dance halls, discos etc.)
Table 6.11  Context under which sports and recreation activities were being undertaken at the time of injury in Australia - adults.  
(Figures are the proportion (%) of cases from each activity occurring within a given context)

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>Organised Competition or Practice</th>
<th>Informal</th>
<th>Unspecified</th>
<th>Total</th>
<th>Playing (general activity)</th>
<th>Recreation or hobby - indoor</th>
<th>Recreation or hobby - outdoor on land</th>
<th>Recreation or hobby - outdoor on water</th>
<th>Other leisure</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian Football</td>
<td>83.3</td>
<td>6.8</td>
<td>6.6</td>
<td>96.7</td>
<td>0.5</td>
<td>0.1</td>
<td>2.5</td>
<td>-</td>
<td>0.2</td>
<td>3.3</td>
</tr>
<tr>
<td>Bicycling †</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Soccer</td>
<td>84.1</td>
<td>5.1</td>
<td>8.4</td>
<td>97.5</td>
<td>0.5</td>
<td>0.3</td>
<td>1.4</td>
<td>-</td>
<td>0.3</td>
<td>2.5</td>
</tr>
<tr>
<td>Rugby</td>
<td>95.0</td>
<td>1.7</td>
<td>1.7</td>
<td>98.4</td>
<td>0.5</td>
<td>-</td>
<td>1.0</td>
<td>-</td>
<td>-</td>
<td>1.6</td>
</tr>
<tr>
<td>Cricket</td>
<td>82.8</td>
<td>7.1</td>
<td>4.7</td>
<td>94.6</td>
<td>1.0</td>
<td>0.7</td>
<td>2.8</td>
<td>-</td>
<td>0.9</td>
<td>5.4</td>
</tr>
<tr>
<td>Basketball</td>
<td>82.5</td>
<td>7.4</td>
<td>7.1</td>
<td>96.9</td>
<td>0.9</td>
<td>0.1</td>
<td>1.8</td>
<td>-</td>
<td>0.2</td>
<td>3.1</td>
</tr>
<tr>
<td>Netball</td>
<td>94.8</td>
<td>1.2</td>
<td>3.2</td>
<td>99.2</td>
<td>0.3</td>
<td>0.1</td>
<td>0.3</td>
<td>-</td>
<td>0.1</td>
<td>0.8</td>
</tr>
<tr>
<td>Hockey</td>
<td>95.4</td>
<td>1.2</td>
<td>1.5</td>
<td>98.1</td>
<td>0.4</td>
<td>1.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.9</td>
</tr>
<tr>
<td>Martial Arts</td>
<td>70.6</td>
<td>7.3</td>
<td>2.3</td>
<td>80.2</td>
<td>0.8</td>
<td>12.4</td>
<td>2.7</td>
<td>-</td>
<td>3.8</td>
<td>19.8</td>
</tr>
<tr>
<td>Dancing</td>
<td>2.0</td>
<td>0.5</td>
<td>-</td>
<td>2.7</td>
<td>1.4</td>
<td>58.8</td>
<td>2.7</td>
<td>-</td>
<td>34.4</td>
<td>97.3</td>
</tr>
<tr>
<td>Roller Skating/Blading</td>
<td>2.3</td>
<td>2.3</td>
<td>-</td>
<td>4.8</td>
<td>2.0</td>
<td>56.6</td>
<td>28.4</td>
<td>-</td>
<td>8.2</td>
<td>95.2</td>
</tr>
<tr>
<td>Squash, Racquet and Paddle Ball</td>
<td>90.9</td>
<td>3.8</td>
<td>3.0</td>
<td>97.6</td>
<td>-</td>
<td>1.3</td>
<td>-</td>
<td>-</td>
<td>0.8</td>
<td>2.4</td>
</tr>
<tr>
<td>Volleyball</td>
<td>79.4</td>
<td>7.4</td>
<td>6.1</td>
<td>93.0</td>
<td>0.5</td>
<td>-</td>
<td>5.4</td>
<td>-</td>
<td>0.6</td>
<td>7.0</td>
</tr>
<tr>
<td>Skateboards</td>
<td>-</td>
<td>0.9</td>
<td>-</td>
<td>1.2</td>
<td>4.1</td>
<td>2.3</td>
<td>81.4</td>
<td>-</td>
<td>10.8</td>
<td>98.8</td>
</tr>
<tr>
<td>Tennis</td>
<td>72.6</td>
<td>10.3</td>
<td>8.2</td>
<td>91.2</td>
<td>0.8</td>
<td>-</td>
<td>6.1</td>
<td>-</td>
<td>1.8</td>
<td>8.8</td>
</tr>
<tr>
<td>Baseball</td>
<td>82.8</td>
<td>5.6</td>
<td>4.5</td>
<td>92.9</td>
<td>1.2</td>
<td>1.2</td>
<td>4.0</td>
<td>-</td>
<td>0.7</td>
<td>7.1</td>
</tr>
<tr>
<td>Horseback Riding</td>
<td>10.8</td>
<td>2.7</td>
<td>-</td>
<td>13.7</td>
<td>-</td>
<td>-</td>
<td>78.0</td>
<td>-</td>
<td>7.6</td>
<td>86.3</td>
</tr>
<tr>
<td>Boats/Sail Boats/Boards</td>
<td>0.9</td>
<td>-</td>
<td>-</td>
<td>1.0</td>
<td>-</td>
<td>-</td>
<td>13.5</td>
<td>78.1</td>
<td>6.8</td>
<td>99.0</td>
</tr>
<tr>
<td>Surfing</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.7</td>
<td>-</td>
<td>-</td>
<td>1.7</td>
<td>92.2</td>
<td>5.6</td>
<td>99.8</td>
</tr>
<tr>
<td>Water Skiing</td>
<td>1.7</td>
<td>1.1</td>
<td>-</td>
<td>2.8</td>
<td>-</td>
<td>-</td>
<td>1.5</td>
<td>91.7</td>
<td>3.1</td>
<td>97.2</td>
</tr>
</tbody>
</table>

† All of these cases we classified as occurring during transportation: 99.1% were bicyclists and 0.9% were bicycle passengers.
Table 6.12  Body region injured whilst participating in the ten most frequent sports and recreational activities leading to injury in Australia - adults. The number of cases refers to the total number of injuries. The percentages in the main body of the table correspond to the distribution of injured body regions for a given activity.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Total Number of Injuries</th>
<th>Body Region Injured</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Head %</td>
</tr>
<tr>
<td>Australian football</td>
<td>12710</td>
<td>20.4</td>
</tr>
<tr>
<td>Bicycling</td>
<td>6859</td>
<td>21.6</td>
</tr>
<tr>
<td>Soccer</td>
<td>4626</td>
<td>11.6</td>
</tr>
<tr>
<td>Rugby</td>
<td>4921</td>
<td>26.6</td>
</tr>
<tr>
<td>Cricket</td>
<td>3846</td>
<td>16.6</td>
</tr>
<tr>
<td>Basketball</td>
<td>3831</td>
<td>10.7</td>
</tr>
<tr>
<td>Netball</td>
<td>3587</td>
<td>4.9</td>
</tr>
<tr>
<td>Hockey</td>
<td>1436</td>
<td>30.6</td>
</tr>
<tr>
<td>Martial Arts</td>
<td>1096</td>
<td>14.1</td>
</tr>
<tr>
<td>Dancing</td>
<td>991</td>
<td>9.5</td>
</tr>
</tbody>
</table>
## Table 6.13  The nature of injury in adults injured during the ten most frequent sports and recreational activities leading to presentation at a hospital emergency department in Australia

<table>
<thead>
<tr>
<th>Nature of Injury</th>
<th>Australian football</th>
<th>Bicycling</th>
<th>Soccer</th>
<th>Rugby</th>
<th>Cricket</th>
<th>Basketball</th>
<th>Netball</th>
<th>Hockey</th>
<th>Martial arts</th>
<th>Dancing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total number of injuries</strong></td>
<td>12710</td>
<td>1096</td>
<td>4626</td>
<td>4921</td>
<td>3846</td>
<td>3831</td>
<td>3587</td>
<td>1436</td>
<td>1096</td>
<td>991</td>
</tr>
<tr>
<td>Laceration</td>
<td>8.9</td>
<td>18.1</td>
<td>7.1</td>
<td>11.1</td>
<td>11.8</td>
<td>6.4</td>
<td>2.0</td>
<td>23.7</td>
<td>7.2</td>
<td>9.8</td>
</tr>
<tr>
<td>Puncture</td>
<td>0.2</td>
<td>0.4</td>
<td>0.2</td>
<td>0.2</td>
<td>0.4</td>
<td>0.3</td>
<td>0.2</td>
<td>0.3</td>
<td>0.5</td>
<td>-</td>
</tr>
<tr>
<td>Bite</td>
<td>0.1</td>
<td>0.5</td>
<td>-</td>
<td>0.1</td>
<td>0.3</td>
<td>0.1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Superficial abrasion</td>
<td>1.1</td>
<td>47.5</td>
<td>1.1</td>
<td>1.2</td>
<td>1.2</td>
<td>0.8</td>
<td>1.4</td>
<td>1.9</td>
<td>0.9</td>
<td>0.9</td>
</tr>
<tr>
<td>Penetrating wound</td>
<td>0.1</td>
<td>0.1</td>
<td>-</td>
<td>-</td>
<td>0.2</td>
<td>0.2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Other wound</td>
<td>0.2</td>
<td>0.4</td>
<td>0.3</td>
<td>0.2</td>
<td>0.3</td>
<td>0.6</td>
<td>0.3</td>
<td>0.5</td>
<td>0.5</td>
<td>0.6</td>
</tr>
<tr>
<td>Haematoma/bruising</td>
<td>14.2</td>
<td>12.4</td>
<td>15.2</td>
<td>13.5</td>
<td>19.6</td>
<td>11.1</td>
<td>9.3</td>
<td>23.0</td>
<td>18.9</td>
<td>11.4</td>
</tr>
<tr>
<td>Haemorrhage</td>
<td>0.3</td>
<td>0.2</td>
<td>0.4</td>
<td>0.4</td>
<td>0.6</td>
<td>-</td>
<td>0.2</td>
<td>-</td>
<td>0.5</td>
<td>-</td>
</tr>
<tr>
<td>Inflammation/swelling/pain</td>
<td>10.7</td>
<td>6.7</td>
<td>11.2</td>
<td>10.1</td>
<td>10.6</td>
<td>8.8</td>
<td>10.0</td>
<td>11.3</td>
<td>12.2</td>
<td>10.6</td>
</tr>
<tr>
<td>Burn</td>
<td>-</td>
<td>0.1</td>
<td>-</td>
<td>-</td>
<td>0.2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Foreign body</td>
<td>0.1</td>
<td>0.5</td>
<td>-</td>
<td>-</td>
<td>0.3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Crush injury</td>
<td>0.3</td>
<td>0.4</td>
<td>0.3</td>
<td>0.4</td>
<td>0.6</td>
<td>0.2</td>
<td>0.4</td>
<td>1.6</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fracture</td>
<td>22.7</td>
<td>19.2</td>
<td>20.8</td>
<td>21.8</td>
<td>20.7</td>
<td>18.3</td>
<td>13.3</td>
<td>15.3</td>
<td>25.1</td>
<td>17.8</td>
</tr>
<tr>
<td>Dislocation/subluxation</td>
<td>5.9</td>
<td>2.1</td>
<td>3.0</td>
<td>5.5</td>
<td>5.6</td>
<td>4.8</td>
<td>3.2</td>
<td>2.4</td>
<td>5.0</td>
<td>5.8</td>
</tr>
<tr>
<td>Sprain/strain</td>
<td>29.8</td>
<td>8.2</td>
<td>37.1</td>
<td>29.0</td>
<td>26.0</td>
<td>45.7</td>
<td>57.5</td>
<td>17.7</td>
<td>26.4</td>
<td>40.1</td>
</tr>
<tr>
<td>Systemic injury</td>
<td>4.1</td>
<td>4.5</td>
<td>2.2</td>
<td>5.0</td>
<td>1.5</td>
<td>1.6</td>
<td>0.9</td>
<td>1.4</td>
<td>1.8</td>
<td>0.9</td>
</tr>
<tr>
<td>Other</td>
<td>1.3</td>
<td>1.4</td>
<td>0.9</td>
<td>1.2</td>
<td>1.8</td>
<td>1.0</td>
<td>0.9</td>
<td>0.8</td>
<td>1.4</td>
<td>1.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>
It is perhaps to be expected that adventure sports such as hang gliding and sky sailing, sky diving, scuba diving and horseback riding are close to the top of this list because of the very nature of the risks undertaken during these activities.

Table 6.14  Top 20 most frequent sports and recreational activities leading to an adult injury hospital admission in Australia (following presentation to an emergency department)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Proportion of all emergency department presentations resulting in hospital admission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hang gliding or sky sailing</td>
<td>32</td>
</tr>
<tr>
<td>Sky diving</td>
<td>25</td>
</tr>
<tr>
<td>Minibikes or trailbikes</td>
<td>21</td>
</tr>
<tr>
<td>Horseback riding</td>
<td>20</td>
</tr>
<tr>
<td>Bowling (not 10 pin)</td>
<td>17</td>
</tr>
<tr>
<td>Scuba diving</td>
<td>17</td>
</tr>
<tr>
<td>Bicycling</td>
<td>14</td>
</tr>
<tr>
<td>Diving</td>
<td>14</td>
</tr>
<tr>
<td>Boats</td>
<td>13</td>
</tr>
<tr>
<td>Other ball sports</td>
<td>13</td>
</tr>
<tr>
<td>Go-carts</td>
<td>12</td>
</tr>
<tr>
<td>Lacrosse</td>
<td>12</td>
</tr>
<tr>
<td>Swimming</td>
<td>11</td>
</tr>
<tr>
<td>Rugby</td>
<td>11</td>
</tr>
<tr>
<td>Badminton</td>
<td>11</td>
</tr>
<tr>
<td>Skateboards</td>
<td>10</td>
</tr>
<tr>
<td>Roller skating/blading</td>
<td>10</td>
</tr>
<tr>
<td>Surfing</td>
<td>9</td>
</tr>
<tr>
<td>Australian football</td>
<td>8</td>
</tr>
<tr>
<td>Golf</td>
<td>8</td>
</tr>
</tbody>
</table>

6.5 HOSPITAL ADMISSIONS DATA

In each state and territory, a central, computerised database of hospital admissions containing considerable inpatient details is maintained. These hospital admissions data files vary according to whether they include patients' names, when centralised and whether both public and private hospitals are included or only public hospitals. The Queensland and New South Wales hospital admissions data, for example, contain information about patients in both public and private hospitals but do not include their names.

The timeliness of hospital admissions data is currently a problem in some states and territories. Lags are commonly of the order of about one year but vary depending on staffing restrictions in hospitals. However, because the coding does not occur until the patient has been discharged from hospital, there is an inherent lag in the system. These delays are unlikely to persist as hospital funding becomes contingent on Casemix information (a component of the Victorian hospital admissions file from 1993). Furthermore, because of the role that it plays in the provision of funding to hospitals, the hospital admissions data files are generally considered to count all hospital admissions; that is there is no under-reporting.

A "mechanism of injury" code (International Classification of Disease 9th Revision, 1978) is recorded for each injured patient admitted to hospital. External causes of injury codes (E-codes) and nature of injury (N-codes) are used to identify cases that are admitted to hospital because of injury. Up to twelve E-Codes can be specified per case. The first E-
code is called the primary E-code because it is the major injury reason for admission to a hospital.

Analysis of hospital admissions data can provide information about:

- The total number of persons injured
- Patterns of injuries
- Demographics of persons injured
- Some location information
- Nature of injury
- Limited external cause of injury data
- Destination on discharge
- Limited injury outcome
- Length of stay in hospital
- Assigned cost, which does not necessarily approximate the true cost of the injury since it is based on hospital costs alone.

The hospital admissions information is particularly limited for sports injury surveillance because it is based on the existing ICD 9 E-codes as discussed in Section 4.2.

Sports injuries can also be identified by the place where the accident occurred code E849.4 (place for recreation and sport). However, this code is not used very often and so its validity needs to be questioned.

Australian Bureau of Statistics mortality data also relies on ICD 9 E-coding of the cause of death and therefore is of little use in identifying fatal football injuries, for example.

The updated version of the ICD classification system (ICD 10) will allow the recording of environmental events and circumstances as the cause of injury. This means that sports injuries will be able to be identified as occurring "while engaged in sports activity" and the place of occurrence of injury as "sports and athletics area" (including football field). However, there are still limitations. For example, different football codes will not be able to be differentiated. It is essential that these limitations in the ICD 10 coding scheme are rectified by the inclusion of supplementary nationally agreed additional sports codes if a broad range of activities are to be identified.

Whilst hospital-based data collections are a very important means of identifying some sources of severe, acute injury, they have obvious limitations.

6.6 THE VICTORIAN INPATIENT MORBIDITY DATABASE

The Victorian Inpatient Morbidity Database (VIMD) is a collection of data on admissions to Victorian public hospitals. From 1993, some private hospitals have also contributed to this data collection. The data is collected by the Health Computing Service Victoria (HCS) under the direction of the Health Department of Victoria. The database is primarily used for health policy and planning in the Victorian Health Department.

The HCS has identified those admissions that had been coded with an external cause of injury E-code in accordance with the internationally used ICD-9-CM manual, excluded all
confidential information and provided the Monash University Accident Research Centre with the data on these admissions for the purposes of injury prevention research.

Table 6.15 lists the inpatient admissions to Victorian public hospitals during the financial year 1992/93 that would be classified as a sports injury on the basis of the E-code assigned to the discharge diagnoses. The E-codes relevant to sports and recreational injury are also given. According to these E-codes there were 4625 people admitted to hospital in 1992/93 for a sport or recreational injury. Over 99% of all cases admitted to hospital with one of these E-codes had it mentioned as the primary E-code.

<table>
<thead>
<tr>
<th>ICD Code</th>
<th>E-codes</th>
<th>Number of admissions mentioning this E-Code</th>
<th>Number of admissions with this E-code as the Primary E-code</th>
<th>Percent of admissions with this E-code not as the Primary E-code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accidents involving animal being ridden</td>
<td>E828</td>
<td>598</td>
<td>595</td>
<td>0.5%</td>
</tr>
<tr>
<td>Accident to watercraft causing other injury to water skier</td>
<td>E831.4</td>
<td>4</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Other accidental submersion or drowning in water transport accident to water skier</td>
<td>E832.4</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Other fall from one level to another in water transport to water skier</td>
<td>E834.4</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Other and unspecified fall in water transport to water skier</td>
<td>E835.4</td>
<td>18</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>Explosion, fire, or burning in watercraft. Injury to water skier</td>
<td>E837.4</td>
<td>1</td>
<td>1%</td>
<td>0</td>
</tr>
<tr>
<td>Other and unspecified water transport accident to water skier</td>
<td>E838.4</td>
<td>32</td>
<td>32</td>
<td>0</td>
</tr>
<tr>
<td>Other and unspecified water transport accident to swimmer</td>
<td>E838.5</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Fall on same level from collision, pushing, or shoving, by or with other person in sports</td>
<td>E886.0</td>
<td>989</td>
<td>987</td>
<td>0.2%</td>
</tr>
<tr>
<td>Accidental drowning and submersion while water-skiing</td>
<td>E910</td>
<td>11</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>Accidental drowning and submersion while engaged in other sport or recreational activity without diving equipment</td>
<td>E910.2</td>
<td>30</td>
<td>29</td>
<td>3.3%</td>
</tr>
<tr>
<td>Striking against or struck accidentally by objects or persons in sports</td>
<td>E917.0</td>
<td>2936</td>
<td>2925</td>
<td>0.4%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>4625</strong></td>
<td><strong>4608</strong></td>
<td></td>
<td><strong>0.4%</strong></td>
</tr>
</tbody>
</table>
Table 6.15 also shows that the major sports injury E-codes are E917.0 (striking against or struck accidentally by objects or persons in sports) and E886.0 (fall on same level from collision, pushing, shoving, by or with other person in sports). However, the inadequacy of existing E-codes to adequately describe the range of sports injuries is clearly apparent.

Table 6.16 gives the number of admissions for injuries that were recorded in the VIMD as occurring in a place for sports and recreation. In 1993, there was 4024 such admissions. Comparison of Tables 6.16 and 6.15 shows that only 46% of the falls in sports (E886.0) and 63% of the collision in sports (E917.0) injuries were also coded as occurring in a place for recreation and sport. This clearly shows the underestimation of the number of cases being admitted to a hospital when the code for place of activity is used to define them.

<table>
<thead>
<tr>
<th>Broad ICD Grouping</th>
<th>Primary E-codes</th>
<th>Number of admissions</th>
<th>Proportion of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport</td>
<td>E800-E848</td>
<td>105</td>
<td>2.6%</td>
</tr>
<tr>
<td>Fall on same level from collision, pushing, or shoving, by or with other person in sports</td>
<td>E886.0</td>
<td>456</td>
<td>11.3%</td>
</tr>
<tr>
<td>Other accidental falls</td>
<td>E880-E888 (excluding E886.0)</td>
<td>930</td>
<td>23.1%</td>
</tr>
<tr>
<td>Striking against or struck accidentally by objects or persons in sports</td>
<td>E917.0</td>
<td>1836</td>
<td>45.6%</td>
</tr>
<tr>
<td>Others</td>
<td>all others</td>
<td>697</td>
<td>17.4%</td>
</tr>
</tbody>
</table>

As noted in earlier Chapters, a major limitation of data coded according to ICD schemes is that individual sports cannot be identified. Thus the codes E886.0 and E917.0 are not very useful. An estimate of the numbers of hospital admissions for these two E-codes that can be attributed to particular sports can be obtained by applying the proportion of hospital emergency department presentations that resulted in hospitalisation for each sport to the total number of hospital admissions coded as E886 or E917 (n=3925). In Victoria, this information is available from VISS data for a select group of sports leading to injuries that present at the emergency departments and which resulted in subsequent admission to hospital of the VISS participating hospitals. The inherent assumption in this process is that the mix of sports leading to injuries that present and are admitted at the VISS hospitals is the same as that which leads to admission at all hospitals throughout Victoria.

Table 6.17 shows the estimated numbers of admitted cases of sports injuries (E886.0 and E917.0) that could be attributed to particular sports, based on VISS data.

6.7 THE NEW SOUTH WALES HEALTH DEPARTMENT CODING SCHEME

Recognising the limitations of the ICD-9 E-codes for sports injuries, the New South Wales Health Department has developed a set of sporting codes to replace the ICD E917.0 (collisions in sports) and E886.0 (falls in sports) codes. This coding system has been applied to the hospital admissions database since July 1989 [Eckstein, NSW Health Department, personal communication]. The implemented codes are summarised in Table 6.18. This table also shows that these codes account for a large proportion of all sport-
injuries and that only 882 (that is, 9%) of the sports injuries were not able to be classified according to the scheme.

### Table 6.17: Estimated numbers of sports injuries due to particular sports that resulted in hospital admission in Victoria during the financial year 1992/93. n=3925

<table>
<thead>
<tr>
<th>Sport</th>
<th>Proportion of all emergency department presentations resulting in hospitalisation for sport and recreational injuries attributed to this sport (%)</th>
<th>Expected number of hospital admissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian football</td>
<td>19.1</td>
<td>769</td>
</tr>
<tr>
<td>Soccer</td>
<td>7.0</td>
<td>282</td>
</tr>
<tr>
<td>Basketball</td>
<td>6.0</td>
<td>242</td>
</tr>
<tr>
<td>Cricket</td>
<td>4.8</td>
<td>193</td>
</tr>
<tr>
<td>Netball</td>
<td>1.8</td>
<td>72</td>
</tr>
<tr>
<td>Rugby</td>
<td>1.1</td>
<td>43</td>
</tr>
</tbody>
</table>

These codes have totally replaced the ICD-9 codes with the 848x series covering 'recreational conveyance' activities and the 927x series covering 'team games'. The ICD-9 has codes for bicycling, horse-riding and water-skiing injuries and these have been retained.

### Table 6.18

<table>
<thead>
<tr>
<th>Code</th>
<th>Activity</th>
<th>Number of hospital admissions for a sports injury in NSW during the 1992/93 financial year</th>
<th>Proportion of all sports injuries %</th>
</tr>
</thead>
<tbody>
<tr>
<td>8481</td>
<td>Skateboard</td>
<td>290</td>
<td>3.1</td>
</tr>
<tr>
<td>8482</td>
<td>Roller skates</td>
<td>808</td>
<td>8.5</td>
</tr>
<tr>
<td>8483</td>
<td>Snow ski</td>
<td>411</td>
<td>4.3</td>
</tr>
<tr>
<td>8485</td>
<td>Trampoline</td>
<td>45</td>
<td>0.5</td>
</tr>
<tr>
<td>8487</td>
<td>Surfcraft</td>
<td>132</td>
<td>1.4</td>
</tr>
<tr>
<td>9270</td>
<td>Combat sports</td>
<td>186</td>
<td>2.0</td>
</tr>
<tr>
<td>9271</td>
<td>Rugby football</td>
<td>3077</td>
<td>32.5</td>
</tr>
<tr>
<td>9272</td>
<td>Other football</td>
<td>1724</td>
<td>18.2</td>
</tr>
<tr>
<td>9273</td>
<td>Hockey</td>
<td>129</td>
<td>1.4</td>
</tr>
<tr>
<td>9274</td>
<td>Squash</td>
<td>203</td>
<td>2.1</td>
</tr>
<tr>
<td>9275</td>
<td>Basketball and netball</td>
<td>877</td>
<td>9.2</td>
</tr>
<tr>
<td>9276</td>
<td>Cricket, baseball and softball</td>
<td>580</td>
<td>6.1</td>
</tr>
<tr>
<td>9277</td>
<td>Gymnastics</td>
<td>128</td>
<td>1.4</td>
</tr>
<tr>
<td>9278</td>
<td>Other sport not elsewhere classified</td>
<td>882</td>
<td>9.3</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>9472</td>
<td>100.0</td>
</tr>
</tbody>
</table>

As Table 6.19 shows, this coding scheme provides useful information about the range, and relative proportion, of sports activities that lead to hospital admission in NSW. On review of the coding system, Eckstein has noted the following limitations and comments:

- The code 9271 is applied to the most common form of football played in the area. In the South west of NSW, it refers to Australian football rather than rugby.
• Other football, code 9272, is composed of 80% soccer cases, 15% from touch football and 5% gridiron and Australian football, except in the Murray region of the state.

• Basketball and netball should be separated.

• Combat sports include boxing, wrestling, fencing and various martial arts.

• A new code for tennis should be established.

The NSW sports injury codes are now used instead of the ICD-9 codes for all hospital admissions in that state. It would be useful to compare the allocation of the standard ICD-9 sports codes with the NSW codes but this is not possible since only the new set of sports codes has been implemented and used since mid-1989.

Discussions with the Health Department of Victoria have suggested that there is the potential to use the NSW codes, or to develop new codes, for the Victorian Inpatient Morbidity Database. The possibility of agreeing upon, and using, a national set of sports codes should also be investigated for hospital admissions data in other states. The fact that a set of codes has been successfully implemented in one state indicates the potential for the development and implementation of a sports injury coding scheme on a wider scale.

6.8 EXTRAPOLATION OF RESULTS FROM THE NEW ZEALAND HOSPITAL ADMISSIONS DATABASE

The New Zealand hospital admissions database is unique in that, in addition to the ICD-9 diagnosis and mechanism of injury codes, a narrative text description is available. Thus sports injuries can be identified by searching the text narrative, as well as by selecting the limited sport-specific E-codes. This means that the extent of under-ascertainment of the sports injury problem by the ICD-9 coding scheme can be assessed by examining the range of E-codes corresponding to cases with a text narrative that indicates that the injury is a sports-related.

The Injury Prevention Research Unit in Dunedin has provided the following data (Table 6.19) for public hospital discharges throughout New Zealand in 1988. There was a total of 47941 hospital admissions for treatment of an injury in 1988 of which 9.1% (n=4374) were sports-related according to the text narratives. The data in Table 6.19 corresponds to all cases for which the text narrative description of the injury event indicated that a sporting activity was involved. The E-codes given are those that the hospital admissions were assigned to.

The sports injury E-codes (E886 and E917) obviously make up a large proportion of the discharge diagnoses in the ranges given in Table 6.19. Other road vehicles, that is ICD-9 codes in the range E826-9, include incidents involving bicyclists and animals being ridden.

Collisions (E917) account for 38.5% of all sports-related hospital admissions, falls (E880-8) account for 32.6%, other road vehicles (E826-9) 15.9% and overexertion and strenuous movements (E927) for 10.0% of these sports injuries. Thus Table 6.19 indicates the high level of under-ascertainment of sports injuries based on the ICD sports codes alone.

In the VIMD (Section 6.6) we found that there was a total of 4027 hospital admissions assigned to the two sports injury E-codes in 1992/93. This corresponds to 4.2% of the total number of injury admissions (n=95,684) in that year. If we assume that the figure of 9.1% determined for the New Zealand data represents the true proportion of injury admissions that are due to sports activities because of the narrative data confirmation, we would expect the total number of injury admissions in 1992/93 in Melbourne to have been 8726. This
means that the use of the ICD sports injury codes has probably only identified at most 46% of the actual number of sports injuries that resulted in hospitalisation in Victoria in 1992/93.

This analysis once again highlights the limitations of the ICD codes for identifying the full range of sports injuries. Adding narrative text descriptions to our hospital admissions databases would help but this would be a very costly exercise. An alternative approach would be to establish a new set of sports injury codes as has already been done by the New South Wales Health Department (Section 6.7).

Table 6.19  E-codes assigned to sports-related public hospital discharges in New Zealand in 1988

<table>
<thead>
<tr>
<th>E-Code</th>
<th>Description</th>
<th>Number of sports-related hospital discharges assigned to this E-code</th>
<th>Proportion of all injuries assigned to this E-code that are sports-related (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E810-9</td>
<td>Motor vehicle traffic</td>
<td>2</td>
<td>0.02</td>
</tr>
<tr>
<td>E820-5</td>
<td>Motor vehicle non-traffic</td>
<td>3</td>
<td>0.4</td>
</tr>
<tr>
<td>E826-9</td>
<td>Other road vehicles</td>
<td>696</td>
<td>36.6</td>
</tr>
<tr>
<td>E840-5</td>
<td>Air transportation</td>
<td>1</td>
<td>1.4</td>
</tr>
<tr>
<td>E846-8</td>
<td>Other vehicles</td>
<td>2</td>
<td>15.4</td>
</tr>
<tr>
<td>E880-8</td>
<td>Falls</td>
<td>1427</td>
<td>10.6</td>
</tr>
<tr>
<td>E900-9</td>
<td>Environmental</td>
<td>15</td>
<td>2.1</td>
</tr>
<tr>
<td>E914-5</td>
<td>Foreign body</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>E916</td>
<td>Falling object</td>
<td>9</td>
<td>1.9</td>
</tr>
<tr>
<td>E917</td>
<td>Struck by object or person</td>
<td>1684</td>
<td>53.7</td>
</tr>
<tr>
<td>E918</td>
<td>Caught in/between object</td>
<td>12</td>
<td>2.6</td>
</tr>
<tr>
<td>E919</td>
<td>Machinery</td>
<td>4</td>
<td>0.4</td>
</tr>
<tr>
<td>E920</td>
<td>Cutting or piercing instrument</td>
<td>35</td>
<td>1.1</td>
</tr>
<tr>
<td>E922</td>
<td>Firearm missile</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>E923</td>
<td>Explosive material</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>E927</td>
<td>Overexertion and strenuous movements</td>
<td>439</td>
<td>43.0</td>
</tr>
<tr>
<td>E928</td>
<td>Other environmental</td>
<td>42</td>
<td>22.0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>All sports injuries according to the text narratives</td>
<td>4374</td>
<td>9.1</td>
</tr>
</tbody>
</table>
CHAPTER 7: OTHER CURRENT AUSTRALIAN SPORTS AND RECREATIONAL INJURY DATA COLLECTIONS

7.1 INTRODUCTION

Chapter 6 presented a review of hospital-based data collections of sports and recreational injury data. In this Chapter, other major sports injury data sources are summarised. These include mortality data collections as well as others describing sports injuries that are not severe enough to present at a hospital for treatment. Unfortunately, only limited data is currently available. However, a number of new initiatives that involve the collection of sports injury data are also described in this Chapter. In addition, the injury data collected by respondents to the survey questionnaire are summarised.

7.2 AUSTRALIAN BUREAU OF STATISTICS (ABS) MORTALITY DATA

The ABS uses ICD (9th revision) codes to classify the cause of injury deaths registered in Australia. The ICD scheme provides a widely recognisable way of defining injury deaths. However, as mentioned in Chapter 4, it has limitations when identifying sports injuries.

Harrison and Cripps [1994] have recently presented detailed tabulations of the major categories of injury deaths registered in Australia during 1992. In total, there were 7,489 injury deaths registered in Australia in that year. This mortality data was provided by the ABS and injury deaths were identified on the basis of being assigned an "External Cause of Injury and Poisoning" (E) code. When there were fewer than 4 deaths in any category, the exact number of cases cannot be given to preserve the confidentiality of the information.

According to this report, there were 1-3 deaths that could be attributed to the ICD code E886.0 (fall on same level from collision, pushing or shoving, by or with other person in sports). These deaths occurred amongst 15-24 year olds. In addition, 1-3 deaths could be attributed to the E-code E917.0 (striking against or struck accidentally by objects or persons in sport). These deaths occurred amongst 10-14 year olds. No deaths in any of the other age groups were attributed to either sports E-code. This means that, at most, 6 of the 7,489 injury deaths registered in Australia in 1992 were related to a sports E-code.

If we use the proportions of deaths from selected categories that can be attributed to sport and recreational activities as suggested by Kraus and Conroy [1984, see Table 4.2], we can assume that there would have been at least a further 88 sports and recreational deaths (34 assigned to bicyclist E-codes, 55 assigned to non traffic motor vehicle accidents and 9 assigned to E-codes representing animal drawn/ridden).

The National Injury Surveillance Unit (NISU) plans to update this report of injury mortality on an annual basis.

More detailed information about sports-related deaths, however, could be obtained by establishing a register of sports fatalities.

7.3 CORONIAL DATA

Coronial data are available on any sudden or unexpected death for which a post mortem is required, by law, to be performed. Coroners' data is therefore a rich source of detailed information about sports and recreational deaths. It has the particular advantage over the
ABS mortality data in that it is not restricted by the ICD coding scheme and more details about the event leading to the death are available.

There is considerable interest by the Police, Emergency Services and other government agencies in the creation of a national database of Coronial data. For example, the National Institute of Occupational Health and Safety proposed that a national system for the surveillance of work-related injuries, particularly fatalities, should be created [Harrison & Frommer, 1989]. Coronial services throughout Australia have also begun to recognise the value of an integrated database of their records [Johnstone, 1991].

Victoria is the only state with fully computerised Coroners' records. A coding scheme for details such as the cause of death and the activity being undertaken at the time of the death are available. Narrative data is also available to provide further insight into the cause of death. The Coroner's findings for the period 1991/92 have recently been released [State Coroner's Office, 1994]. Table 7.1 summarises the number of deaths that were found to have occurred during sport or recreational activities according to the Victorian Coroner for the 3 years over which the computerised database has been in operation [State Coroner's Office, 1992; State Coroner's Office, 1993; State Coroner's Office, 1994]. These records show that sports and recreational activities are not a major cause of sudden and unexpected deaths in Victoria. Many of the recreational activity deaths are due to drowning, activities involving water sports including water-skiing or fishing.

<table>
<thead>
<tr>
<th>Activity</th>
<th>1989/90</th>
<th>1990/91</th>
<th>1991/92</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of deaths examined by the Coroner</td>
<td>1698</td>
<td>1631</td>
<td>1522</td>
</tr>
<tr>
<td>Sports</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sports organised competition or practice</td>
<td>-</td>
<td>2.0 (0.1%)</td>
<td>-</td>
</tr>
<tr>
<td>Sports informal</td>
<td>-</td>
<td>1 (0.1%)</td>
<td>-</td>
</tr>
<tr>
<td>Sports not specified</td>
<td>1 (0.1%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total sports</strong></td>
<td>1 (0.1%)</td>
<td>3 (0.2%)</td>
<td>-</td>
</tr>
<tr>
<td>Leisure or recreation excluding organised sport</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Playing (General activity)</td>
<td>32 (1.9%)</td>
<td>20 (1.2%)</td>
<td>24 (1.6%)</td>
</tr>
<tr>
<td>Recreation or hobby - indoor</td>
<td>2 (0.2%)</td>
<td>1 (0.1%)</td>
<td>-</td>
</tr>
<tr>
<td>Recreation or hobby activity - outdoor on land</td>
<td>9 (0.5%)</td>
<td>8 (0.5%)</td>
<td>10 (0.7%)</td>
</tr>
<tr>
<td>Recreation or hobby - outdoor on water</td>
<td>37 (2.2%)</td>
<td>31 (1.9%)</td>
<td>18 (1.2%)</td>
</tr>
<tr>
<td><strong>Total leisure or recreation</strong></td>
<td>80 (4.8%)</td>
<td>60 (3.7%)</td>
<td>52 (3.5%)</td>
</tr>
</tbody>
</table>

7.4 SPORTS AND RECREATION RELATED SPINAL INJURY

A report prepared by NISU recommending the implementation of a national spinal injury register has been endorsed by the spinal unit directors in each state. It is anticipated that national data collection including the National Minimum Dataset (Injury Surveillance) will begin in the calendar year 1995. Centralised data from the register should be able to identify all cases of spinal injury due to sports and recreational activities. These data are expected to be reported regularly by NISU.
7.5 MEDICAL COVERAGE SERVICES OF SPORTING EVENTS

Sports Medicine Australia (SMA) coordinates the provision of a Sports Medicine Coverage Service to a range of sporting events conducted throughout Australia. This service uses SMA members (all sports medicine professionals) attending the sporting events to treat the various injuries that occur. The SMA members include medical practitioners, physiotherapists, sports trainers and other specific professionals such as podiatrists, nurses and dietitians.

In Victoria, for example, the SMA's Medical Coverage Service has expanded rapidly in the past year to cover 85 sporting events including fun runs, triathalons, netball and football. Since 1994, it has provided coverage of many of the State's triathalon events and a range of other sporting events at the community, state, national and international level.

For medico-legal reasons, the SMA Medical Coverage Service currently uses a standard injury report form to record injuries occurring during each event at which it provides its medical coverage service. This form collects information about the participant themselves and details of the injury assessment and treatment received. In its current form, it does not provide details about the events that lead to the injury so it has limited uses for injury prevention purposes. A further limitation is that data collected during these events is not systematically analysed, collated or reported.

Another problem is that the form is not widely used and has some limitations in that it is not sport-specific nor is it relevant to all sports events. The current injury report form needs to be evaluated regarding its appropriateness for injury data collection, ease of use and relevance for particular sports. Barriers to its use should also be explored so that compliance can be improved. This will increase the number of sports medicine professionals and sports trainers who use it, thereby improving injury surveillance at events with medical coverage. Discussion with sports medicine professionals and accredited sports trainers will be essential to this process.

The potential exists to use the medical coverage service to collect valuable data on sports injuries. This has been demonstrated by Farquharson [1989] in his report of the coverage service provided to the Adelaide Masters Games.

7.6 SPORTS MEDICINE AND OTHER CLINICS

Currently, no comprehensive general practitioner, sports medicine or other practitioner data are available about sports injuries. Where sports based collections do exist, they tend to concentrate only on elite players. This means that little information on the less severe sports injuries (i.e., those that do not result in hospitalisation or death) is not available.

Sports medicine clinics are a rich source of injury information about a select group of sports participants. They generally do not treat the general community nor people injured during recreational activities. Furthermore, some clinics have developed a particular expertise or reputation for providing care to certain types of sports participants, e.g., track and field athletes.

Sports medicine clinics generally collect information about sports injuries as medical or case records. These records form the basis of an injury surveillance scheme but the major disadvantage is that they are not computerised so retrieval of information can be a problem. Nevertheless, these records have been very useful as the basis of much sports injury research as a scan of abstracts presented at the recent International Conference of Science and Medicine in Sport in Brisbane in 1994 shows.
Some clinics have recently moved towards setting up a computerised database of these records so that injury surveillance can be performed within their organisations. An example of this, is the Olympic Park Sports Medicine Centre in Melbourne which has instituted a computerised data collection system since May 1994 [Brukner, personal communication]. The aim of this system is to collect almost complete information on about 12 months of patients attending the centre. A specific injury diagnosis coding system has also been developed.

7.7 GENERAL PRACTITIONER DATA

The Monash University Accident Research Centre (MUARC) is currently coordinating two surveys of General Practitioners (GPs) that will provide detailed data about the types of injuries, including sport injuries, that present to them. The first of these is a joint project of MUARC and the Royal Australian College of General Practitioners (RACGP) which is being funded by the Commonwealth Department of Health and Human Services. This is based on the annual RACGP Inter Practice Comparison that surveys up to 800 GPs in both rural and urban Australia. In October 1994, a pilot survey collected detailed information about injuries that presented to GPs during a two week period. A definitive study on a representative sample of GPs is expected to be conducted in October 1995.

The second survey is being conducted in the Latrobe Valley over a 12 month period starting November 1994. The Latrobe Valley has 17 general practices and 50 GPs. The aim of the study is to collect detailed injury data on at least 85% of all injury cases presenting to the GPs in this regional area and to determine any bias in missing cases by a regular audit process. This study is particularly important because it will allow the relative proportions of injury cases that are fatal, admitted to hospital, attend emergency departments or present to GPs to be determined for the first time for a well-defined community. This means that a meaningful sports injury pyramid will be able to be developed for the Latrobe Valley population.

7.8 THE ORCHARD SYSTEM

The Orchard Sports Injury Classification System is currently being used by some sporting bodies, including the Australian Football League and the NSW Rugby League records details of sports injuries [Orchard, 1993]. Its major limitation from an injury prevention perspective is that it is a diagnosis-based system and does not obtain information about the mechanisms of injury. As such, it may be useful for monitoring trends in the numbers and types of injuries over time but its use for injury prevention is likely to be minimal. Coordination of this system with the NMDS (injury surveillance) should be a priority.

7.9 INSURANCE DATA BASES

Some insurance companies maintain records of claims made to them for costs of treating sports injuries by a range of health professionals. Some insurers, such as the Insurance Exchange of Australia, have a particularly well developed sports injury data collection system. The major disadvantage, however, is that the relevant injury data is often not computerised and has to be manually extracted from insurance claim records. Nevertheless, this source of data has the potential to describe a range of sports injuries that do not present to hospitals for treatment.
7.10 SPORTS BODY COLLECTIONS

Some sports associations are beginning to collect information about injuries related to their particular sport. For example, the Victorian Squash and Racquetball Federation requires that a copy of each insurance claim from an injured participant be forwarded to their head office. This enables the federation to maintain a record of a good many of the injuries that occur in their sport.

The All Australian Netball Association has developed a knee injury survey and questionnaire. This survey aims to obtain information about the factors associated with knee injuries amongst netballers. Knee injuries are a particular problem for this group of participants and the study should provide valuable information for guiding injury prevention activities. Data has been collected by the national body since 1991.

7.11 THE SPORTS INJURY SURVEY FOR NSW

The Northern Sydney Area Health Service is currently conducting a sports injury prevention project that aims to collect information about the extent of the sports injury problem amongst adolescents in the community. One of the project's specific aims is to identify both the incidence of sports injuries in New South Wales high school students and possible risk factors for sports related injuries.

The project involves a survey of at least 39 high schools in New South Wales. This takes the form of a two phase survey to account for seasonality in sports participation. The first survey was conducted in August 1994 and the second survey will be conducted in February 1995.

7.12 OTHER SPORTS INJURY DATA COLLECTIONS - SURVEY RESULTS

The survey of key organisations described in Chapter 5 sought information about sports injury data collections that are currently under way across Australia. This section summarises the responses to this survey.

Forty-three respondents stated that their organisation collected information on sports and recreational injuries and 51 stated that they did not. Data on this question was missing from 15 respondents. The data described below therefore relates to the 43 respondents from organisations that collect sports injury data.

The most frequently cited person with responsibility for the collection of this data was, not surprisingly, the treating or team doctor (28%). Other persons with responsibility for collecting injury data include research staff/data processors/receptionists (14%), insurers (14%), physiotherapists (12%), providers of medical coverage at events (9%), survey respondents (7%) and ambulance officers/first aiders(7%).

Forty-seven percent of the organisations collecting injury data did so using injury report forms, 26% through the notes of treating health professionals and 19% through an incident form. Fourteen percent of the responding organisations have collected sports injury data for 10 years or more, 26% for 5-9 years and 47% for 1-4 years.

Purpose of the sports injury data collections

The major purpose for which the injury data is collected was for research purposes (58% of all organisations collecting injury data) including surveillance of injuries and to address more general epidemiological issues. Data is also collected for insurance purposes (21%),
medico-legal reasons (12%), program review and planning (9%), monitoring of athletes’ health (7%) and for statistical purposes (7%).

**How a sports/recreational injury is identified**

Injury is, in most cases, identified through the need for medical attention (21%) and through diagnosis codes established by hospital record or surveillance systems, or non-hospital doctor and physiotherapist diagnoses (14%). Other means of identification include: time lost from training or matches (14%), insurance reports (9%) and reports from the athlete themselves (9%).

**Information is collected on the level of play, supervision**

As can be seen from Table 7.2, 18% of respondents stated that they collect injury data for participants at all levels of play with most others stating that data is collected for participants at only selected levels.

<table>
<thead>
<tr>
<th>The levels of play or supervision for which injury data is collected</th>
<th>Frequency % (n=43)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of play</td>
<td></td>
</tr>
<tr>
<td>- Junior</td>
<td>9</td>
</tr>
<tr>
<td>- Senior</td>
<td>5</td>
</tr>
<tr>
<td>- Elite</td>
<td>7</td>
</tr>
<tr>
<td>- Veteran</td>
<td>0</td>
</tr>
<tr>
<td>Level of supervision</td>
<td></td>
</tr>
<tr>
<td>- Professional</td>
<td>2</td>
</tr>
<tr>
<td>- Competition</td>
<td>9</td>
</tr>
<tr>
<td>- Recreational</td>
<td>2</td>
</tr>
<tr>
<td>- Practice games/training</td>
<td>0</td>
</tr>
<tr>
<td>All levels</td>
<td>18</td>
</tr>
<tr>
<td>Other</td>
<td>12</td>
</tr>
</tbody>
</table>

**Information collected about the type and severity of injury**

Almost all (n=40) of the 43 respondents who collect data on injuries stated that they collect information on the type of injury and its severity. Specific information is collected on the type of injury (diagnosis, including E-codes) (58%), the body part injured (40%) and injury severity (40%). Measurements of injury severity include the level of consciousness, treatment, post-treatment destination, and lost time from sport.

**Collection of information about the circumstances and mechanisms leading to injury**

Thirty-one of the 43 respondents stated that they collect information on the circumstances and mechanism of injury. Nineteen percent collect data on the activity (sport type) in which the person was participating at the time of injury. Nineteen percent also collected information on the circumstances leading to injury (what went wrong), 28% on the mechanism of injury (how the body was injured) and 40% on whether protective gear or modified rules were in use at the time when the injury occurred. Sixteen percent of the respondents to this question also collect data on the location and time when the injury occurred. Previous medical history is collected by 12% of respondents.
Information collected about the injured person

Most data specified in this section of the questionnaire has been previously outlined. Data on the direct and indirect cost of injury (medical costs, time lost etc) was collected by 23% of respondents. Twelve percent of respondents also stated that they recorded a narrative (text description) of the event and 12% collected information on follow-up visits required by the injured participants.

Data accuracy, storage, access and dissemination

Less than half (44%) of all respondents in this section of the questionnaire stated that quality assurance of data was undertaken by various means including phone, interviewer and direct observer verification. Other methods include checks against insurance claims, medical records or X-ray reports. Data is stored by 56% of respondents as a written record in standardised form and by 56% of respondents as a computerised record.

Sixty-three percent of respondents stated that the data could be provided to other groups. The form of this data is as a summary of injury data as tables and other statistical summaries (16%), individual records (4%), journal publications (2%), data provided on disc (7%) or a hard copy (7%). Sixteen percent of respondents stated that written permission is required and 9% stated that a request needed to be made but did not provide further specification. The cost of accessing this data was stated as nil by 16% of respondents, as the cost of labour by 10%, as a charge by 4% and as needing to be negotiated by a further 4%.

About one third (35%) of respondents stated that any personal identifiers would be removed before data provision and 42% stated that medical files would not be made available. Typical users of the data are personnel internal to the organisation (40%), sports administrators, committees or affiliated organisations (28%) and medical staff (21%). Data on injury is disseminated through reports and publications (42%), internal reports (16%), annual reports (9%) or at conferences (9%). One-fifth (21%) of the respondents stated that the data is not disseminated.
CHAPTER 8: PARTICIPATION DATA

8.1 INTRODUCTION

The aims of this Chapter are to describe recent and existing collections of sports participation data in Australia and to examine the scope for improved participation data collections. Data sources have been identified through consultation with the key bodies that have the most responsibility, or need, for this sort of data. The survey of sporting bodies described in Chapter 3 also provided valuable information about smaller participation data collections around Australia. A summary of the survey results is therefore also presented in this Chapter.

The benefits of sports participation have been succinctly summarised by the Australian Sports Commission in their publication entitled Sport and the Quality of Life [1992]. This document has also summarised the major sources of sports participation data available before its publication date. The reader is referred directly to this publication for information about earlier sports participation data collections. This Chapter will therefore generally focus on the more recent sources of sports participation data.

8.2 SURVEYS OF PHYSICAL ACTIVITY LEVELS IN THE AUSTRALIAN POPULATION

The assessment of physical activity has been an important component of epidemiological studies into cardiovascular and other non-communicable diseases because of the role that it plays in preventing these conditions [National Heart Foundation, 1990]. The most widely used method for assessing physical activity levels in these studies has been activity questionnaires [Bauman, 1987; Bauman et al., 1990; Aaron et al., 1993]. For example, the National Heart Foundation's 1989 Risk Factor Prevalence Studies involved the administration of a self-report questionnaire to 9328 adults from the major Australian capital cities [National Heart Foundation, 1990]. Included in the survey were two questions that sought information about exercise for recreation, sport or health and fitness:

In the past 2 weeks, did you engage in vigorous exercise - exercise which made you breathe harder or puff and pant? (e.g. vigorous sports such as football, netball, tennis, squash, athletics, Jogging or running, keep-fit exercise, vigorous swimming, etc.)

If yes, how many sessions of vigorous exercise did you have over the 2 week period?

Please estimate the total time spent exercising vigorously during the past 2 weeks.

In the past 2 weeks, did you engage in less vigorous exercise for recreation, sport of health-fitness purposes which did not make you breathe harder or puff and pant?

If yes, how many sessions of less vigorous exercise did you have over the 2 week period?

Whilst this information is useful for obtaining information about levels of physical activity participated in with respect to cardiovascular health benefits, it does not provide information for quantifying exposure to particular sports activities since information about these is not
available. Furthermore, sporting versus general recreational activities cannot be separately analysed.

The 1989 National Heart Foundation Risk Factor Prevalence survey was the third in a series of surveys of adults, the others being conducted in 1980 and 1983. At this stage, there are no plans to conduct any repeat surveys.

The other major source of population data about participation in physical exercise for health is given by the Australian Bureau of Statistics (ABS) National Health Survey which is conducted every five years. The last survey was conducted in 1989/90 and collected information on physical activity levels as the frequency and duration of vigorous and moderate exercise undertaken and of walking for exercise or recreation.

The National Health Survey will be repeated in 1995 and the information about exercise participation will be identical to that obtained in the earlier survey to ensure compatibility. Some data about injuries and the events leading to them will be obtained at a greater level of detail than during the 1989/90 survey. It will be possible, for example, to find out whether an injury occurred during sport, game or recreational activity. However, no finer identification of particular sports or activities will be possible.

Surveys of physical activity, in their current form, have little potential to contribute to improved sports involvement data collection methodologies. It is recommended that future National Health Surveys provide a more meaningful focus on the collection of risk factor data for injury including sport and recreational injury.

8.3 AUSTRALIAN BUREAU OF STATISTICS DATA COLLECTIONS

8.3.1 National surveys

In recognition of the need for national sports and recreational participation data, and trends across time, the Commonwealth Department of Environment, Sport and Territories (DEST) and the Australian Sports Commission (ASC) have commissioned the Population Survey Monitor (PSM) program to collect national sports and recreational participation data. The PSM is coordinated by the Adelaide office of the ABS and is conducted in both metropolitan and non-metropolitan areas of all states and territories.

The ABS PSM surveys households on a sample survey basis using methodology common to all other ABS surveys. It collects data on a range of issues including those specially commissioned by other organisations such as the participation data requested by DEST and the ASC. The PSM is a national survey of approximately 2,500 households and 5,000 people, each quarter. The PSM is a user-pays survey with each included question costing approximately $2,500.

Collection of sports participation data through the PSM began in August 1993. Both DEST and the ASC plan to continue to support it on a quarterly basis for at least another 2 years. This should enable enough data to be collected to identify some trends and to overcome the deficiencies of needing to cover four seasons of sport and recreation activity. Although core questions are consistent across each survey, it is possible that some questions, such as those relating to social sport activities, vary from quarter to quarter.

Core information that is collected includes:

- Duration
- Frequency
- Type of sport or recreational activity
- Organised versus non-organised
- Type of participation (coach, player, official, etc.)
- Demographics
- Money spent on travel, equipment or membership.

The sport and recreational participation data collected through the PSM can be obtained from State and Territory Government Sport and Recreation agencies. The typical users of this information are likely to be government, sport and recreation agencies, peak sporting bodies or associations, industry and academia.

There is the potential to also use the PSM to collect information about the occurrence of sport injuries in the two week period before each survey. This could then be correlated with the participation data to provide some very valuable information about relative injury occurrence and risks in various sports. A lead agency would need to take responsibility for developing these questions with the ABS and for providing the funds for including them in the PSM.

### 8.3.2 Victorian surveys

In October 1989, the Australian Bureau of Statistics conducted a survey of Sports Participation in Victoria [ABS, 1989]. This survey collected participation data for the period November 1988 to October 1989 from Victorians aged at least 15 years. The information collected included: the sports participated in; how the sports activities were organised; level of involvement; length, frequency and occurrence of training and participation; club membership and its cost; expenditure on sport; reasons for no involvement in any sport; trends in sport participation; sports attended as spectators where admission charged and no admission charged. For the purposes of this survey, a participant was defined to include anyone who engaged in sport as a player or competitor, coach, trainer, paid or unpaid official (referee, umpire, judge, adjudicator, lines person, etc.), administrator or volunteer.

This information is the most detailed and recent information for Victoria. Its limitations are that it does not include information on children aged under 15 years and that it is possibly becoming out-of-date since the survey was conducted 5 years ago. There is a need to repeat this survey to get more timely data for Victoria. It is also important that a similar survey is conducted on children.

The Victorian Government Departments of Sport and Recreation Victoria, Conservation and Natural Resources, Tourism Victoria and Gaming are currently planning a proposal for the 1995 ABS State Supplementary Survey to collect information on sports participation. The aim of this survey would be to repeat the 1989 survey using the same methodologies and questions so that trends can be identified. It is recommended that such a survey should include children's sports participation and sports injury data for the previous 2 weeks as well as most of the previous data. The likelihood of success would be enhanced if this were a joint bid with the Department of Health and Community Services as suggested by the Victorian "Taking Injury Prevention Forward" strategy [HC&S, 1994].

### 8.3.3 Queensland survey

A survey of sports participation amongst people aged at least 15 years throughout Queensland was conducted by the ABS in October 1993. The survey was conducted as a supplement to the monthly population survey coordinated by the ABS. The sports...
participation survey collected information on the nature of participation in sporting and physical recreational activities, organisers of the sport or activity, frequency of participation, expenditure on the sport or physical activity, the intention to participate in a sport or activity, main reason for non-participation, demographic characteristic and educational qualifications of both participants and non-participants [ABS, Catalogue Number 4110.3].

8.3.4 Tasmanian participation data

Data on participation in sport in Tasmania was collected by the ABS in March 1993. Recent reports from the Department of Tourism, Sport and Recreation in Tasmania describe the collected data [Hagan, 1994a, 1994b]. The available data is similar to that obtained in the Victorian and Queensland surveys described above.

8.3.5 Other issues

Wicklin (1992) has noted that large population surveys of sports participation may be subject to recall or systematic bias. The former can occur when there is considerable time between when the sporting activity took place and the survey is conducted. Recall bias is most likely to be a problem for non-regular participants and can be minimised by conducting surveys every quarter, rather than annually. However, follow-up surveys by the ABS to the pilot survey of the Fitness of Australians found that recall did not create bias when questions were limited to a period of two weeks.

Occasionally survey respondents may consider that it is beneficial to participate in sports and to state that they are active. This might influence their responses in a positive way but this sort of bias is very hard to quantify.

8.4 MARKET RESEARCH SURVEYS

Annual surveys of the sporting interests of Australians have been conducted by Brian Sweeney and Associates since 1987 and a prospectus for the 1993/94 survey is available from the market research company [Brian Sweeney & Associates, 1993/94 prospectus]. These surveys are of 1500 adults aged over 15 years interviewed across the mainland capitals and Canberra and provide information on fifty-one sports and activities. The advantages of these surveys are their timeliness and the fact that they are conducted annually. However, the relatively small sample size means that the results may not be truly representative. Furthermore, since the surveys are only conducted in the cities of Melbourne, Adelaide, Sydney, Perth, Brisbane and Canberra, they are not representative of all sports participants across Australia. A further limitation is that they do not collect information on children's participation in sport. Nevertheless, they are useful because they are one of the few sources of information about population levels of sports participation.

8.5 THE NATIONAL SPORT AND RECREATION INDUSTRY STATISTICAL FRAMEWORK

The Sport and Recreation Ministers Council was first established in 1973 to coordinate the development of the Sport and Recreation industry in Australia. In September 1993, this Council established a Statistical Working Group (SWG) to:
• Advise on the statistical needs of the Commonwealth, State, Territory and local levels of government.

• Arrange and assist consultations with representatives of industry.

• Review successive drafts of the National Sport and Recreation Industry Statistical Framework to ensure government needs are met.

• Advise on studies which may be necessary to develop the Framework and improve the definition, range and quality of statistics for the Sport and Recreation Industry.

• Seek to ensure the collection of data on the Sport and Recreation Industry within the jurisdiction of individual members of the Statistical Working Group is compatible with the Framework.

• Report to the Sports and Recreation Ministers Council at key intervals on progress.

The activities of the SWG are being coordinated by DEST. Activities are currently in the consultative phase with the anticipated outcome of a final set of reports in 1995. Draft reports of the first edition have recently been prepared and circulated for comment [Brokensha, 1994a, b].

The SWG recognises that a key component of the Sport and Recreation industry is the sports participants themselves. Therefore considerable attention has been given to the identification of available data and sources for Sports and Recreation. In summary, the consultative process has highlighted sports participation data needs in terms of the number, gender, age, education and income level, ethnicity, occupation, frequency and type and reasons for non-participation or discontinuing participation. Major deficiencies in the existing data collections were identified by comparing the available data with the industry's actual data requirements. Whilst this information is available from some sources, it is not consistently available across all data collections.

At this stage, the statistical framework does not include any information about sports injuries, as an essential component of sports participation data. However, discussions are currently under way with the SWG and its consultants as to how this can be included in the future. It is hoped that the ensuing statistical framework will be able to incorporate guidelines on how this can be collected in the future.

8.6 THE INTERNATIONAL COMMITTEE FOR SPORTS STATISTICS

In 1993, the International Statistical Institute established an International Committee for Sports Statistics. The aim of this Committee is to promote the cooperation amongst experts and institutions to improve the collection, compilation and the presentation of statistics about the various aspects of sports. Sports participation data has been set as one of the priority areas and the Committee states "action should be taken to develop common indicators (selection of variables) to monitor changes in sports participation".

The Statistical Working Group described in Section 8.5 will contribute the Australian experiences to the International effort and further development of the UNESCO Framework for Cultural Statistics relating to sport.

At this stage the UNESCO Framework for Cultural Statistics does not include sports injuries as a topic of relevance. However, the authors have corresponded with the Chair and Secretary of the International Committee who agree that sports injuries are a specific aspect of sports participation and should be addressed at future meetings. Australia has the opportunity to set the international stage in this area and a recommendation should be
made that sports injury data can be collected and incorporated into the UNESCO Framework.

The International Committee has also established an international directory of people and bodies active in sports statistics either as generators of data or data users. Some Australian groups are already represented in this directory.

8.7 SPORT-SPECIFIC DATABASES

Some sporting organisations conduct surveys of the numbers of participants in their sports. These are generally based on the number of registered members, not all of whom are active players. Most sporting organisations are required to supply these numbers to funding bodies, such as State Government Departments, to justify their level of funding. It is not known how accurate these statistics are and some sporting associations may inflate their membership numbers to increase their funding subsidies.

Perhaps the most extensive and detailed of the sporting organisation surveys is the Australian Football Census commissioned by the National Australian Football Council (NAFC). This Census obtained its data with the assistance of State football bodies and collated information about current club registrations at all levels of organised play. This included information in State, metropolitan and country regions and both primary and secondary school football. This national survey, "The socio-economic impact of Australian Football", was conducted by Street Ryan and Associates in May 1993 [NAFC, 1993 a, b].

The advantage of this type of survey is that it enables considerable detail about a specific sport to be obtained. It would be useful for other sporting organisations to conduct similar surveys in their sport.

8.8 THE VICSPORT DATABASE

The Department of Sport and Recreation Victoria (SRV) operates a computerised database of registered participants of a number of sports - the VICSPORT database. This includes information about the numbers of participants, coaches and clubs involved in formal or organised sports. There is also information about the sporting facilities. The database has not been updated since 1991/92 but is expected to be current as from the end of 1994. A disadvantage of the data is that it is provided by the sporting bodies that are seeking funding and no quality control measures to validate the data are currently in place. Access to this database is through the SRV.

8.9 THE WESTERN AUSTRALIA SPORTS CENSUS

The Ministry of Sport and Recreation in Western Australia recently reported the results of its Sports Census 1993 [Ministry of Sport and Recreation, 1993]. This was the fourth census conducted by the Ministry, the earlier ones being carried out in 1981, 1984 and 1990. The census is the only one of its kind produced in Australia and one of the few longitudinal sources of sports participation data. An individual is considered to be a sports participant if they are an active participant (ie as a player or competitor), coach, administrator, social or associate member or an official.

The 1993 Census provides a statistical summary of data complied from 91 (89%) of the Western Australian sporting organisations. This includes information about membership numbers and participation patterns, membership fees, employee type profiles, finance, computer technology application, provision for special groups, number of coaches.
A disadvantage of the data is that it is limited to affiliates and/or registered members of state sporting clubs. This means that accurate participation rates for casual or school competition cannot be obtained. Furthermore, the figures do not reflect the numbers of participants who are neither affiliated nor registered with a state sporting organisation.

Unlike other participation surveys, the Census provides valuable information about participants under the age of 15, including school-age participation. It is also one of the few sources of trend data for sports participation over a substantial period of time.

8.10 RESEARCH STUDIES - THE VALUE OF JOINTLY COLLECTING PARTICIPATION AND INJURY DATA

Sections 8.2-8.9 have described some of the existing sports participation data collections. These provide information across a range of activities at a community level or across a range of participants of a particular sport. They are therefore useful in obtaining estimates of the numbers of participants of particular activities so that injury rates per 10,000 participants, for example, can be calculated.

As an example, consider a study to estimate the incidence of sports injury within a well defined geographically based region, such as metropolitan Melbourne or the Latrobe Valley in Victoria. The number of people resident in this region, that is the population size, can be obtained from Australian Bureau of Statistics (ABS) census data for the defined region. This can then be used to obtain injury rates per 100,000 population. Whilst population data such as this provides some useful rate data for comparison with other injury types, they are limited because not all people participate in sports activities. It would therefore be more meaningful to describe the population at risk for those exposed to sports activities, ie sports participants.

To do this, the ABS population data can be supplemented with data obtained from the Population Survey Monitor and Surveys of Sports Participation conducted by the ABS, in conjunction with the Department of the Environment, Sport and Territories (Canberra), or the appropriate state-based collections. The results of these participation surveys provide multipliers to the population figures for estimating the numbers of people who participate in sports and recreational activities within a given region.

The above approach for calculating injury rates is limited for detailed studies of particular sports or specific levels of competition, however. In these studies, the injury rate needs to be more closely related to the direct injury risk or exposure of individuals. Estimates of injury incidence per standard number of player hours are more desirable. The only way to reliably collect this sort of participation data is to collect it at the same time as the injury data. This approach has been shown to be very successful in two recent studies of injuries in Australian football [McMahon et al., 1993; Sewrad et al., 1993].

The only way to be able to match participation data with the actual within a group of sports participants is to collect both types of data at the same time over the period of interest. Whilst this is not feasible for large community-based studies or general sports injury surveillance, it should be the procedure used for smaller, targeted studies.

8.11 OTHER DATABASES

The Australian Coaching Council Database can be used to provide information on the numbers of accredited coaches in each State.

Sports Medicine Australia maintains a national database of accredited Sports Trainers.
8.12 OTHER SPORTS PARTICIPATION DATA COLLECTIONS - SURVEY RESULTS

The survey of key organisations described in Chapter 5 sought information about sports participation data collections currently under way across Australia. This participation data is collected either on organisations (e.g. the number of registered players of a sporting organisation or club) or directly on individuals (e.g. insurance claims or medical histories of patients treated at sports medicine clinics). For this reason, the questionnaire sought information on these two broad data collection methods separately. The results are given in the following sections.

8.12.1 Participation Data Obtained On Groups Of Individuals

Thirty-one of the 100 respondents to the survey stated that their organisation collected information on participation in sports activities for groups of participants. The following statistics refer to this set of 31 respondents. For some survey questions, more than one response was provided by a given respondent and so the following percentages do not necessarily add to 100%.

Collection of data on organisations participating in sport and recreational activities is undertaken mainly by those groups most directly associated with such activities, namely sports associations (45%), sports clubs (29%), administrators and event organisers (10%) and doctors and general practitioners (10%).

How this data is collected

Participation data is collected mainly through registration forms (58%) and event records (45%). Ten percent of respondents stated that data is collected through sports and ABS surveys. Reasons for the undertaking of the data collection were given as program planning and monitoring (in 48% of cases), insurance purposes (26%), injury surveillance (13%) and for the general collection of statistics (10%). Thirteen percent of respondents have collected data for ten years or more, 20% for 5-9 years and 32% for 1-4 years.

How sports or recreational participation is identified

Participation numbers are most commonly identified through the registration of participants or teams in events (81%); through registrations to sporting organisations (10%); as the number of matches or practice sessions played (23%); or by the number of hours of play (10%).

What information is collected and collated on the level of play or supervision

As can be seen in Table 8.1, only 3% of respondents stated that they collect participation data at all levels of play. Most respondents collect data on participation at senior (65%) and junior (68%) levels. Seventy-four percent collect data for competitions and 42% at practice games or training.

Information collected on participation

The type of information collected by respondents is outlined in Table 8.2. From this table it can be seen that data relating to the level of play (55%) and the type of sport or activity (45%) is by far the most frequently collected information.
Data - accuracy, storage, access and dissemination

Forty-five percent of all respondents to this part of the questionnaire stated that quality assurance of data is undertaken. Verification is undertaken by consulting registrations at the state or club level (19%) or by unspecified means (10%). Six percent of respondents compared their data to data from the previous year or to data from other clubs.

Table 8.1  Collection of data on level of play and supervision for groups of participants

<table>
<thead>
<tr>
<th>The levels of play and supervision for which participation data is collected</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level of play</strong></td>
<td></td>
</tr>
<tr>
<td>- Junior</td>
<td>68</td>
</tr>
<tr>
<td>- Senior</td>
<td>65</td>
</tr>
<tr>
<td>- Elite</td>
<td>29</td>
</tr>
<tr>
<td>- Veteran</td>
<td>32</td>
</tr>
<tr>
<td><strong>Level of supervision</strong></td>
<td></td>
</tr>
<tr>
<td>- Professional</td>
<td>29</td>
</tr>
<tr>
<td>- Competition</td>
<td>74</td>
</tr>
<tr>
<td>- Recreational</td>
<td>29</td>
</tr>
<tr>
<td>- Practice games or training</td>
<td>42</td>
</tr>
<tr>
<td>- School-based events</td>
<td>13</td>
</tr>
<tr>
<td><strong>All levels</strong></td>
<td>3</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>6</td>
</tr>
</tbody>
</table>

Table 8.2  Range of information collected about groups of participants

<table>
<thead>
<tr>
<th>Participant data items</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of play</td>
<td>55</td>
</tr>
<tr>
<td>Sport or activity name</td>
<td>45</td>
</tr>
<tr>
<td>Injury details</td>
<td>23</td>
</tr>
<tr>
<td>Demographics</td>
<td>23</td>
</tr>
<tr>
<td>Event details</td>
<td>19</td>
</tr>
<tr>
<td>Duration or frequency of play</td>
<td>6</td>
</tr>
<tr>
<td>Other</td>
<td>23</td>
</tr>
</tbody>
</table>

Data is stored by 48% of respondents as a written record in standardised form and by 74% of respondents as a computerised record. Many different databases are used to store the data but the most commonly used ones are Dbase (10%), ACCORD (10%), Microsoft Access (6%) and the Victorian Database for Sports (6%).

Forty-eight percent of respondents stated that data could be provided to other groups. This could be as a computer disc (19%), a sport-specific report (6%), specific information requests (modified and de-identified) (5%) or data in either a written or spreadsheet form (26%). Thirteen percent of respondents stated that a written request is required and 10% stated that a request needed to be made but did not provide further specification. The cost
of accessing this data was stated as nil by 19% of respondents, as the cost of labour (6%) and as stationery and postage costs only (3%).

Thirty-five percent of respondents stated that any personal identifiers would be removed before data provision and 13% that access to data is restricted. Ten percent stated that confidentiality was adhered to but did not specify further. A further 10% stated that the organisation had no concerns with privacy in the release of the data. Nearly all respondents stated that the main users of the data were sports administrators, committees, clubs, participants or coaches (94%). Internal personnel (32%), the government, the ASC, state departments of sport (26%) were also cited as frequent users. The media (13%), researchers (6%) and medical personnel (6%) were cited as less frequent users.

Data on injury is disseminated through reports and publications (32%), annual reports (29%), and through the media (6%) and internal reports (6%). Thirty-two percent of respondents stated that the data is not disseminated.

8.12.2 Participation Data Collected On Individuals

Twenty respondents stated that their organisation collected information on participation in sports for individuals, rather than in groups of people. Collection of data on individuals participating in sport and recreational activities appears to be undertaken mainly by those groups most directly associated with such activities: sports associations (30%) and sports clubs or event organisers (40%). Researchers (25%) and doctors or general practitioners (15%) are also responsible for collection of some of this data. The following percentages refer to the 20 respondents to this part of the questionnaire.

How this data is collected

Participation data is collected mainly through registration forms (45%), surveys (25%) and injury case details (15%). Reasons given for the undertaking of the data collection included injury surveillance (25%), collection of statistics, program planning and monitoring (25%) and medico-legal or insurance purposes (15%). Fifteen percent of respondents have collected data for 10 years or more, 20% for 5-9 years and 35% for 1-4 years.

How sports or recreational participation is identified

Injury is, in most cases, identified by the registration of participants or teams (55%), hours of play (20%), surveys (20%) or the number of matches or practices played (10%).

What information is collected and collated on the level of play and supervision

Table 8.3 shows that only 10% of respondents stated that they collected injury data for players at all levels of play.

Half of the respondents collected data at competition level and 30% for recreational activities.

Information collected on participation

A summary of the information collected by respondents is given in Table 8.4. Data relating to details of club of origin (65%), the level of play (45%), the type of sport or activity (35%) and injury details (35%) are the most frequently collected information.
Table 8.3  Collection of data on the level of play and supervision for individual participants

<table>
<thead>
<tr>
<th>Items relating to levels of play and supervision</th>
<th>Frequency %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level of play</strong></td>
<td></td>
</tr>
<tr>
<td>- Junior</td>
<td>45</td>
</tr>
<tr>
<td>- Senior</td>
<td>40</td>
</tr>
<tr>
<td>- Elite</td>
<td>20</td>
</tr>
<tr>
<td>- Veteran</td>
<td>20</td>
</tr>
<tr>
<td><strong>Level of supervision</strong></td>
<td></td>
</tr>
<tr>
<td>- Professional</td>
<td>15</td>
</tr>
<tr>
<td>- Competition</td>
<td>50</td>
</tr>
<tr>
<td>- Recreational</td>
<td>30</td>
</tr>
<tr>
<td>- Practice games or training</td>
<td>25</td>
</tr>
<tr>
<td>- School-based events</td>
<td>10</td>
</tr>
<tr>
<td><strong>All levels</strong></td>
<td>10</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>25</td>
</tr>
</tbody>
</table>

Table 8.4  The range of information collected about individual sports participants

<table>
<thead>
<tr>
<th>Information collected about participation</th>
<th>Frequency %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Club or association where the registration or membership is held</td>
<td>65</td>
</tr>
<tr>
<td>Level of play</td>
<td>45</td>
</tr>
<tr>
<td>Sport or activity name</td>
<td>35</td>
</tr>
<tr>
<td>Injury details</td>
<td>35</td>
</tr>
<tr>
<td>Demographics</td>
<td>40</td>
</tr>
<tr>
<td>Duration or frequency of play</td>
<td>20</td>
</tr>
<tr>
<td>Other</td>
<td>50</td>
</tr>
</tbody>
</table>

Data - accuracy, storage, access and dissemination

Thirty-five percent of respondents stated that quality assurance of data is undertaken. Verification is undertaken by verifying registration at state or club level (10%), by unspecified means (10%), by comparing data with similar data (5%) and through telephone interview audits (5%). Data is stored by 35% of respondents as a written record in standardised form and by 70% of respondents as a computerised record. Many different databases are used but no single database is used by more than one organisation. Both generic (e.g. EXCEL or Dbase) and customised packages (e.g. Coach database - ASC, SSOS - ABS) are used.

One half of the respondents to this section of the questionnaire stated that data could be provided to other groups on disc (20%), as a variable-specific report (15%), aggregate form (10%) or in a written or spreadsheet form (10%). Thirty percent of respondents stated that a formal request is required and 10% stated that no procedure is in place.

One quarter of respondents stated that any personal identifiers would be removed before data provision and 25% that access to data is restricted and not for general distribution.
Most respondents stated that the main users of the data were sports administrators, committees, clubs, participants or coaches (55%). However, internal personnel, researchers and government were also cited as frequent users.

Data on injury is disseminated mainly through reports and publications (60%), annual and internal reports (20%), through the media (15%) and conferences (15%).
CHAPTER 9: SUMMARY OF FINDINGS

9.1 INTRODUCTION

A comprehensive national review of the status in sports injury and participation data collections, has been presented in Chapters 5-8. This includes the results from a national survey of government sectors, sports bodies and health sector practitioners. This Chapter summarises the major findings of this feasibility study, including the results of the consultation process.

Detailed recommendations arising from these findings will be developed in Chapter 10.

9.2 REASONS FOR THE LIMITED CURRENT SPORTS INJURY DATA COLLECTION ACTIVITIES

The principal finding from the review of current data sources is that, at present, information about the incidence and factors associated with sport injuries in Australia is very limited.

The major reasons for this appear to be the following:

1. A lack of clear leadership and/or ownership of the problem.
   - Sports injuries are only just beginning to be recognised as a public health problem.
   - To date there has been no "ownership" of the sports injury problem by either the health or the sports sectors.
   - There is no lead agency currently driving progress towards improved sports and recreational injury data collection activities.
   - There is currently no national, or state-based, sports injury surveillance system.

2. A lack of involvement of sports bodies in data collection activities.
   - There is little or no incentive to sports bodies or sports medicine professionals, in general, to collect sports injury data.
   - Different sports have different organisational structures making national efforts difficult.

3. No readily available methodology to facilitate data collection activities.
   - There are no agreed definitions for answering questions such as: what is a sports injury?; how severe must an injury be before it should be considered to be a sports injury?; what is a sports participant?; and how should sports participation be measured?
   - There is a need for a standardised data collection methodology, including data collection forms and associated computer database systems, that can be applied across a number of levels of participation and different sporting activities.
   - Many of the coding systems for sports injuries are medically based and relate only to diagnoses or treatment (e.g. the Orchard system). Because these
systems often omit information about the circumstances leading to injury, they are of limited value for injury prevention purposes.

4. **Limitations of existing data sources.**

- For many sports, reported injury data on elite or professional players is relatively easy to obtain but little information exists at any other level of play.
- Very little detailed participation data is available, particularly at the community level.
- Most sports injuries are not treated in, or at, hospitals. However, most of the data about sports injuries currently available comes from hospitals.
- Apart from a few emergency department data collections, little information is available from current data sources as to how and why the sports injuries occur. This limits their potential to identify possible risk factors for prevention purposes.
- Sports medicine clinics are only just beginning to systematically collect information about sports injuries and associated medical risk factors but this largely exists as medical records.

9.3 **BARRIERS TOWARDS SPORTS INJURY AND PARTICIPATION DATA COLLECTION ACTIVITIES**

The following barriers towards collecting sports injury and participation data were identified:

1. **Funding and associated constraints.**

- A lack of funding and resources. This is related to the fact that collection of this data is not a priority on government agendas.
- Time and workload constraints for both sports bodies and sports medicine professionals.
- There could be a perception amongst sporting bodies that the accurate reporting of numbers of participants would lead to higher fees levied against them.

2. **A lack of co-ordination. Administrative constraints.**

- A general lack of co-ordination and guidelines. In particular, there appears to be little communication between the relevant government authorities.
- Administration of sports bodies and other organisations requires streamlining.

3. **A lack of understanding of the need for, and a lack of skills to progress, data collection activities.**

- A lack of interest in, and understanding of, the need to collect data about sports injuries. There is also a lack of commitment to collect this information.
- A lack of cooperation from coaches, trainers, etc. and the lack of suitable personnel with the appropriate skills and knowledge to collect injury information. Often the people best placed to collect this information are volunteers who may not have this knowledge and skill base.

4. **The available data and recording practices.**
• Poor recording practices and the lack of accurate information collected and reported.
• The data currently collected is often not representative across a broad range of sports injuries and self-reported data may be subject to recall bias.
• The large number of unregistered players and participants in informal sports.
• The range of possible modalities and places for treatment. This limits the representativeness of sports injury data collections based on just one source of data from a particular place of treatment.

9.4 CURRENT DATA COLLECTIONS

The major existing sports injury and participation data collections were explored in depth to determine the extent to which they currently contribute to sports injury information and how they can be improved by relatively simple means to maximise their utility. These are summarised below.

9.4.1 Injury data bases

The major current injury data collections are:

• Coroners’ databases
• ABS mortality data
• Hospital admissions data
• Emergency department data collections
• The spinal injury register
• Limited sports medicine clinics collections
• Limited medical coverage data.

9.4.1.1 Limitations

Apart from emergency department data collections and Coronial records, these data sources do not readily identify a range of sports activities or participation at different levels. Emergency department collections contain the most detailed information about sports injuries that could lead to their prevention but most sports injuries are not treated at an emergency department. Sports medicine clinics and medical coverage services typically collect diagnosis and treatment details with only limited information about how the injury occurred. This means that they are limited from the injury prevention perspective.

A particular major limitation of databases of hospital admissions and ABS mortality data is that they currently can not identify individual sports because of the limitations inherent in the ICD-9 E-coding system used to classify the injuries. Furthermore, this classification scheme does not readily identify many of the sports injuries.

Emergency department and other health sector databases will require implementation of the National Minimum Data Set (Injury Surveillance) (NMDS(IS)), plus a second level of more detailed data to collect sport-specific data, in the future.
9.4.1.2 Suggested Improvements

Sport injury data collection activities could be improved through a number of means. Firstly, identification of appropriate data collectors is required. It would be sensible to continue to use the health sector data to monitor the more severe injuries, i.e. those that result in death, hospitalisation or presentations to hospital emergency departments. The potential of other data collection sources, such as sports trainers, to collect information about the less severe injuries needs to be explored as a priority.

Sports bodies are not currently involved in most of the present data collection activities. However, they should be strongly encouraged to participate in such activities in the future. Adequate training of the appropriate collectors in standardised data collection methodologies and procedures is required before any surveillance activity. This would be greatly enhanced by the development of standardised data collection forms and procedures that could be used across sports and levels of participation. Protocols are also required to complement the nationally compatible sports injury data forms so that they include both core (e.g. demographic details) and sport specific data items. These need to be in as simple a format as possible so that they can be used across a wide range of sporting contexts. A simple, yet comprehensive coding system, based on that developed for the NMDS(IS) is required.

Finally, a stand alone simple data entry and analysis software package to accompany sports injury databases using uniform data items and data collection forms would be advantageous. This would need to be very simple to use and able to generate standard statistical summaries of data in a form that can be readily used by sports clubs etc. Development of this software, and provision of it to sports bodies at a nominal cost, could encourage data collection at this level. A lead agency needs to be identified to take on this role.

9.4.2 Participation data bases

The major sports participation databases include:

- National Health surveys
- ABS surveys
- Market research surveys
- State Departments of Sport and Recreation specialist collections
- Australian Coaching Council and Sports Medicine Australia's National Sports Trainers Scheme.

9.4.2.1 Limitations

Unfortunately, much of the data about registered players is incomplete. Surveys of participation in sports and recreational activities have generally been of adults only and they are conducted infrequently. Information about the level of participation, number of training hours, etc. are not always available from these sources. Furthermore, sample sizes are relatively small so extrapolation of data to the whole population may be a problem.

A systematic approach is currently lacking for the aggregation, analysis and dissemination of this information. Quality control of data appears to be poor or non-existent.
9.5 SUGGESTIONS MADE BY SPORTS BODIES FOR IMPROVING DATA COLLECTION ACTIVITIES

Ideas and information about future plans for sports injury surveillance activities in Australia were sought both in the national survey undertaken as part of this study and during the many face-to-face interviews with key organisations. These have been useful in contributing to the development of recommendations for moving towards a sports injury data collection strategy.

In summary, the major recommendations arising during this consultation process were the following:

1. The sports and health sectors should work cooperatively.
   - Encourage the health and sport sectors to recognise sports injury as a problem common to them both.

2. Sports bodies should be involved in data collection activities.
   - Encourage sports bodies to have an active role in injury data collection activities. Financial incentives for them to participate in such activities could be considered.
   - Support sports bodies in their injury prevention activities by providing them with up-to-date information.

3. Identify a lead agency or agencies.
   - A lead body, or bodies, needs to be identified to coordinate the collection and dissemination of sports injury information. Coordination on a national level is particularly important.
   - A lead agency should take responsibility for providing information about sports injury prevention to sports bodies, participants, coaches, sports trainers, etc.

4. Infrastructure and policy support needs to be provided.
   - Develop appropriate government policies to address the problem of sports injuries.
   - Provide funding and other incentives to sports associations, bodies and professionals to collect and record sports injury data.
   - Increase the media profile of sports injury prevention activities and decrease its focus on the "sports-hero" aspects of injury occurrence.

5. Improve the coverage of data across a range of participation.
   - Collection of sports injury data across a range of levels of sports participation is needed. A move away from a focus only on injuries that occur at the elite level of participation to community participation is necessary.
   - Some valuable data is currently available from hospital-based data collections. However, to obtain a complete picture of the sports injury problem in this country, this needs to be complemented with the addition of data from sports medicine practitioners, general practitioners and other health professionals involved in the treatment and management of sports injuries.
6. *Appropriate data collection methodologies need to be developed.*

- A higher standard of data collection and injury reporting could be achieved by improving training in injury prevention methodologies and philosophies. This training should be particularly targeted at coaches, trainers and sports bodies.
- Improve the collection of sports participation data and agree upon standard definitions that account for registered versus non-registered participants, sports versus recreational play, etc.
- Improve the existing diagnosis and sports injury identification coding schemes. Develop a standardised scheme to be used across a broad range of sports and recreational activities and levels of participation that is applicable nationally.
- A standardised data collection form, coding scheme and computer package that are simple to use need to be developed.

9.6 **CONCLUSIONS**

It is confirmed from this study that information on sports injury in Australia is currently fragmented. However, sufficient information is available to begin to actively address injury prevention in some sport and recreational activities. With our current knowledge base, it is also possible to identify a systematic and strategic approach to substantially increase the potential for both prevention and reduction in severity of sports and recreational injury. This will be developed in Chapter 10.
CHAPTER 10: DISCUSSION AND RECOMMENDATIONS

10.1 INTRODUCTION

This Chapter develops recommendations for improving sports injury data collection methodologies in Australia. In doing so, it attempts to place them within the broader context of the current status of sports injury prevention activities and research. This is important because any consideration of injury data collection methodologies must be integrally related to the purposes to which the data will be used.

As we have seen, data collection activities are a vital component of any injury control and prevention program. Thus recommendations are made for improving sports and recreational injury data collection methodologies within the context of a more general examination of the pre-requisites towards making progress in sports injury prevention. These recommendations support and underlie the National Injury Control Strategy as well as the state-based strategies for the prevention of sports and recreational injuries.

This Chapter begins with a discussion of the pre-requisite infrastructure and information needs for injury prevention activities. A framework for sports injury data collection activities is developed, based on the results of the review of the current situation. Finally recommendations for a five year work program are outlined.

The underlying principles of the recommendations for data collection methodologies presented in this Chapter are those of an injury prevention perspective and include appropriate regard for financial and practical constraints.

10.2 INFRASTRUCTURE PRE-REQUISITES FOR SPORTS INJURY PREVENTION

In the course of undertaking this study, it has become apparent that both an infrastructure and an information framework are necessary to effectively progress sports injury prevention activities. Improved data collection methodologies are an integral part of this. The broad infrastructure pre-requisites are described in this section. Section 10.4 describes the information needs.

Currently, no structure or lead agency exists to guide these sports injury prevention activities or to provide funding for them. Furthermore, injury prevention research activities are currently forced to compete with all other types of medical and basic scientific research identified as also being necessary by the sports bodies. A lead agency, or agencies, at both the National and State levels is needed to prioritise these sports injury research needs and, where appropriate, to fund and commission such research. Organisations with a potential to fulfil this role are the Australian Sports Commission and both the federal and state Government Departments of Sport and Recreation.

Some injury prevention activities and research is currently being undertaken at the elite and professional levels of play, primarily through sports medicine clinics. However, particular attention needs to be given to community level and the less formal levels of participation. This could be a new focus area for the Australian Sports Commission, but would need appropriate resources to support it. For the long-term injury prevention goals, involvement of sports bodies, themselves, is crucial.
At the national level, a lead agency could either be created (e.g. a National Office of Sports Safety) or formed from an amalgamation of existing agencies such as the Australian Sports Commission and the Commonwealth Department of Human Services and Health. However, a national agency may not be appropriate for progressing activities at community levels of sport participation. For this reason, state based agencies may need to be identified in each state, possibly through the state Government Departments of Sport and Recreation.

A national committee formed by these lead agencies is needed to review progress on the implementation of data collection methodologies and injury prevention activities. Membership of this committee should also include representatives from other key organisations such as Sports Medicine Australia, the Australian Coaching Council, sports physicians, researchers across a range of disciplines and injury prevention professionals. This committee should meet at least annually and circulate its annual report to organisations such as the Australian Sports Commission, the Australian Coaching Council and Sports Medicine Australia to help guide them in their injury prevention activities.

It is likely that the identified lead agency, or agencies, will not have all of the expertise needed to assess the current injury prevention research and activities or to prioritise them. Sports injury prevention advisory groups, such as the VICHealth Sports Safety Working Party, could be established within each state and nationally to provide advice and guidance, when needed, to these lead agencies. It is possible that other funding bodies, such as health promotion foundations, would also benefit from access to these advisory groups.

Other functions of a lead agency or agencies could include:

- Coordination of data collection, research and prevention activities.
- Setting priorities for future activities.
- Policy development.
- Establishing and maintaining networks and communication across the full range of sports bodies, sports medicine professionals and injury prevention experts.
- Coordination and support for the training of appropriate professionals in the principles and practices of sports injury prevention.
- Provision of funding for injury prevention activities.
- Provision of funding for injury research and coordination of these activities.
- Acting as a clearing house for sports injury prevention information.
- Consideration of the role of levies, sponsorships, government funding, and sports industry backing for injury prevention activities.

It should be noted that a serious commitment to data collection and sports injury prevention would involve considerable financial support.

### 10.3 INFORMATION PRE-REQUISITES FOR SPORTS INJURY PREVENTION

#### 10.3.1 Sports injury and participation data needs

Sports injury data needs can be summarised under the following categories:

1. **Overview information about the size and nature of the injury problem.**

   This data is available, to a limited extent, from hospital-based data collections across the country but there are a number of limitations as identified in Chapter 6. Data is
required at all levels of participation and for all sports and physical recreational activities. This means that the hospital-based data collections need to be supplemented with information from the wider health sector, sports sector, sporting organisations, insurance companies and community surveys. Data from each of these areas will contribute to describing the magnitude of the sports injury problem in this country.

It is acknowledged that different levels of data will be available from the various sources. When combined, however, they will provide a broad overview of the epidemiology of sports injuries in Australia.

2. *Both baseline and ongoing injury data*

Collection of sports injury information across a broad level of participation and sporting activities needs to be done on an ongoing basis to maintain an overview of the sports injury problem. This would be useful for identifying trends in injury occurrence over time, thereby providing the basis for evaluating community-wide intervention strategies.

This data needs to be at two levels: a broad, overview level and a more specific level for certain types of injury outcome, e.g. catastrophic injuries or fatalities. Sports activities should be viewed across two distinct levels (elite and professional versus other) because they have different patterns of health care usage and types of injuries. This is related to differences in the numbers of participants and general levels of fitness and performance skills in participants from these levels.

At the broad overview level, this data would provide information about community level activities. The monitoring of specific intervention strategies can be achieved by ongoing data collections for particular types of injury (e.g. head and neck injuries, fatalities, etc.) or particular sporting activities (e.g. football, horse riding, netball, etc.).

Ongoing injury data is particularly required to monitor the effectiveness of injury prevention programs. Good data is required over time at both the health sector and sporting organisation level. For example, evaluating the success of the National Sports Trainers Scheme in achieving its goal of injury prevention will depend upon a reliable injury data collection system. Targeted studies aimed at evaluating specific sports injury countermeasures, such as modified rules, depend upon the monitoring of injuries either in a pre- and post- implementation period or in concurrent control and test groups, such as different teams.

3. *Participation data*

This is required to determine the relative risks of injury between sports and to identify whether any change in the frequency of sports injury is real or merely a function of the number of participants or hours played.

Collection of this information is limited presently by the varying definitions of sports participants and the extent of participation. Definitions of exposure to injury risks and participation in sports need to be determined. Agreement on the best measure of exposure to use, such as the number of matches played in a season or the number of participants in a particular competition, etc. is also essential.

It should be recognised, however, that some sports injury prevention activities can be undertaken without much exposure data.
4. **Information about the long term sequelae of sports and recreational injury**

Data is required to determine the relationships, if any, between the development of chronic diseases such as arthritis and previous sports participation. It is likely that this would be best achieved by analytical research studies.

### 10.3.2 Injury prevention strategy needs

The consultation process undertaken as part of this project, has highlighted that many sports bodies and sports medicine professionals would like to do more to prevent injuries from occurring amongst their members now. However, they lack readily available information about suitable strategies to direct this. The following injury prevention strategy needs highlight some of the areas where information is currently needed.

1. **Information on the full range of available countermeasures (interventions)**

   A scientific review of the literature is required to summarise the full range of available sports injury countermeasures, particularly those proven successful or with good potential for success.

   All collated information needs to be documented and presented in a form that can be readily understood and acted upon by sports bodies, coaches, trainers, parents, participants, etc.

2. **Information on the full range of available implementation strategies**

   A scientific review and documentation of the full range of implementation strategies, particularly those proven successful or with good potential, is required. This should include a review of the methods used to evaluate them.

   This information about implementation strategies is needed to guide sporting bodies and others in the application of appropriate countermeasures (identified in 1) to their particular sport, in the field.

3. **Information about treatment and rehabilitation methods**

   A review of the literature is required to identify and document those methods which have been proven to be successful in reducing the recovery time and complications arising from sports injuries and the subsequent time lost from usual sporting activity.

4. **The cost of sports and recreational injury and cost/benefit ratios for implemented countermeasures**

   Crude estimates of the costs of sports injury could be made from the existing sources discussed in Section 10.3.1. Injury and associated cost data are required as the basis of cost/benefit analyses for the development and prioritisation of countermeasures and their implementation strategies. This information would be valuable for government and other funding bodies for directing, prioritising and supporting injury prevention strategies.

### 10.4 RESEARCH NEEDS TO PROGRESS INJURY PREVENTION ACTIVITIES

Many of the limitations and gaps identified in Sections 10.3.1 and 10.3.2 could be addressed by specifically targeted research. The following broad research needs are therefore recommended:
1. Literature reviews
   - Of the available sports injury countermeasures (such as protective equipment, modified rules, etc.) and intervention strategies. These may also be useful for identifying potential countermeasures and strategies.
   - Of information about the effectiveness of treatment and rehabilitation regimens.

2. Data collection activities
   - Simultaneous collection of participation and injury data for specific sports so that injury rates (rather than absolute frequencies) can be determined more accurately.
   - Epidemiological studies of the size and nature of the sport and recreational injury problem.

3. Biomechanical studies
   - Development of new sports injury countermeasures, such as protective equipment.
   - Ongoing testing and improvement of existing countermeasures.
   - Contributions to the development of appropriate Australian Standards for protective equipment.

4. Epidemiological studies
   - Identification of possible risk factors that have a potential for prevention. This should include an examination of both intrinsic and extrinsic factors.
   - Analysis of trends over time in both injury and participation rates. This should be done across a broad community-wide level. However, more detailed studies could be conducted within specific localities or based on specific sports.

5. Evaluation studies
   - On-field testing of the effectiveness of new or improved countermeasures, including an examination of any unanticipated negative side effects.
   - Of existing and potential sports injury countermeasures (e.g. shin guards, ankle bracing, education, pre-season training, rule changes, etc.).
   - Of implementation strategies (e.g. the National Sports Trainer Scheme, controlled trials of protective equipment in the field, etc.).
   - Of the effectiveness of various treatment and rehabilitation regimens.

6. Biomedical and basic scientific studies
   - To assess the value of activities such as pre-season training, talent matching, nutrition, etc. in injury prevention.

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10.5 A FRAMEWORK FOR SPORTS AND RECREATIONAL INJURY DATA COLLECTION ACTIVITIES

Initially, this project aimed to recommend a single comprehensive injury data collection system. However, following consultation and extensive review, it has been determined that the feasibility of proposing such a system at this time is limited by the general lack of sufficient development in sports injury data systems to date. Australian collections are too rudimentary and world best practice does not yet offer a developed model. Consequently cost studies cannot be undertaken for such a system.

However recommendations can be suggested which would vastly improve the current status of data collections. The other relevant research and development studies that are described in Sections 10.3 and 10.4 would help to provide the beginnings of a surveillance system within a few years.

Currently, the most likely framework for sports injury data collection activities in the short term is a composite of Coronial, health sector (expanded and enhanced), sport and recreation department (participation data) and special collections from sporting bodies, sports medicine professionals, medical coverage services and local communities.

Different types of data collection methodologies are required for distinct purposes. State and national level data is necessary to maintain a perspective on the broader sports injury picture and for relative risk determination of identified factors relating to injury occurrence. This would preferably involve continuous surveillance but generally on a sampling basis, e.g. continuous monitoring of sports injuries that present to a sample of hospital emergency departments. On the other hand, time-limited studies will be useful in the short term for the directing of immediate preventive actions. These studies could also be useful for identifying preventive strategies and aetiological factors.

It may be feasible, in the future, to develop a network of sporting bodies that would be able and willing to collect and centralise data to contribute to a state or national surveillance system. However, significant progress will require the collaborative effort of many organisations and government departments. A lead agency, or agencies, would also be necessary to drive this process forward.

A proposed framework for a preliminary sports injury surveillance system is outlined below, although its specific configuration would be expected to vary to some extent during its establishment. It seems that the only practicable model for the short to medium term, given existing financial and practical constraints, is an integrated one using data from several sources. Such a framework raises the difficulties associated with data matching and the avoidance of duplication. It also moves away from the ideal of a simple model. The recommendations that follow are for both short and long term directions.

Before considering this framework, it is worthwhile summarising the potential sources of injury data according to level of participation.

10.5.1 Potential sources of sports injury data

The potential sources of sports injury data are shown in Tables 10.1 and 10.2. These tables correspond broadly to the two levels of participation “community and social” and “elite, professional and formal competition”. Since different patterns of health care usage are likely to be used by participants from the broad levels, the tables have marked differences in potential data sources. This reflects the fact that injury data is best obtained from the source of treatment.
At the community and social level (Table 10.1) participation can be considered to occur at four sub-levels:

- Formal competition or play
- Informal play and general exercise participation
- School
- Recreation.

Table 10.1 shows that four data sources have the potential to contribute across each sub level of participation: Coronial data, hospital admissions data, emergency department presentations and general practitioner data. Apart from general practitioner data, continuous surveillance is currently under way for each data source. It would seem prudent, therefore, to maintain monitoring of data from these sources since they cover all levels of community and social play.

Table 10.1  Potential sources of injury data for participants at the community and social levels

<table>
<thead>
<tr>
<th>POTENTIAL SOURCE OF INJURY DATA</th>
<th>LEVEL OF PARTICIPATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FORMAL</td>
</tr>
<tr>
<td>Coronial data</td>
<td>√</td>
</tr>
<tr>
<td>Hospital admissions</td>
<td>√</td>
</tr>
<tr>
<td>Emergency department presentations</td>
<td>√</td>
</tr>
<tr>
<td>GP data</td>
<td>√</td>
</tr>
<tr>
<td>State and local sporting organisations</td>
<td>√</td>
</tr>
<tr>
<td>Government Departments of Sport and Recreation</td>
<td>√</td>
</tr>
<tr>
<td>SMA Medical Coverage service</td>
<td>√</td>
</tr>
<tr>
<td>SMA Sports Trainers Scheme</td>
<td>√</td>
</tr>
<tr>
<td>Sports Medicine Clinics</td>
<td>√</td>
</tr>
<tr>
<td>Sports Medicine Professionals</td>
<td>√</td>
</tr>
<tr>
<td>Insurance records</td>
<td>√</td>
</tr>
<tr>
<td>Funding or sponsorship bodies</td>
<td>√</td>
</tr>
<tr>
<td>Community Surveys</td>
<td>√</td>
</tr>
<tr>
<td>ABS Surveys</td>
<td>√</td>
</tr>
<tr>
<td>Directorates of School Education - Physical Education Units</td>
<td></td>
</tr>
<tr>
<td>School accident reports</td>
<td></td>
</tr>
<tr>
<td>School surveys</td>
<td></td>
</tr>
</tbody>
</table>
Table 10.1 also shows that the Government Departments of Sport and Recreation have a potential major role to play in data collection activities. These organisations should be encouraged to do so and to take a lead role in this. Both community-wide and ABS surveys would also be of considerable value in describing the injury problem at this level. As would be expected, school-based surveillance would be best achieved through an audit of school accident reports or school surveys.

The potential sources of injury data for the elite, professional and formal competition levels of participation are shown in Table 10.2. The level of participation is subdivided into three categories (national, state and local competition) to distinguish between the nature and organisation of these activities.

Table 10.2 Potential sources of injury data for participants at the elite, professional and formal competition levels of play

<table>
<thead>
<tr>
<th>POTENTIAL SOURCE OF INJURY DATA</th>
<th>LEVEL OF PARTICIPATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NATIONAL</td>
</tr>
<tr>
<td>Coronial data</td>
<td>✓</td>
</tr>
<tr>
<td>Hospital admissions</td>
<td>✓</td>
</tr>
<tr>
<td>Emergency department presentations</td>
<td>✓</td>
</tr>
<tr>
<td>State and local sporting organisations</td>
<td>✓</td>
</tr>
<tr>
<td>National Sporting Organisations</td>
<td>✓</td>
</tr>
<tr>
<td>State Government Departments of Sport and Recreation</td>
<td>✓</td>
</tr>
<tr>
<td>SMA Coverage service</td>
<td>✓</td>
</tr>
<tr>
<td>Sports Medicine Clinics</td>
<td>✓</td>
</tr>
<tr>
<td>Sports Medicine Professionals</td>
<td>✓</td>
</tr>
<tr>
<td>Insurance records</td>
<td>✓</td>
</tr>
<tr>
<td>State Institutes of Sport</td>
<td>✓</td>
</tr>
<tr>
<td>Australian Sports Commission</td>
<td>✓</td>
</tr>
<tr>
<td>Professional Medical Officer Groups</td>
<td>✓</td>
</tr>
<tr>
<td>Olympic Medical Teams</td>
<td>✓</td>
</tr>
</tbody>
</table>

As with the level of participation shown in Table 10.1, Coronial data, hospital admissions data and emergency department presentations are able to provide information at the more formalised level of participation. Whilst some cases may be treated by general practitioners, this is likely to be rare and so this source of data has been omitted from this table.

A wide range of organisations have the potential to contribute to sports injury surveillance across all sub-levels at this level of participation: the Australian Coaching Council, Sports Medicine Australia, sports medicine clinics, sports medicine professionals and insurance records. The Australian Sports Commission and National sporting organisations are particularly important for data collection at the national level whereas their state-specific counterparts could be responsible for state-based activities.
Taken together, Tables 10.1 and 10.2 have identified the following major potential data collections across all, or most, levels of participation. Priority should be given to maintaining or establishing these data collections:

- Coronial data
- Hospital admissions
- Emergency department presentations
- State Government Departments of Sports and Recreation
- Sports medicine professionals.

Other important sources of data that should be developed include:

- National, state and local sporting organisations
- The Sports Medicine Australia medical coverage service
- Sports medicine clinics
- Insurance records.

This highlights the role that Commonwealth and State Government Departments of Sport and Recreation should take in injury surveillance activities in their areas and supports the earlier suggestion that these bodies should be nominated as lead agencies. For the Australian Sports Commission to take a lead role in data collection activities across the full spectrum of sporting activities, it would need to change its focus from largely elite and professional level competition to a wider community base. However, this would probably be seen by many within the sports community as inevitable.

### 10.5.2 A proposed framework for sports and recreational injury data collections

Considering the potential data sources across a range of levels of sporting activities and the injury prevention focus introduced in Section 10.2, the following framework for sports injury data collections in Australia is proposed.

#### Figure 10.1 Components of a sports injury data collection framework for Australia

<table>
<thead>
<tr>
<th>Continuous</th>
<th>Periodic</th>
<th>Time-limited</th>
<th>Specific</th>
</tr>
</thead>
<tbody>
<tr>
<td>collections to cover all levels of participation</td>
<td>sampling schemes</td>
<td>studies</td>
<td>studies</td>
</tr>
</tbody>
</table>
For the most part, the framework necessarily collects injury and participation data from separate sources. Coronial, health sector and sports based injury and participation data collections are required. Only certain types of surveys or other research methodologies would be expected to have the capability of directly relating sports injury data to participation on the basis of individuals (i.e. directly) (as discussed in Section 8.10).

The utility of the proposed framework, as with any injury data collection system, would also relate to the timeliness of data and the ability to monitor the occurrence of new hazards in sport and recreation activities by routine mechanisms.

It can be anticipated over a five year work plan that pilot studies of the various components of this data collection framework would be undertaken and that the model could be substantially refined. National, state and local data would need to be accessible, as would analyses by individual sports.

The model also relies on a number of specific data collection recommendations for sports and participation data being implemented. For example, the identification of individual sports in hospital admissions, Coronial and spinal cord injury data is essential from the perspective of prevention. It also requires the development of appropriate tools such as acceptable, compatible and standardised data collection forms, agreed coding and a central computerised data entry, analysis and storage system.

The following two sections provide a more detailed description of the two "arms" of this proposed framework.

10.5.2.1 Ongoing overview surveillance

Ongoing overview injury monitoring could be achieved by three methods:

1. **Continuous collections to cover all levels of participation**

   These are currently quite well developed and include the following collections:
   - Hospital admissions data
   - Emergency department presentations (continuous at the state level but national sampling)
   - Coronial data
   - Spinal injury register.

   These collections could be enhanced in the future by specific registries established to monitor other catastrophic injuries such as the head and neck injury registry proposed by the NH&MRC for the football codes.

   The maintaining of these data collections is a priority for the monitoring of sports injuries. Either complete coverage or sampling schemes could be used as data collection processes.

2. **Continuous collections to cover some levels of participation**

   Data collections at this level are yet to be fully developed but could include:
   - Australian Sports Commission Data
   - Sports medicine clinics
• The Australian and State Institutes of Sport
• National Sporting organisations
• Community surveys
• ABS surveys
• Government Departments of Sport and Recreation
• Insurance records
• SMA Sports Trainers.

The development of some of these data collections as supplementary to the continuous collections discussed above should receive attention over the next few years once an effective infrastructure is set in place. Success will depend upon close collaboration between the sports and health sectors. Data collections at this level will provide valuable information about the more common, less severe injuries that are not fatal or catastrophic or which do not present to a hospital for treatment.

3. Periodic sampling schemes

Data collection activities based on periodic sampling schemes are another means of proving ongoing overview surveillance. Some examples include:

• Regular updates of the numbers of registered sports participants
• ABS surveys
• Community surveys.

These schemes are valuable for monitoring trends in participation or injury rates over a specified time period.

10.5.2.2 Specific and targeted surveillance

Specific and targeted data collection activities provide the opportunity to explore particular sports, activities or groups of participants in greater detail than can usually be achieved during overview surveillance activities. It is this sort of surveillance that is crucial for detailed identification and assessment of injury hazards and for monitoring the effectiveness of any implemented injury control strategies. This sort of surveillance can be achieved by two types of studies:

1. Time-limited studies

Time limited studies are a particular type of study that enable very detailed injury or participation data to be collected over a defined period of time, e.g. a couple of seasons, one year, during a single event. Some potential sources of time limited data collections are the following:

• Government Departments of Sport and Recreation specialist collections
• Sports medicine clinic specialist studies
• General practitioner data collections
• SMA medical coverage of sporting events
• Community-wide surveys of sports participation and injury occurrence
• State and local sporting clubs and associations.

2. Specific studies

Specific studies provide very detailed information that is useful to feed back into injury prevention programs and their evaluation processes. Examples of potential sources for some of these include

• Government Departments of Sport and Recreation specialist collections
• Sports medicine clinic studies
• State and local sporting clubs and associations
• Surveys of participants of specific sports or activities
• Longitudinal follow-up of particular clubs or teams or groups of participants.

10.6 GENERAL RECOMMENDATIONS

Before the model described in the previous section can be implemented the following general recommendations need to be addressed. Specific recommendations for data collection methodologies are presented in the following section.

1. It is essential that both the sports and the health sectors take joint responsibility for sports safety.

2. It is essential that government departments of sport and recreation recognise sports injury as integrally related to sports participation.

3. Government Departments of Sport and Recreation should:

   a) give consideration to collecting data on sports injury at the same time as collection of sports participation data (through surveys, etc.).

   b) give serious consideration to providing funding to sports bodies to encourage their involvement in sports injury prevention activities and sports injury surveillance activities.

   c) give serious consideration to providing funding for sports injury research projects that enhance sports bodies' capacities for injury prevention activities.

   d) should consider establishing a requirement of all sports bodies they fund to provide evidence of participation in sports injury surveillance and prevention activities.

4. Sports bodies should be encouraged to endorse the sports injury strategies contained within the National Health Goals and Targets and implement strategies to address these.

5. Incentive funding should be provided to sports bodies to collect information about sports injury and to establish links with prevention programs at the time of their development where possible.

6. Direct funding towards non-elite and community level sports injury prevention through a central body - possibly a new focus for the Australian Sports Commission. Funding also needs to be directed towards research, implementation and evaluation approaches.

7. Establish a clearing house for sports injury prevention information.
10.7 SPECIFIC DATA COLLECTION RECOMMENDATIONS

Specific recommendations for improving data collection methodologies to improve the standard of sports injury data collection are as follows:

1. **Establish a lead agency or agencies**
   - Identify and establish a lead agency, or agencies, to oversee data collection developments over a five year time-frame.
   - Establish a national sports injury surveillance advisory committee.
   - Develop a work-plan within an appropriate lead agency, or agencies, to regularly report on sports injury data to the extent possible.

2. **Involve sports bodies**
   - Involve sports bodies more directly in data collection activities.
   - Trial specific sports association based injury and participation data collections to determine the rate, severity and nature of injuries for particular sports. Also to determine whether this is an appropriate method for obtaining baseline injury rates for ongoing intervention and evaluation studies.
   - Support the development of demonstration models of "best practice" for sports bodies to follow.

3. **Enhance Government collections and data collection activities**
   - The Commonwealth Department of Community Services and Health and DEST should support the recommendation that sports participation data be collected within the UNESCO Framework for Cultural Statistics.
   - Enhance Commonwealth DEST and ABS participation data collections by:
     a) including children
     b) conducting state surveys to supplement the national surveys
     c) collecting injury data in addition to participation data in all remaining quarterly surveys to provide useful numbers. It needs to be recognised, however, that this will still be limited because of small numbers of participants by seasonal sports.
   - Future National Health Surveys should collect risk factor data for injury, including sports and recreational injury.

4. **Develop standardised data collection procedures**
   - Develop compatible and standardised injury data collection forms across a range of sports. These should incorporate the National Minimum Dataset (Injury Surveillance) specifications, together with agreed demographic data and other sports-specific agreed items.
   - Develop associated coding, data entry and analysis software.
   - Include a facility for the insertion of modules for specific time-limited studies in electronic data collection programs.
5. **Agree on standardised coding systems and definitions**

- Introduce electronic collection of sports and recreation injury data routinely in hospital emergency departments using the NMDS(IS) and negotiate second level sports injury data collections in at least some hospital emergency departments.
- Improve hospital admission injury mechanism coding through expansion and implementation nationally of ICD 9 CM or ICD 10 sports and recreation codes. For example, these could be adapted from the NSW Health Department's sport codes.
- Co-ordinate the Orchard system and other sports injury coding schemes with the National Minimum Data Set (Injury Surveillance).
- A workshop to reach agreed national and/or international definitions of sports and recreational injury, sports participation, injury severity, etc. should be conducted. There could be the opportunity to do this during the Third International Conference on Injury Prevention and Control to be held in Melbourne in February 1996.

6. **Collation of information**

- Monitor overseas developments in sports injury surveillance.
- Develop methods for the quality control, centralisation and interpretation of data from different sources.
- Link computerised emergency department and hospital admission data to provide comprehensive sports injury data, including direct costs of treatment.

7. **Establish new data collections**

- Develop an integrated register of fatalities and other catastrophic injuries (including spinal and severe head injury).
- Collect general practice and sports clinic data to develop multipliers for ongoing health sector data collections and to provide estimates of the total numbers and range of sports injuries presenting to the health sector (together with hospital emergency department presentations and admissions) by sport and nature and circumstances of injury.
- Conduct community surveys of sports and recreational injury for defined populations, where health sector data at all levels of severity are potentially available (e.g. Latrobe Valley).
- Conduct epidemiological studies of existing data for at least one state (Vic) to assess the utility of current information for enumeration, targeting and monitoring interventions, etc.

8. **Training**

- Develop a training module on the methods and functions of data collections for incorporation into coaching and sports trainers courses including those leading to re-accreditation.
10.8 INVOLVING SPORTS IN DATA COLLECTION ACTIVITIES

The success of implementing any improved methodology for sports injury data collections will be dependent upon the active participation and co-operation of sporting bodies. A culture of awareness of sports safety needs to be developed in many sports before the collection of injury data would be seen as a priority. The further development and wider implementation of sports coach and trainer education programs may be fundamental to this process. However, some sports have already indicated their ability and willingness to participate in such a system.

It is vital to include sports organisations from the grass roots level upwards in any surveillance activities. This is because they are the basis that will have to implement any suggested injury prevention strategies in the future. This process will only be successful if they adopt ownership of the problem now. However, it is also important that individual sports are not singled out for attention, unless they specifically request this, as this may alienate them from participation in further activities.

For many sports, a major cultural change is necessary to encourage them to participate in specific injury prevention and data collection activities. For others, the sporting bodies are willing to participate in these activities but are seeking guidance on how this could be done.

Some pressure may need to be applied to encourage sports bodies to participate in data collection activities. Rather than a dictatorial approach, or one that is tied to funding, models of good performance could be promoted and performance agreements developed. Alternatively, an accreditation scheme, as suggested in the next section, could be developed through the lead agency, or agencies to encourage the sports themselves to take leadership.

10.8.1 A suggested sports safety accreditation scheme

The Victorian Safety Council has for some time promoted a five point accreditation scheme for occupational safety. A similar model could be used to promote sporting bodies to take the lead in injury prevention and data collection activities. It would seem appropriate that such a model should be coordinated on both a national and state basis through the government departments of sport and recreation. The accreditation process could occur simultaneously with the annual review of each sport's performance by these departments.

The accreditation scheme could consist of a five medal system with a medal being awarded to each sporting organisation in recognition of their performance on each of five agreed activities. A "gold" medal could be awarded for outstanding performance, a "silver" medal for activities commenced but not yet fully implemented or completed and a "bronze" medal for sports that have made some progress towards implementing the stated activity or to those who once performed the activity but do not do so any more. Each of the identified activities would be graded as to the sport's safety performance so that a sport awarded five gold medals could be promoted as the best and safest sport.

The activities contributing to the sports safety accreditation scheme could include the following:

- Participation in, or support of, injury and participation data collection activities. This could include evidence of support of research into injury prevention and safety promotion for their sport.
- Adoption and promotion of modified sports for juniors.
• Development and implementation of a protective equipment standard for the specific sport. This could include sport specific policies, requirements for all participants to use it when participating in that activity and general maintenance of standards.

• All teams to have a coaching accreditation program specific to that sport.

• All teams to have a sports trainer or first aider attached to them who are accredited by a recognised program.

It would be unfair to require that all sporting activities should compete for accreditation on the same scale. For some sports, it may not be appropriate for them to achieve some of the goals set. For this reason it may be more appropriate to groups sports activities into broad groups such as contact, non-contact, adventure sports, etc. to compare the validity of this accreditation scheme.

An accreditation scheme developed from the suggestions above could be very important in encouraging sports bodies to improve their safety performance. A sports body awarded five gold medals would be able to promote itself as one of the best and safest sports, thereby increasing its potential participation rate.

10.9 TIME FRAME AND PRIORITIES FOR ACTION

A five year time frame is proposed for the implementation of the above recommendations and to conduct a program of sports injury prevention research, which will provide a firm basis for sport and recreational injury reductions leading to the year 2000 and beyond. The work program for the later years will require further development that is dependent on progress in years 1 and 2.

This work program should be further developed in consultation with sporting bodies and other key organisations such as the Australian Sports Commission, the Commonwealth Department of Human Services and Health, the Australian Coaching Council and SportsMedicine Australia.

A suggested program follows:

Years 1 and 2 (1995 and 1996)

• Identification of a lead agency for co-ordination, developing funding strategies, and overseeing the five year work plan.

• Establishment of a national sports injury surveillance advisory committee.

• Implementation of the recommendations of this report for direct data collection improvements for both injury and participation.

• Development and testing of a uniform injury data collection form and coding system.

• Trial of this standardised data collection tool across a range of participation levels.

• Development of software for data entry and analysis.

• Implementation of pilot studies of new data collection methods in general practice.

• A detailed epidemiologic study of existing data for one state, possibly Victoria.

• Access the utility of the data from this study for targeting injury prevention and monitoring progress.

• Community surveys of sports participation and injuries.
• Presentation of progress at the 3rd International Conference on Injury Prevention and Control in Melbourne in 1996.

• Work towards setting definitions of sports injury, sports participation, etc. and coordinating a workshop to discuss these issues at the 1996 international injury conference.

Year 3 (1997)

• Begin to disseminate annual publications of sports injury and participation data, to the extent possible, by the lead agency.

• Develop and report on linked emergency department and hospital admission data systems to provide comprehensive data on severe sports injuries.

• Monitor overseas developments in sports injury surveillance and research.

• Establish a clearing house for sports injury prevention information.

• Convene a national workshop to review progress and to determine future directions.

Year 4 (1998)

• Continue a sports injury prevention research program.

• Reassess and redirect, if necessary, research and data collection directions.

• Refine the annual data reporting system.

Year 5 (1999)

• Convene a national workshop to review progress and to determine future directions.

• Conduct trend analyses on the newly established data sets for the period available (perhaps 3 years).

• Set directions for future activities.
LIST OF REFERENCES


Brodersen M. Medical coverage for the Iowa Games. Iowa Medicine 1992; 82(7):299-301.


Irving L. Directory of injury surveillance data recorded in New Zealand hospital emergency departments. Auckland: Injury Prevention Research Centre, Department of Community Health, School of Medicine, University of Auckland, 1992.


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APPENDICES
Feasibility Study of Improved Data Collection Methodologies for Sports and Recreational Injury

Section 1  Organisation Details

1. Name of organisation __________________________________________________________

2. Name of contact person ______________________________________________________
   Position title _________________________________________________________________
   Role ________________________________________________________________________

3. Address _____________________________________________________________________

   __________________________________________________________________________
   Postcode ____________________________________________________________________

4. Phone No. ( ) __________________ Fax No. ( ) ________________________________

Office use only:

Date form received ____/____/94  Form Number ____________
5. Type of organisation:
(tick as many as apply)
- Sporting body/club/assoc.  
- Sports medicine
- Sports administration
- Government
- Community Educator
- Professional Educator
- Insurance company
- Research
- Injury surveillance
- Individual
- Other
(please specify)

6. Level of responsibility:  
(tick as many as apply)
- National
- State (specify _________)
- Local
- School
- Community
- Other
(please specify)

7. Do you or your organisation cover particular sports or recreational activities?
- No (none)  
- Yes (please list below)
- No (general coverage)
- Don't know

8. Please describe the main role of your organisation.

If you have a brochure about your organisation, please attach this.
Section 2  Sports and Recreational Participation Data

1. Does your organisation collect or collate data on sports and recreational participation rates?
   (e.g. number of players, number of registered members, hours played, etc.)
   
   No □ please go to Section 3 (page 10)
   Yes, on organisations □ please complete Section 2 (a) 
   Yes, on individuals □ please complete Section 2 (b) (page 6)
   Don't know □ please go to Section 3 (page 10)

Section 2(a) Participation Data for Organisations
   (e.g. club membership)

2. Who collects this data (e.g. sports body, event organisers, sports trainers, coaches, etc.)?
   
   
   
   
   
   Please attach a copy of your data collection form/sheet.

3. How is the data collected (e.g. team sheets, registration sheets, lists updated annually)?
   
   
   
   

4. For what purpose is this data collected?
   
   
   
   

5. Over what time period has this data been collected?
   
   
   
   


6. How is participation measured? (e.g. number of players, number of registered members, hours of play, number of matches, etc.)

________________________________________________________________________

7. For what levels of play and supervision is information collected? (tick as many as apply)

Male .................................................. Recreational ..................................

Female ................................................. Unsupervised .................................

Junior .................................................. Training .................................

Senior ................................................. Practice games ............................

Veteran ............................................... Organised school event ..............

Elite .................................................... Other ........................................

(please specify) __________________________

Competition ........................................

Professional ......................................

8. Please describe the information you collect. You may prefer to provide specific details on the attached sheet for this purpose.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
9. Do you do checks of the data's accuracy?
   No ........................................... □
   Yes ........................................... □ please specify below
   Don't know ................................. □

10a) How do you store your data (e.g. written records, standardised form, computerised database, etc.)?

10b) If computerised database, please provide its name. ____________________________

11. Can the data be provided to other groups for further use? In what form can the data be obtained?

12. What is the procedure for accessing your data? What costs, if any, are involved?

13. Describe any privacy issues relating to access and use of your data.
14. Who are the typical users of your data? 


15. How is your data disseminated? How has the data been published or released (e.g. reports, publications, not at all, etc.)?


Please provide copies of any relevant publications and reports based on your data.

Section 2(b) Participation Data for Individuals (e.g. patients attending a sports medicine clinic)

2. Who collects this data (e.g. sports body, event organisers, sports trainers, coaches, etc.)?


3. How is the data collected (e.g. team sheets, registration sheets, lists updated annually)?


Please attach a copy of your data collection form/sheet.

4. For what purpose is this data collected?


5. Over what time period has this data been collected? ____________________________
_________________________________________________________________________
_________________________________________________________________________

6. How is participation measured? (e.g. number of players, number of registered members, hours of play, number of matches, etc.) ________________
_________________________________________________________________________
_________________________________________________________________________

7. For what levels of play and supervision is information collected?
(tick as many as apply)

- Male ................................................ Recreational ................................................
- Female ............................................ Unsupervised ............................................
- Junior ........................................... Training ....................................................
- Senior .......................................... Practice games ...........................................
- Veteran ......................................... Organised school event ..............................
- Elite .............................................. Other ...................................................
    (please specify) __________________________
- Competition ................................ Professional ........................................

8. Please describe the information you collect. You may prefer to provide specific details on the attached sheet for this purpose.
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
9. Do you do checks of the accuracy of the data?

No ........................................... □

Yes ......................................... □ please specify below

Don't know ................................... □


10a) How do you store your data (e.g. written records, standardised form, computerised database, etc.)?


10b) If computerised database, please provide its name.


11. Can the data be provided to other groups for further use? In what form can the data be obtained?


12. What is the procedure for accessing your data? What costs, if any, are involved?


13. Describe any privacy issues relating to access and use of your data.


14. Who are the typical users of your data?

15. How is your data disseminated? How has the data been published or released (e.g. reports, publications, not at all, etc.)?

Please provide copies of the relevant publications and reports based on your data.
Section 3 Sports and Recreational Injury Data

1. Does your organisation collect or collate data on sports and recreational injuries?
   
   No ........................................... □ please go to Section 5 (page 15)
   
   Yes ........................................... □ please complete Section 3 ▼
   
   Don't know .................. □ please go to Section 5 (page 15)

2. Who collects this data (e.g. sports trainers, team doctor, coach, etc.)?

   __________________________________________

   __________________________________________

3. How is this data collected (e.g. compulsory reporting, self-report, injury report form, etc.)?

   __________________________________________

   __________________________________________

   __________________________________________

   Please attach a copy of the data collection form.

4. For what purpose is this data collected?

   __________________________________________

   __________________________________________

   __________________________________________

5. Over what period has this data been collected?

   __________________________________________

   __________________________________________

   __________________________________________

6. How is a sports/recreational injury defined or identified?

   __________________________________________

   __________________________________________

   __________________________________________
7. For what levels of play and supervision is information collected on? (please indicate)

- Male .............................................................. Recreational ..............................................
- Female ............................................................. Unsupervised ............................................
- Junior ................................................................. Training ...................................................
- Senior ................................................................. Practice games ...........................................
- Veteran ................................................................. Organised school event ..............................
- Elite ................................................................. Other .........................................................
- Competition ...........................................................
- Professional ............................................................

(please specify) 

8. Do you collect information about the type and severity of the injury (e.g. body part)?

- No .........................................................
- Yes ................................................................. please describe briefly below or indicate on the attached sheet
- Don't know ..................................................

9. Do you collect information about the circumstances and mechanisms leading to the injury (i.e. what caused it and associated factors)?

- No ..........................................................
- Yes ................................................................. please describe briefly below or indicate on the attached sheet
- Don't know ..................................................

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
10. Do you collect information about whether protective equipment, modified rules or some other measure to prevent injuries at the time of the injury?

No ................. ☐
Yes ................. ☐ please describe briefly below or indicate on the attached sheet
Don't know ..... ☐

11. What information do you collect about the injured person (e.g. age, sex, experience, activity at time of injury)?

12. Please describe any other data you collect. You may prefer to provide specific details on the attached sheet.

Please supply a copy of your data collection and coding forms (if available).
13. Do you do checks of the accuracy of the data?

No ........................................ [ ]

Yes ........................................ [ ] please specify below

Don't know ................................ [ ]

14. How do you store your data (e.g. written records, standardised form, computerised database, etc.)?

15. Can the data be provided to other groups for further use? In what form can the data be obtained?

16. What is the procedure for accessing your data? What costs, if any, are involved?
17. Describe any privacy issues relating to access and use of your data.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

18. Who are the typical users of your data?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

19. How is your data disseminated? How has the data been published or released (e.g. reports, publications, not at all)?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Please provide copies of relevant publications and reports based on your data.

Section 4  Other Data Collections Within your Organisation

Please provide brief details about any other data collections that you or your organisation conducts (e.g. registered members, etc.)

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

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________________________________________________________________________

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Section 5  Plans for Future Data Collections

1. Do you have plans to collect sports/recreational participation data over the next three years?

No ..............................................................

Yes ............................................................... please specify below

Don't know .................................................

2. Do you have plans to collect data on sports/recreational injuries over the next three years?

No ..............................................................

Yes ............................................................... please specify below

Don't know .................................................

3. Do you have plans to collect data on circumstances leading to (i.e. the causes or sequence of events) sports/recreational injuries over the next three years?

No ..............................................................

Yes ............................................................... please specify below

Don't know .................................................
4. Do you have plans to collect data on the use of injury prevention countermeasures (e.g. use of protective equipment and clothing, modified rules, improved coach training, increased supervision, etc.) over the next three years?

No ........................................ [ ]

Yes ..................................... [ ] please specify below

Don't know ......................... [ ]

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Section 6  Recommendations for Improved Data Collection, Storage and Dissemination

1. Do you have any recommendations for improved sports injury data collection, storage and dissemination?

   No ....................................................... [ ]

   Yes .................................................. [ ] please specify below

   Don't know ................................. [ ]

   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

2. What do you think are the main barriers to collecting sports participation data?

   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

3. What do you think are the main barriers to collecting sports injury data?

   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

Please suggest any organisations involved in the collation and collection of sports injury or sports participation data that may be relevant to our review.

   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

Thank you for taking the time to complete this questionnaire. Your input to our review has been most valuable.
The Monash University Accident Research Centre has received funding from the National Sports Research Centre (Australian Sports Commission) and the Victorian Health Promotion Foundation to conduct a feasibility study of improved data collection methodologies for sports injury, including sports participation data. The study will involve a summary of existing sports injury surveillance systems throughout Australia, including their strengths and limitations. In addition, opinions are being sought on ways to improve data collection systems and the availability of information about sports injuries. It is anticipated that this will lead to a number of recommendations for improving sports injury data collection methodologies in this country.

It is important that the study represents the current practices and views of key individuals and organisations involved, or likely to become involved, in collecting and using sports injury and participation data. We would therefore appreciate it if you could take the time to complete the attached questionnaire which seeks your input to the study. This questionnaire is being sent to key sports administration bodies, coaching and sports trainers associations, national sporting organisations, sports medicine bodies, government bodies, sports insurance companies and researchers. The study has a fairly tight time frame. Study outcomes and recommendations will be finalised in early June. For this reason, we request that you return your completed questionnaires to our office by the 25th of May. This will ensure that your organisation's input is included in the final project report.

If you have any questions about this study please contact: Caroline Finch, Research Fellow, Monash University Accident Research Centre, PO Box 197, Caulfield East, Victoria 3145. Phone: (03) 903 2893, Fax: (03) 903 2882.

Thank you for your contribution to this important study.

Please return your completed questionnaire to:

Fiona Williams
Monash University Accident Research Centre
PO Box 197
Caulfield East, Victoria 3145.


Checklist

Have you included the following with your completed questionnaire?

☐ a copy of a brochure and/or annual report about your organisation
☐ a copy of your data collection and data coding sheets if you or your organisation collects data on sports and/or recreational participation rates
☐ a copy of your data collection and data coding sheets if you or your organisation collects information on sports and/or recreational injuries
☐ copies of relevant publications and reports based on your data
6th May 1994

Dear AUSTRALIA

Over the past few years, there has been an increased awareness of the occurrence of sports-related injuries and some successful prevention strategies have been applied to deal with a limited number of such injuries. However, the full picture of sports injuries in Australia remains fragmented, in part, due to limitations in sports injury surveillance. In addition, there is little information available about sports participation rates.

The National Sports Research Centre (Australian Sports Commission) and the Victorian Health Promotion Foundation have jointly funded the Monash University Accident Research Centre to conduct a feasibility study of improved data collection methodologies for sports injury, including sports participation data. The study will involve a summary and analysis of existing sports injury surveillance systems throughout Australia. It is anticipated that this will lead to the identification of strengths and limitations and a number of recommendations for improving sports injury data collection methodologies in this country.

It is important that the study represents the current practices and views of key individuals and organisations involved, or likely to become involved, in collecting sports injury and participation data. It is equally important to receive the views of those who will use the data for injury prevention purposes. We would therefore urge you to take the time to complete the attached questionnaire so that you can contribute to the study. This questionnaire is being sent to key sports administration bodies, coaching and sports trainers associations, national sporting organisations, sports medicine bodies, government bodies, sports insurance companies and researchers.

It is also important that recommendations for improving data collection methodologies for sports injury and participation rates are applicable both nationally and locally. Data collections must be relevant to the end users of the data including coaches and trainers, sports medicine professionals, policy makers, researchers and the sports participants themselves. Your views on how current data collections could be improved and what they should focus on are also being sought.

If you have any questions about this study please contact Caroline Finch on Phone: (03) 903 2893, Fax: (03) 903 2882.

Thank you for your contribution to this important study which will help to set priority areas for particular attention in the future.

Yours sincerely

Dr Ross Smith
Director, Sports Sciences
Australian Sports Commission

Peter Thompson
Manager, Sports Program
Victorian Health Promotion Foundation
APPENDIX 3

LIST OF RESPONDERS TO THE SURVEY

Adolescent Health Research Unit, Dr Marianne Hibbert, Head
Albion Hat and Cap Company Pty. Ltd., Mr Tony Henson, Director
Alphington Sports Medicine Clinic (VIC.), Dr Peter Harcourt, Manager
Amateur Boxing Union of Australia, Mr Arthur Tunstall
American Home Assurance Company, Mr Robert Meldrum, Product Development Manager
Arthritis Foundation, Ms Susan Dimmick, Health Promotion Co-ordinator
Athletics Australia, Mr Neil King, National Executive Director
Australian Association of Exercise & Sports Science, Professor Tony Parker, President
Australian Bureau of Statistics, Mr Paul Taylor, Assistant Director, Statistical Consultancy Section
Australian Coaching Council, Mr Lawrie Woodman, Director
Australian College of Sports Physicians, Dr Peter Brukner and Dr Jeff Steinweg
Australian Commonwealth Games Association, Mr Arthur Tunstall OBE JP, Secretary General
Australian Council of Health, Physical Education and Recreation, Mr Bob Scholefield
Australian Cricket Board, Mr Ron Steiner, Cricket Operations Manager
Australian Dental Association, Mr Garry Pearson, Executive Director
Australian Football League, Dr Hugh Seward, President
Australian Netball Association, Ms Jill McIntosh, National Coaching Director
Australian Olympic Committee, Dr Ken Fitch and Mr Robert Lay (VIC)
Australian Red Cross Society, Mr Phillip Healy, Manager, Health & Safety Education
Australian Sports Commission: Sports Sciences, Dr Kieran Fallon, Course Co-ordinator
Australian Sports Medicine Federation, Dr Paul Myers, President Elect (QLD)
Australian Sports Medicine Federation, Mr Brian Bennett, Executive Officer (TAS)
Australian Sports Medicine Federation, Mr Mark Williams, Education Officer (S.A.)
Australian Sports Medicine Federation, Mr Terry Sanders, Executive Director (Nat.)
Australian Sports Medicine Federation, Ms Anne Johnston, Executive Officer (W.A.)
Australian Sports Medicine Federation, Ms Di St. Clair, NSW Sports Trainers Co-ordinator (N.S.W.)
Australian Sports Medicine Federation, Ms Janice Maple, Branch Assistant (VIC)
Australian Sports Medicine Federation, Ms Kay Copeland, Victorian Co-ordinator(VIC)
Australian Sports Physiotherapy Group, Mr Julian Russell-Jones, National President
Australian Sports Trainers Association (ASTA), Mrs. Joan Ryan, National Secretary & Victorian President
Australian Swimming, Dr Ralph Richards, National Coaching/Development Co-ordinator
Australian Women's Lacrosse Council, Ms Wendy Pilz, Delegate
Austswim, Professor John Kilpatrick
Basketball Australia, Dr Peter Harcourt, Chief Medical Officer
Brian Sweeney & Associates (Market Researchers), Mr David Barmer, Managing Director
Centre for Health Promotion and Research, Mr Gary Eggar, Director
Colac Physiotherapy Centre (VIC), Mr Steve Jones, Physiotherapist/Manager
COMCARE, Ms Anne Fitzgerald, Manager, Management Information Unit

Committee of Heads of Schools of Human Movement, Exercise & Sports Science, Professor Tony Parker

Dental Health Services (VIC), Ms Kellie-Ann Jolly, Co-ordinator, Dental Health Promotions

Department of Health & Community Services (VIC), Dr Michael Ackland, Child Health Epidemiologist

Department of Tourism, Sports & Recreation - Recreation Division (Tas), Mr John Hagan

Department of Tourism, Sports & Recreation - Sports Division (Tas), Mr Dennis Keats

Dept. of Occupational Health, Safety & Welfare, Mr Chris White, Principal Policy and Research Officer

Dieticians Association of Australia, Ms Sue Cassidy and Ms Janice Montgomery (VIC)

Directorate of School Education (VIC), Mr Ian Maddison

Diversified Insurance Brokers P/L, Ms Margaret Vandermost

Farmsafe Australia, Mr Richard Coleman, Farmsafe Australia

Health Organisation Responsible for Safety in Equitation, Mrs. E. Wilson, Secretary

Heath Fielding Australia P/L, Mr Shane Crocker

Insurance Exchange of Australia, Mr John Hibbert, National Sports Manager

Knox Private Hospital: Emergency Department (VIC), Dr Craig Macaulay, Director

La Trobe Valley Better Health Injury Prevention Program, Mr Henk Harberts

Lambert Bain P/L, Mr David Wallace

Latrobe University: Physiotherapy Department, Mr Gregory Kolt, Physiotherapy Dept.

Malvern Sports Medicine Clinic (VIC), Ms Lihla Wyles, Head Masseur

Monavale Hospital Health Promotion Unit, Mr Alan Knox, Project Officer, Sports Injury Prevention

Mt. Buller Medical Centre (VIC), Dr Craig Macaulay, Director

N.S.W. Department of Health, Mr G. Eckstein, Manager, Needs Planning

N.S.W. Dept. of Sport, Recreation & Racing, Mrs. Leonie Baldwin, Regional Director (N.S.W.)

N.S.W. Sporting Injury Committee, Mr John Anderson, Executive Director

National Australian Football Council, Mr Kevin Madden, National Coaching Director

National Heart Foundation, Dr Paul Magnus, Research Manager

National Injury Surveillance Unit, Mr Jerry Moller, Assistant Director

North Sydney Orthopaedic and Sports Medicine Centre, Dr Ken Crichton, Sports Physician

Olympic Park Sports Medicine Centre (VIC), Mr Rob Granter, Director, Dept. of Soft Tissue Therapy

Olympic Park Sports Medicine Centre (VIC), Ms Kaye Crossley, Director/Physiotherapist

Olympic Park Sports Medicine Centre (VIC), Dr Peter Brukner, Director

Prahran Sports Medicine Centre, Dr Peter Larkins, Sports Physician

Queensland Government Statisticians Office, Mr Tony Callaghan, Manager, Client Services

Queensland Institute of Technology, Mr Scott Hahn, Lecturer, Centre for Public Health Research

Riverina Academy of Sport, Mr Steve Francia, Executive Director (N.S.W.)

RMIT: Department of Human Movement Science, Mr John Ashton, Lecturer

Royal Australian College of General Practitioners, Dr John North, Chairman

Royal Children's Hospital: Epidemiology and Biostatistics Unit, Dr Terry Nolan, Head

Royal Children's Hospital: Physiotherapy Department, Mr Theo Kapakoulakis, Physiotherapist

Shire of Bulga: Safe Living Programme, Mr Richard Arnold

Sport and Recreation Victoria: Aussie Sport (VIC), Mr Brian Mott, Manager
Sport and Recreation Victoria: Executive Administration, Mr Guy Wilson-Brown
Sports Medicine Centre of Western Australia (W.A.), Dr Gerard Taylor, Sports Physician
Sportscover Australia, Mr Peter Nash, General Manager, Sales & Administration
St. John's Ambulance Association, Dr Barry Price and Mr Ken Swanson (VIC)
Statistical Working Group, Sport and Recreation Ministers Committee, Mr Frank Nizynski, Deputy Director
Sydney Swans A.F.L Club (N.S.W.), Dr John Orchard, Club Doctor
The Equestrian Federation of Australia, Ms Gillian Canapini, National Coaching Director
The Sports Medicine Centre (A.C.T.), Ms Anne Davis, Physiotherapist
University of Melbourne: Ocular Trauma Centre, Dr Lye Pheng Fong, Department of Ophthalmology
University of Ballarat: School of Human Movement and Sports Sciences, Assoc. Professor Warren Payne
Vicsport, Ms Anne-Marie Harrison, Chief Executive Officer (VIC)
Victoria University: Executive Director (Research), Professor William Morrison
Victorian Badminton Association, Mr Mike Smith, State Director (VIC)
Victorian Baseball Association, Mr Les Flower, Executive Director (VIC)
Victorian Basketball Association, Mr Lindsay Gaze, General Manager
Victorian Football Union, Mr Jim Ure
Victorian Gymnastics (VIC), Ms Kay Mahlook, Executive Director
Victorian Injury Surveillance System, Ms Virginia Routley
Victorian Institute of Sport, Dr Peter Harcourt, Medical Consultant (VIC)
Victorian Netball Disability Service, Ms Michelle Davidson, Programme Co-ordinator (VIC)
Victorian Occupational Health & Safety Commission, Mr Steve Battas
Victorian Rugby Union, Mr Carl Wood, Executive Director (VIC)
Victorian Soccer Federation, Mr Terry Jones, Chief Executive Officer, Victorian Soccer Federation (VIC)
Victorian Softball Association, Ms Elaine Dujvestyn, Administrative Officer (VIC)
Victorian Squash Federation, Mr Paul Vear, Executive Director
Wheelchair Sports Victoria, Ms Kim Luczkowski, Sports Development Officer
WorkCover Authority, Ms Anne Macky, Manager
Workers Compensation Board, Mr Rod Lethborg, Secretary
Worksafe Australia, Mr Tim Williams, Statistics Unit
APPENDIX 4

ORGANISATIONAL REPRESENTATIVES INTERVIEWED

Dr Michael Ackland, Analysis and Monitoring, Health and Community Services, Victoria
Dr Frank Archer, Medical Director, Victorian Ambulance Service
Mr Bill Bailey, Policy and International, Australian Sports Commission
Mr Alan Black, Coordinator Physical Sports Education Unit, Directorate of School Education, Victoria
Dr Peter Brukner, Director, Olympic Park Sports Medicine Centre
Ms Erin Cassell, Injury Control Section, Commonwealth Health Department
Ms Kay Copeland, Co-ordinator, National Sports Trainers Scheme, ASMF, Victoria
Mr Graeme Dempster, Director, Department of the Environment, Sport and Territories, ACT
Mr Marcus Dow, Department of the Environment, Sport and Territories, ACT
Dr David Hughes, Australian Sports Commission
Dr Peter Harcourt, Medical Director, Victorian Institute of Sport
Ms Anne-Marie Harrison, Chief Executive Officer, VICSPORT
Dr William Hart, Manager, Analysis and Monitoring, Health and Community Services, Victoria
Mr John Hibbert, National Sports Manager, Insurance Exchange of Australia
Ms Kaylene Hood, Acting Manager, National Sports Research Centre, Australian Sports Commission
Ms Janice Maple, Victorian Coverage Service Co-ordinator, ASMF
Mr Dene Moore, Confederation of Australian Sport
Mr Frank Nizinsky, Acting Director, Statistical Research Section, DEST, ACT
Ms Henny Oldenhove, Manager, National Aussie Sport, Australian Sports Commission
Dr Frank Pyke, Director, Victorian Institute of Sport
Mr Matt Reid, National Director of the National Sports Trainers Scheme and Coverage Service, ASMF
Mr Terry Sanders, National Executive Director, Australian Sports Medicine Federation
Mr Michael Scott, Director, Sport and Recreation Victoria
Dr Ross Smith, Manager Technical Services, Australian Sports Commission
Mr Peter Thompson, Manager, Sports Program, Victorian Health Promotion Foundation
Mr Guy Wilson-Browne, Economic and Industry Officer, Sport and Recreation Victoria
Mr Steve Whan, Policy and International, Australian Sports Commission
APPENDIX 5

VICTORIAN INJURY SURVEILLANCE SYSTEM

LATROBE REGIONAL HOSPITAL —
TRARALGON/MOE

Injury and Poisons Form
For all injuries and poisonings

Complete only for FIRST attendance of a particular episode

Date: Time: am/pm

UR No.

GIVE AS MUCH DETAIL AS POSSIBLE

1. When did the injury occur? Date __________ Time __________ am/pm

2. Where did the injury occur? (Give exact place and suburb where injury or poisoning occurred)
   (e.g. at intersection of Jones and Smith St in on the side of the road - Coburg; in the bathroom shower recess at home - Werribee)

3. What was the injured person doing at the time the injury occurred?
   (e.g. having tea and playing around with sister; using a bench grinder; crossing road on way to school; up ladder pruning tree)

4. What went wrong?
   (e.g. chased by dog and lost control of bike; fell off top level of ladder; hot coffee knocked over; scaffold collapsed)

5. What actually caused the injury?
   (e.g. landed on concrete; cut hand on edge of broken toy; swallowed disinfectant and digoxin tablets; hot metal flew into eye)

6. Was he/she injured on the job? (please tick) Yes □ No □

7. What is the injured person's occupation?

8. In what sort of business is he/she employed?

9. If a specific product or article was involved, please give details (product, brand & model):

10. What safety precautions or devices were being used at the time the injury occurred?
    (e.g. seat belt; invisible capsule; child-resistant bottle cap; bicycle helmet; safety goggles, harness, none)

11. If a motor vehicle was involved, please give details:
    Make __________ Model __________ Year __________ Type of vehicle __________
    (e.g., Honda Civic)

12. If injured in a motor vehicle, show the seating position of the injured person. CIRCLE THE APPROPRIATE NUMBER ->

   Sometimes additional information is needed for injury prevention. If you do not wish to be contacted, please place an X here.

IMPORTANT: PLEASE HAND THIS SHEET TO THE DOCTOR WHEN YOU ARE SEEN

SPECIAL PROJECTS □ □ □ □ □ □ □
1. Nature of the Injury

<table>
<thead>
<tr>
<th>Code</th>
<th>Injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Severest</td>
</tr>
<tr>
<td>1</td>
<td>Second</td>
</tr>
<tr>
<td>2</td>
<td>Third</td>
</tr>
</tbody>
</table>

Select up to three codes.

Soft tissue
- 01 cut/laceration
- 02 puncture
- 03 bite
- 04 superficial abrasion
- 05 penetrating wound
- 06 other wound, incl. amputation
- 07 haematoma/bruising
- 08 haemorrhage
- 09 inflammation/edema/tenderness
- 10 burn, full thickness
- 11 burn, partial thickness
- 12 foreign body in soft tissues
- 13 damage to major blood vessel
- 14 crushing injury

Bone, tendon or joint
- 20 fracture
- 21 dislocation
- 22 sprain/strain

Systemic and special injury
- 91 poisonings (through skin/lungs/mouth etc)
- 93 asphyxiation or respiratory difficulty
- 94 electric shock
- 95 over-exertion, heat/cold stress
- 96 concussion
- 97 dental injury
- 98 no injury detected

2. Body Part

<table>
<thead>
<tr>
<th>Code</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>000</td>
<td>Defined as in Section 1 at left</td>
</tr>
</tbody>
</table>

Systemic and special injury
- 000 defined as in Section 1 at left

Trunk
- 401 rib(s)
- 402 sacroiliac joint
- 403 spine (incl. cervical), excluding cord
- 404 pelvis
- 405 chest, NEC
- 406 abdomen, NEC
- 407 upper back, NEC
- 408 lower back, NEC
- 409 genitalia
- 410 heart
- 498 other injury to trunk

Respiratory tract
- 501 pharynx
- 502 larynx
- 503 trachea
- 504 bronchus
- 505 lung
- 598 other injury to respiratory tract

Digestive tract
- 601 mouth internal, e.g. gum, palate
- 602 oesophagus
- 603 stomach
- 604 small bowel
- 605 colon
- 606 rectum
- 607 liver
- 608 spleen
- 609 injury to other internal organs
- 698 other injury to digestive tract

Nervous system
- 701 brain, not concussion
- 702 brain stem
- 703 cervical spinal cord
- 704 thoracic spinal cord
- 705 lumbar spinal cord
- 706 peripheral nerve
- 798 other injury to nervous system

3. Intent of Injury

<table>
<thead>
<tr>
<th>Code</th>
<th>Intent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Accidental injury (ie, unintentional)</td>
</tr>
<tr>
<td>1</td>
<td>Intentionally self-inflicted, or possibly so</td>
</tr>
<tr>
<td>2</td>
<td>Victim of assault, or possibly so</td>
</tr>
<tr>
<td>3</td>
<td>Unknown intent</td>
</tr>
</tbody>
</table>

4. What you did with your patient

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>No treatment</td>
</tr>
<tr>
<td>02</td>
<td>Treated, no referral</td>
</tr>
<tr>
<td>03</td>
<td>Treated, referred to outpatients</td>
</tr>
<tr>
<td>04</td>
<td>Treated, referred to family doctor</td>
</tr>
<tr>
<td>05</td>
<td>Treated, other referral</td>
</tr>
<tr>
<td>06</td>
<td>Short-stay observation in Emergency</td>
</tr>
<tr>
<td>07</td>
<td>Admitted to hospital</td>
</tr>
<tr>
<td>08</td>
<td>Transferred to other hospital</td>
</tr>
<tr>
<td>09</td>
<td>DOA or died in Emergency</td>
</tr>
</tbody>
</table>

Note: NEC means "not elsewhere classified"