PREVALENCE AND INCIDENCE OF ATHLETIC RELATED SPORTS INJURIES IN PRIMARY AND HIGH SCHOOL CHILDREN IN THE CAPE METROPOLITAN AREA

JOSÉ MERLE DANTU-FRANTZ

SUPERVISORS:

PROFESSOR SL AMOSUN
(Department of Physiotherapy, UWC)

AND

PROFESSOR TD NOAKES
(Sports Science Institute of South Africa)

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Declaration:

I declare that "**Incidence and Prevalence of Athletic-Related Sports Injuries in Primary and High Schools in the Cape Metropolitan Area**" is my own work and that all the sources used or quoted have been indicated and acknowledged by means of references.

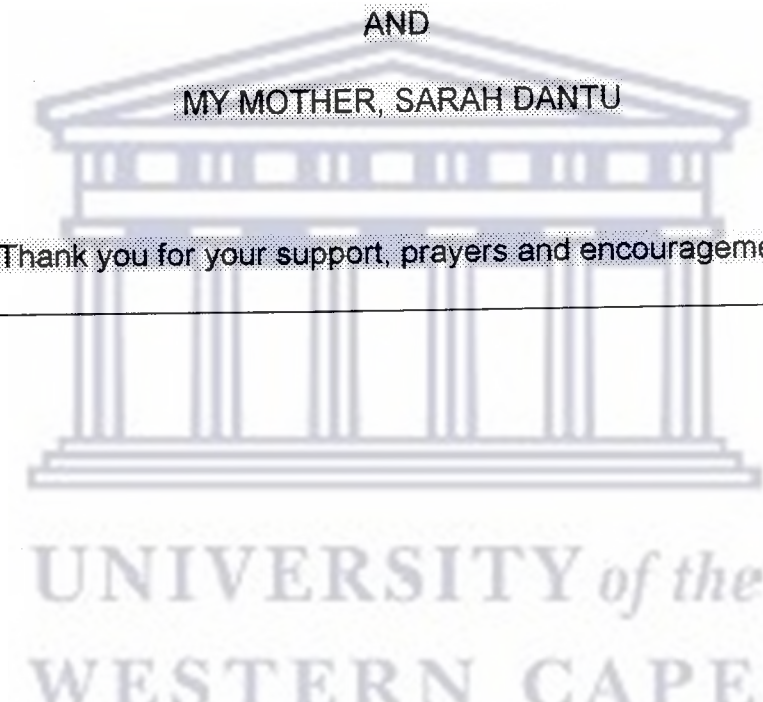
THIS THESIS IS DEDICATED TO

MY FATHER , JOSEPH DANTU

AND

MY MOTHER, SARAH DANTU

Thank you for your support, prayers and encouragement



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ABSTRACT

Sports injuries are unwanted side-effects of sports participation in children and adolescents. In South Africa, there is a dearth of information on sports injuries. The aim of the study was to determine if primary and high school children sustained injuries during athletics in schools and at competitions. This community-based survey would serve as an epidemiological basis for planning community programs to prevent injuries during athletic activities. The study was conducted in two stages namely a retrospective stage and a prospective stage. The retrospective stage of the study attempted to determine if injuries did occur during athletics at schools in the Cape Metropolitan Area of the Western Cape for the athletics season between 1995 and 1998 and whether the data were adequately documented. The study found that accurate injury records were not kept at the schools. The prospective study attempted to document the injuries sustained during athletic competitions for two successive athletic seasons. The study revealed that injury incidence was high. A large proportion of the injuries sustained were musculo-skeletal injuries. The need for medical services to assist with the high incidence of injuries during athletic competitions involving school children was identified. An information booklet was designed to inform teachers and trainers of the situation in schools and to offer information needed to prevent the high incidence of injury. The booklet highlighted the types of injuries sustained by athletes participating in athletics, predisposing factors to these injuries, and recommendations to prevent the injuries from occurring.

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CHAPTER 1.0

INTRODUCTION

1.1 INTRODUCTION TO THE CHAPTER

In this chapter, some background information is provided on developments in sports especially among children, global injury surveillance, justification for the study, the aims and significance of the study.

1.2 BACKGROUND

The World Health Organisation (WHO) launched the 'Health for All by the year 2000' programme at the Alma-Ata Conference in 1978 (Tarimo 1990). At this conference it was decided that each country should interpret and adapt particular aspects of primary health care within the country's own social, political, and developmental context. It was recommended that research should be carried out to ensure that primary health care is included and progressively improved as an integral part, and main focus, of the comprehensive health system (World Health Forum 1996).

At a meeting convened in March 1988 by WHO in Riga, in the former United Soviet Socialist Republic (USSR), where the Alma-Ata declaration was reviewed, it was observed that although the quality of health had improved in many countries, Africa and

Southern Asia were not keeping pace with the rest of the world (Tarimo 1990). However, many countries had defined not only their targets but also concrete programmes to achieve them. The developments in the WHO European region was particularly highlighted. As part of the 'Health for All by the year 2000' programme, the Council of Europe had launched a regional policy named: "Sports for all: Sports injuries and their Prevention". The purpose of the policy was to improve the understanding of sports injuries and to develop a scientifically based prevention strategy (Backx et al 1991; Van Mechelen 1997b). The recommended plan was divided into four stages (Backx et al 1991). During the first stage data was obtained on prevalence, nature, extent and severity of sports-related injuries. The second stage identified the causative factors of the injuries. The third stage involved the implementation of measures to prevent the occurrence of the sports-related injuries. The last stage involved the evaluation of the preventive measures to compare the incidence and severity of injuries before and after intervention.

The government of South Africa launched the 'Health for All by the year 2000' in 1994 providing a comprehensive health care system that would include an integrated and co-ordinated system of health care having promotive, preventive and curative components (De Haan 1996). There is no evidence that the government incorporated a policy similar to the one developed by the European Council which focussed on prevention of sports-related injuries. However, there is evidence of a significant increase in the level

of participation in sporting activities after South Africa was re-admitted into the international community (Department of Sport and Recreation 1995). There have been efforts to identify talented sports people at an early age, as sports had been adopted by the government as a means to promote a new democratic ethos for young people who were marginalised during the apartheid era. The privately funded, non-government organisation, The Sports Science Institute of South Africa, was established to optimize the sporting performance and health of all South Africans through the execution, application and dissemination of science.

Sports form part of the activities in primary and high schools. Children participate in sports in physical education classes and also as part of extra-curricular activities at school. One of the most common sports that children participate in at schools is athletics (track and field events). The major athletic events in schools are the inter-house athletic programmes, and the inter-school athletics programmes which ultimately lead to the inter-school championships where scholars are selected to represent the provinces. Children mostly volunteer to participate in events and, depending on their performance, they progress from representing the school to representing United School Sports Association of South Africa. Talent identification for various sports codes for children at an early age is not common in South Africa. The child thus tends to select a sporting code or event without considering the risk of injury.

According to Ogle (1997) the governments of Northern Ireland and the Republic of South Africa (RSA) have explicitly emphasised that the social objectives underlying sports policies often aimed directly at the resolution of fundamental socio-political conflicts. The Department of Sport and Recreation has implemented programmes aimed at developing sporting activities in children from disadvantaged communities. These programmes included Super Kids (for children up to seven years of age), Sports Pioneers (for children from seven to17 years of age) and Isizwe Stars (for children from 15 to 21 years of age). These programmes are aimed at identifying talent in various sports at various age levels, and gradually introducing children to the advantages of sport and physical activity.

The increase in the level of participation in sporting activities suggest the possible increase in sports-related injuries. It is believed by the researcher that South Africa will benefit if a policy similar to the "Sports for all: Sports injuries and their Prevention" is incorporated into the Health for All by the year 2000 programme. Therefore, this study attempts to implement the first stage of the process that the European Council went through by determining the prevalence and incidence, nature and extent of sports injuries among school children.

1.3 PARTICIPATION OF CHILDREN IN SPORTS

During the last 20 years, public policy addressing the global development of sports has increasingly assigned priority to policies and programmes associated with the provision of opportunities for all young people to take part in sports (Ogle 1997). In general, sports development policies for young people centred on three areas of activity. The first area is the strengthening of physical education and sports within schools. The second area is the creation of sustainable links between sports played in schools and sports played outside of the school in the community, and especially through links formed between schools and the surrounding communities. The third area is the development of ways to ensure that all participants, and those with talent, can progress either through an appropriate club setting, coaching or competition. This would mean that if they performed well at school level and club level, they could be identified for Provincial colours and later for South African colours. All three areas of activity are inter-related, and achieving success in one will almost certainly have knock-on benefits for the others. There is consensus across the sports constituency that involving young people in both organised and independent physical activity is beneficial to their long term development (Brenman and Beakley 1997).

Participation in sports and physical activity is a complex issue. Culture, gender, age, race and individual differences in ability are factors that could determine the activity type, level of attainment and motivation to participate (Brenman & Beakley 1997). The

family and education system play a role in children participating in sports. If participation in physical activity does not take place in the family setting, school normally serves as the first point of introduction to sports for children. It is widely recognised that the school plays a prominent role in formulating positive attitudes towards physical activity, whether at a basic, competitive or elite level.

Contrary to the belief of Clarke (1994) that young people were not participating in sports, various studies showed an increase in participation of young people and this could be due to various factors. Backx et al (1989) found that participation in sports activities had increased considerably at every age level in all western countries. The study confirmed that more children than ever before were members of sports clubs or participated in non-organised sports activities. The study done by Kremer et al (1995) in Ireland indicated that 75% of young people participated in sports. Of these 25% participated in athletics. It was also found that 51% of these children had experience at a competitive or higher level. The study also indicated that 61% of these young children participated in school sports. Cook and Leit (1995) indicated that the numbers of children in the United States of America participating in organised, competitive activities had increased dramatically and this placed pressure on coaches, parents and children to improve performance. As a result, more emphasis is placed on physical training to enhance sports capabilities. With inappropriate pressure to perform, along

with training that is too extreme, injuries would occur and could have lasting psychological repercussions.

1.4 GLOBAL INJURY SURVEILLANCE

Injury is still seen by many as a local issue and not a global issue. Everyone recognises the tragedy of disability and death from injury, but few equate this with a global health concern (Meyer 1998). According to Janda (1997), injury is the most under-recognised major public health problem facing the world community. He further stated that in addition to it being an enormous public health issue, injuries continue to usurp the limited financial resources of health care. Meyer (1998) reported that a study conducted by Murray in 1997, classified causes of death and disability into three groups namely, communicable disease, non-communicable diseases, and intentional or unintentional injuries. It is in the large group of unintentional injuries that sports and recreational injuries are categorised.

Because most sports and recreational activities are seen as healthy and fun, particularly among children, they are not considered dangerous or risky. It is estimated that more than 6000 deaths are associated with recreational activities each year in the United States (Baker et al 1992). Sports injuries are a particularly important source of nonfatal injury and disability as well, but morbidity data are not always collected. The

major limitation in evaluating recreational injury data is the large number of incidents that go unreported (Smith et al 1987). A survey conducted by Mulder et al (1998) revealed that sports injuries were the second most common form of injury that was suffered by people in the Netherlands. Out of approximately three million accidents that occurred during 1992 and 1993, 1.1 million was as a result of sports injuries.

It can thus be seen that in the context of general injury surveillance, sports injury plays a significant role. It therefore becomes imperative that comprehensive sports injury occurrence data systems be developed. According to Janda (1997) these injury surveillance systems will aid in (i) identifying risk factors and types of injuries; (ii) determining the effectiveness of preventive intervention; and (iii) delineating the costs of injury in order to develop financial resource planning.

1.5 AIMS OF THE STUDY

In South Africa, there is a dearth of information on sports injuries. The main objective of this study is to initiate the development of a data bank on athletic sports-related injuries, which is the first stage of the plans developed by the European Council in their efforts at developing a prevention strategy (Backx et al 1991).

The specific aims of this study are:

- To determine the prevalence and incidence of sports-related injuries among school children taking part in athletics at both high and primary school levels in the Cape Metropolitan Area.

- To determine the nature, extent and severity of sports-related injuries among school children taking part in athletics at both high and primary school levels in the Cape Metropolitan Area.
- To identify the mechanism of occurrence of the sports-related injuries.
- To identify intrinsic risk factors that could lead to injury

1.6 SIGNIFICANCE OF THE STUDY

The data from this study will contribute to knowledge on the prevalence and incidence, nature, extent and severity of sports-related injuries sustained during athletic competitions among children at high and primary school level in the Cape Metropolitan Area in the Western Cape. From this knowledge, appropriate preventive measures may be developed to prevent the occurrence of sports injuries. The data collected will also be valuable to the Sports Science Institute of South Africa in its efforts to optimize the sporting performance and health for all South Africans.

1.7 DEFINITION OF TERMS

Sports injury: an injury that results in the inability of the sports person to compete as usual and ultimately seeks medical attention.

Athletes: all track and field event participants.

School: refers to primary and high schools in the Cape Metropolitan Area in the Western Cape

Learners: children attending primary and high schools in the Western Cape

Elite Athletes: athletes that participate at school level, club level and/or provincial level

1.8 OUTLINE OF THE CHAPTERS

Chapter one is concluded with an outline of the chapters that follow. It has stated the background, participation of children in sport, global injury surveillance, aims and significance of the present study. In South Africa the government launched the "Health for all by the year 2000" in 1994. During this process, very little emphasis was placed on prevention of injuries. It has been noted that there with an increase in participation there is an increase in injuries. However, the benefits of physical activity far outweighs the negative aspects such as injuries but it should not be allowed to become one of the major barriers to activity. In order to monitor the injuries that occur one needs to have a

good injury surveillance systems in place in order to introduce effective prevention strategies. The study thus attempts to contribute to the knowledge on prevalence and incidence, nature, extent and severity of sports related injuries sustained during athletic competitions among children at high and primary school level in the Western Cape.

Chapter two presents a review of the literature that is relevant to understanding the need for the study. It focuses on the importance of sports injury data, factors influencing collecting sports injury data, factors influencing children's participation in sport, factors influencing sports related injuries in children and the impact of these injuries. All the literature highlights that injuries do occur and there is a need to monitor these injuries even in children by keep accurate data. This will assist in educating trainers, athletes and parents about injury prevention and thus assist them in minimising the costs associated with injuries.

Chapter three considers the methodological issues relevant to the study. It clearly explains the research setting, the procedure followed in obtaining information during the three stages. The first stage was a retrospective study which gathered information from schools in the Western Cape regarding athletes participating in athletics and the incidence of injury. The second stage of the study was a prospective study and was

conducted in two parts. The first part collected data of injuries occurring at athletic competitions among school children. The second part monitored school athletes who also participated at club level. These athletes were tested at the beginning of the season to see if intrinsic factors contributed to the occurrence of injury. The third stage of the study was based on the first two stages and an injury prevention guideline booklet was designed for trainers.

Chapter four offers the analysis of the data in the form of frequencies, means and percentages. From the results we were clearly able to determine the prevalence and incidence of sports related injuries among school children participating in athletics. We were also able to determine the nature, extent and severity of the injuries and also the mechanism of occurrence of the injuries. The second part of the second stage helped to identify intrinsic risk factors.

Chapter five discusses the findings of the study and attempts to present some ideas and reasons as to the meaning of the results. The discussion also compares similar studies to the current study and attempts to draw comparisons and differences.

Chapter six summarises the current study and discusses various recommendations and limitations.

CHAPTER 2.0:

LITERATURE REVIEW

2.1 INTRODUCTION TO THE CHAPTER

In this chapter, the literature review is discussed under the following headings: the importance of sports injury data; the epidemiology of sports injuries among school children; factors influencing children's participation in sports; sports-related injuries in children; athletic-related injuries; the impact of sports injuries and the importance of prevention.

2.2 IMPORTANCE OF SPORTS INJURY DATA

An important goal of the World Health Organisation is a substantial reduction of sports injuries in extent as well as severity, before the year 2000 is reached (van Vulpen 1989). Realisation of this significant reduction calls for a structured plan of preventive measures. The preventive measures highlight the need for important injury surveillance systems. Despite the fact that a preventive approach is currently promoted by the WHO, the scarcity of epidemiological information reflects the lack of baseline data for preventive projects.

The increase in participation in sports had not only brought an increase in the number of sports-related injuries, but also aroused an interest in the treatment and prevention of these injuries (Saperstein and Nicholas 1996; Ytterstad 1996; van Mechelen 1997b). Waller et al (1994) stated that injuries resulting from participation in sporting and physical recreational activities are major contributors to the overall incidence of injuries in the developed world. It was also felt that if sports injuries were to be reduced, a comprehensive approach had to be taken to define the nature and magnitude of the problem, to establish models of relationships between risk factors, protective factors and injury experience, and to address injury through well designed intervention and evaluation programmes (van Mechelen, 1997a). It was suggested that communities should be involved in developing sports-related injury prevention strategies based on scientific research.

Prevention of sports injuries is the outcome of many processes which are: (i) acquiring data concerning prevalence, nature, extent and severity of injuries; (ii) etiological factors involved in sports injuries; (iii) implementing preventive measures and evaluating the applied measures in order to compare incidence and severity before and after intervention (van Mechelen et al 1992a; van Mechelen 1997a). Given the unwanted effects of sports participation, it was recognised within European countries that a preventive approach towards the reduction of sports injuries should have high priority

(van Mechelen 1997a). Van Mechelen (1997b) stated that the 'sequence of prevention' cannot be applied without proper sports injury surveillance. He argued that a general sports injury surveillance system could be used to cover all aspects of sports injury research, i.e. answering questions about the incidence and severity of the sports injury problem in various areas of a population. Van Mechelen (1997b) further stated that if the purpose of injury surveillance was to identify the aetiology or the effectiveness of preventive measures, then sports injury surveillance should be tailored to the specific sports situation. He also indicated that not all sports injury surveillance systems were useful in identifying the mechanism of injury if the mechanism of injury refers to the actual mechanism by which the amount of stress imposed to the human body during a sports situation eventually leads to tissue damage.

Data collection plays an important role in the prevention of injuries. The collection of reliable data and the publication of the results can assist in beneficial changes being implemented in sports (Blythe and Meuller 1987). Persistent surveillance of sports injury data is mandatory if progress is to continue in the prevention of fatalities. Finch (1997) identified injury surveillance as the ongoing collection of data describing the occurrence of and factors associated with injury. The success of any sports injury surveillance system and its wide scale applicability is dependent upon valid and reliable definitions of sports injury, injury severity and sports participation. Finch (1997) emphasised that sports injury data is needed to guide injury prevention activities, to set and monitor

sports safety policies and interventions, and as the basis of sports injury prevention research. Finch (1997) further stated that all injury surveillance systems should collect information about the epidemiology of sports injuries and their outcomes in a form that is relevant across a broad range of potential users of the data.

Van Mechelen (1997b) indicated that it was important to include information on the severity of injuries in a sports injury surveillance system. Van Mechelen(1997a) stated that this kind of information would help set targets for preventive strategies. The more severe the injuries sustained, the higher the priority to prevent these injuries regardless of injury incidence. According to van Mechelen (1997b), in order to describe severity of sports injuries the following six criteria should be looked at: (i) nature of sports injury; (ii) duration and nature of treatment; (iii) sporting time lost; (iv) working time lost; (v) permanent damage; and (vi) monetary cost.

When reviewing literature regarding sports injury surveillance systems, it is significant to note that various authors highlighted that clear aims and definitions should be incorporated and the design should be clear (Finch 1997, Meuwiesse and Love 1997, De Loes 1997). Notwithstanding the differences in data collecting systems, literature continued to highlight the importance of sports injury data. A sports injury surveillance system is needed to (i) monitor trends in sports-related injuries over time; (ii) provide a

guide for sports injury prevention activities; (iii) set and monitor sports policies and interventions, and (iv) serve as a basis for sports injury prevention research.

According to Meeuwisse and Love (1997), there are numerous athletic injury surveillance systems currently in place. They also stated that for our understanding of athletic epidemiology to advance, we must be able to compare data from divergent sources. It was also emphasised, based on the literature, that surveillance systems should have the following qualities namely; simplicity, flexibility, acceptability, representativeness and timeliness.

2.3 DEVELOPMENT OF SPORTS INJURY DATA

A number of interpretive factors such as the difference in injury definition, methodology of data collection, data analysis, and expression of severity are responsible for variations in findings of studies.

2.3.1 Injury Definition

It has been suggested by Finch (1997) that one of the reasons for the difference in reported injury rates may be attributed to the lack of a uniform definition of a reportable injury. The definition of a sports-related injury according to Backx et al(1991) as proposed by the Council of Europe is an injury as a result of participation in sport with one or more of the following consequences:

(1) reduction in the amount or level of sports activity

(2) the need for advice and treatment

(3) adverse social and economic aspects

This definition is not frequently used because most studies are not widely based as suggested by the Council of Europe. Various studies define the term "sports injury" in different ways depending on the information the researcher wishes to gather. Examples of these include:

- any sports injury treated at a hospital or clinic (Sahlin 1990)
- any injury referred for medical treatment of any kind (Finch 1997)
- physical damage caused by a sports related incident and reported as such by the respondent (Backx 1991)
- an event requiring first aid while participating in a particular sport (Janda 1997)
- an event which leads to an individual having to be removed from participation in that particular sport (Janda 1997)

The different definitions partly explain the differing incidences found. The results of these various surveys are therefore not comparable. To make sports injury surveys comparable and unambiguous, a universally applicable definition of "sports injury" needs to be found (van Mechelen et al, 1992a).

2.3.2 Research Designs in data collection

The extent to which sports injury incidence can be assessed depends on the definition of sports injury and the methodology used to determine the incidence. Studies may be retrospective or prospective, it may be hospital and clinic based or it may be population-based studies (De Loës 1997). Van Mechelen et al (1992a) stated that prospective as well as retrospective studies were important. Prospective studies can, by quantifying exposure time, accurately estimate the risk and incidence of injury according to the level and type of exposure of an athlete, while retrospective studies can also identify some risk factors depending on choice of research design, e.g., case-control studies or population-based studies.

A study done by Twellaar et al (1996) attempted to establish the reliability of prospective and retrospective sports injury registration in physical education students during their 4-year education program and to determine the injury incidence of whom in intramural and extramural sports activities. It was found that prospective studies were more reliable as recall bias was a major factor in retrospective studies.

Studies conducted to determine the incidence of sports injuries seldom have a population-based design. Most are simply based on the records from outpatient clinics or regional hospitals. Hospital and clinic-based studies are not a true reflection of the problem. Subjects participating in these studies would not been randomly selected.

They present mainly with severe injuries and are thus not representative of the total population of injured athletes (van Mechelen, 1997a). All types of injuries are not recorded as those not demanding immediate medical attention are not considered. These studies thus represent selection and sample biases, thus threatening internal and external validity. Some of such studies were done by Kvist et al (1989), Watkins and Peabody (1996), Kibler (1993) and Backx et al (1991).

In population-based studies the data is collected directly from the participant. A fault of such studies is that they often include a large number of minor injuries that may exaggerate the incidence of sports related injuries in children (Backx et al 1991). The limitation of population-based studies is that diagnoses are rarely available. Injuries are mostly described as sprains, strains or bruises and this could create the impression that only minor injuries are sustained. Since subjects are randomly selected, the validity of the results is more reliable than hospital and clinic-based studies. Some of such studies include those of Backx et al(1989), Backx et al(1991) and McLain(1990).

De Loës (1997) reviewed the four major types of approaches to collecting sport injury data. The four types included (i) the clinical case series; (ii) the community-based survey; (iii) studies on specific sports or diagnoses without exposure data; and (iv) studies on specific sports or diagnoses with exposure data. De Loës (1997) discussed the advantages and disadvantages and concluded that in order to optimize preventive

efforts and to improve the comparability of studies in sports injury epidemiology, there is a need for consensus on definitional issues and also methodology. The number of participants, time spent at training and competition, inclusions of both injured and uninjured athletes are essential epidemiological variables and this allows the expression of incidence rates per 1000 and 10 000 hours of exposure to sports.

Meeuwisse and Love (1997) reviewed existing athletic injury reporting systems in North America. The systems that existed were case series design, cohort design with exposure estimation and cohort design with exposure measurement. These authors concluded that accumulation of evidence from a number of related studies would advance our thinking and understanding of injury occurrence. It is unlikely that one universal system would fit all the needs of injury reporting in all populations and settings. However, they also stated that if the purpose is clear and information is collected in a manner that fits the purpose, then the data collecting system will generate appropriate data.

2.3.3 Exposure Data

For optimizing preventive efforts and to improve the comparability of studies in sports injury epidemiology, there is not only a need for consensus on definitional issues, but also for agreement on methodology. According to De Loës (1997), attention to exposure issues is a crucial component of this. The number of participants and the time spent at

training and competition, including both injured and uninjured athletes, is essential variables and variations in expression of these variables influence interpretation of data.

Examples of the variability and interpretation of the literature include:

- number of injuries over a 3-year period (Kvist et al 1989)
- number of injuries reported per year (D'Souza 1994)
- number of injuries during a sporting season (Finch 1997)
- number of injuries over a retrospective period of 6 weeks (Backx et al 1991)

Some authors reported data in terms of:

(i) an injury rate per playing hours (Kibler 1993)

(ii) incident rates per 10 000 practice hours (De Loës 1997)

(iii) an incidence per number of injured players without reference to hours (Sahlin 1990)

(iv) an injury rate as a percentage of total number of injuries (Kvist 1989)

(v) number of injuries per 1000 hours (Schmidt-Olsen 1991)

When injury rates are calculated using several different denominators, it makes it difficult to compare evidence across studies.

2.4 FACTORS INFLUENCING CHILDREN'S PARTICIPATION IN SPORTS

According to Kremer et al (1997), previous research regarding young people's participation in sports identified three distinct areas of activity. The first area of activity, namely the psychological, is where sports and exercise psychologists have focussed on either how competitive sports may impact on children's perception of sports and physical activity, or how models of intrinsic motivation can be operationalised in the world of sports. The second area of activity is socialisation . Sports sociologists who have turned their attention towards socialisation, mainly during adolescence, look upon sports and leisure as an essential part of the process of socialisation. The third area of activity is an alliance of educationalists, developmentalists and medical staff who have endeavoured to chart children's physical activity, primarily but not exclusively against the background of the school curriculum.

Three principle factors have been identified that combines to predict participation in sports. These factors include personal attributes (expectancies, values and attitudes), significant others (family, peers, teachers, coaches and top sports people) and socialisation situations, i.e. the opportunities that are made available to the children. It is obvious that an individual's motivation to take up sports will be influenced by both the reinforcement and the support which are offered. Other factors that may influence participation include perceived self- competence, fitness, affiliation, teamwork,

competition and fun. In addition attention is placed on the interaction between variables such as age, gender and sporting opportunities.

An Australian study conducted by Kirk et al (1997) in Australia concluded that family income and structure such as support, socio-economic status and parent's own sporting background are the key factors in determining the likelihood of a child's involvement in junior sport. For many children financial factors may be barriers to their participation in sport. The cost involved in purchasing the necessary equipment, traveling expenses to practice and tournaments is high. Sport also becomes a financial strain on parents when a child starts to perform well and is chosen to compete at higher levels, e.g., Provincial or National.

2.5 FACTORS INFLUENCING SPORTS-RELATED INJURIES IN CHILDREN

Findings from published studies regarding sports related injuries in children vary considerably. The main objective of any injury incidence study is to describe the rate of injury and factors related to them. However, inconsistency of these factors in published studies limits comparability and interpretation of findings. Consequently the significance and extent of sports related injury in children is not well researched.

2.5.1. Increase in sporting activities leads to an increase in injuries

Various studies done by Ytterstad (1996), Quendenfeld (1993) and Lenaway et al (1992) found that with the increase in participation of children in sports came an increase in the number of physical and psychological sports-related injuries sustained. These studies confirmed that sports activities accounted for the largest percentage of injuries occurring in schools and that the percentage of sports-related injuries increased with increasing school-grade level. Analysis of injury rates revealed that high school students were most frequently injured in the gym and on the athletics field, whereas primary school children were injured on the playground. The study done by Kvist et al (1989) in Finland indicated that sports-related injury rate among children had increased by 15 - 20%, as the participation of children in sports had doubled leading to an increased incidence of sports accidents in children. Studies conducted by Saperstein and Nicholas (1996), Landry (1992) and Hanekom (1991) indicated that the number of injuries increased as the child got older, bigger and achieved high skill levels. At high schools and college levels, soccer had the highest injury rate followed by wrestling, gymnastics and athletics. It was also indicated that there is no risk-free sport and that children tended to select the sports they wished to participate in without considering the risk of injury.

2.5.2 Common injuries in children

Hanekom (1991), and Cook and Leit (1995) stated that children sustain most of the injuries that occur in adults. However, children are vulnerable to other specific injuries as a result of such factors as growth spurts, bone growth, voluntary dehydration and energy metabolism. These factors predisposed children to injuries like tendinitis, stress fractures and osteochondritis dissecans. Overuse injuries were also found to be common among children due to improper training and factors like abnormal tissue, anatomy, growth and poor equipment. Saperstein and Nicholas (1996) and Backx et al (1982, 1991) identified certain types of overuse injuries common in children. These were muscular contusions and strain, ligamentous injury, fractures and other soft tissue damage.

The study done by Kvist et al (1989) was a hospital-based study over a 3-year period. No clear definition of injury was given. The aim of the study was to obtain an accurate up-to-date profile of children's sports accidents reporting to a casualty department and collect data regarding type, severity and treatment. It was found that 8% of the injuries resulted from athletic or running injuries. Of the cases reported 69% were boys and 31% were girls. The most common mechanism of injury was a fall or contact with something (53%). The most commonly injured parts reported were the upper limb (36%) and the lower limbs (32.5%). The most common types of injuries were fractures (26.3%), sprains and strains (24.3%) and contusions (22%).

The study by Watkins and Peabody (1996) was a 3-year retrospective survey of sports injuries in children and adolescents treated at a sports injury clinic. The study was able to determine the male to female ratio of injury incidences, the most common type of injury and the sports most commonly responsible for injuries. Of the injuries reported, 50% were acute and 50% were chronic. Most of the acute injuries were muscle/tendon/ligament sprains, strain or contusions (62%). Most of the chronic injuries affected articular cartilage, epiphyseal and apophyseal growth plates (53%). Injuries to the knee and ankle accounted for 51% of all injuries.

Backx et al (1989), conducted a population-based survey on sports injuries in school aged children in Holland. It was a 6-week retrospective study. In this study an injury was defined as a physical damage caused by a sports-related incident and reported as such by the respondent. The aim of this study was to determine not only the incidence and type of injury in intra-scholastic and extra-scholastic sports activities, but also to investigate some determinants and task indicators for sports injuries. The results reported that 33% of children did not take part in sport. Of those that took part in sport, 12% sustained injuries. Injuries which occurred during track and field activities constituted 2% of the injuries. The most common types of injuries were contusions and sprains (77%). Most of the injuries involved the lower extremities (73%) and the ankle accounted for 27% of all injuries.

A reasonable consensus about the type and anatomical location of injuries in track and field events can be found in literature. Most studies described the most common type of acute injuries sustained in sport as sprains and strains of muscles, tendons and ligaments (Frantz et al 1999, Backx et al 1989, Watkins and Peabody 1996, Sahlin 1990). Results of most studies show that injuries to the lower limb are generally more common than the upper limb or trunk (Watkins and Peabody 1996, Backx et al 1991). Anatomical locations of injuries tend to be specific to the sport or event that the athletes participate in. Examples of these in track and field events are the high percentage of injuries to the lower limb in sprints and distance running (D'Souza,1994). In comparison, field events such as throwers have more injuries to the upper limb than the lower limb although the ankle tends to be a common site of injury.

2.5.3 Intrinsic and Extrinsic factors causing injuries

According to Backx (1991), various studies have identified intrinsic as well as extrinsic factors that contribute to sports injuries. Extrinsic factors are usually independent of the injured person. These include circumstantial aspects which are principally related to the type of sport (Taimela et al 1990). Extrinsic factors could be identified as sports-related factors, playing surface, equipment, weather conditions, trainer/coach and conduct of the match. According to Muscari (1998), environmental factors increase the risk of injuries in adolescents. The author further states that injuries are more likely to occur during organised sports club practice and competition. She further states that the

severity of injury increases with the amount of contact in the sport. It is also stated that the extrinsic factors can be eliminated to make participation safer. Intrinsic factors include age, gender, physical build, physical fitness and physical defects.

Age and Gender:

According to Hovell et al (1999), the most consistently documented influences on children's physical activity are age and gender. It is stated that physical activity rate decreases with an increase in age and at all ages boys are more active than girls. It is also stated that injury risk increases with age. The reasoning is: the older the child, the bigger the body mass and the greater the force generated (Backx,1991). According to Sahlin (1990), the influence of age is logical as age corresponds with certain motor abilities and these abilities or disabilities have their effect upon the type of injury. Boys also tended to choose or prefer competitive games that are played in teams or with partners whereas girls are more likely to choose activities that focus on personal goals (Sallis et al, 1993). Thus the higher risk of injury in boys is due to the higher participation rate in vigorous exercise and sport and higher participation in contact sport.

Physical Build

According to Muscari (1998), immature bones when injured may result in premature cessation of growth or abnormal calcifications. Rapid growth of bone, when outpacing

muscle length, may increase the risk of injury and cause teens to experience growing pains. The author confirms that size, weight or maturation mismatching can result in injuries when participating in physical activity.

Physical defect

Abnormalities in local anatomy and biomechanics may lead to acute or chronic injuries (Fredericson & Bergman, 1999). According to Ilahi and Kohl (1998), lower extremity alignment factors, which include tibiofemoral angle, quadriceps angle (Q-angle) and leg length discrepancy is commonly thought to be contributing factors to overuse injuries in the lower extremity. The basic flexibility test included the Sit-and Reach test which is universally used to measure the extensibility of the hamstring musculature, buttocks, lower back, upper back and the shoulders. The Q-angle is affected by the width of the pelvis, hip rotation, femoral anteversion and the position of the tibial tubercle. The average angle is 15,8 ± 4,5° for females and 11,2 ± 3.0° for males (Ilahi and Kohl 1998). Clinically above 15° is usually considered excessive in males and 17° in females. Fredericson and Bergman (1999) stated that besides biomechanical predisposition, muscle and flexibility imbalances and training methods also influence or predispose to injuries in the lower limbs.

2.5.5 Preventive measures

Saperstein and Nicholas (1996), Landry (1992) and Hanekom (1991) found that participation in youth sports is relatively safe. These authors indicated that paediatric sports-related injuries are relatively benign and can easily be treated with conservative measures. However, although sports can be a rewarding and healthy activity for children, enjoyment can be spoiled by poor choice of sports, inadequate training methods and competitive pressure. It was also highlighted by these authors that effective care of the pediatric athlete depends on knowledge of the many types of injuries, insight into the demands of the various sports and the needs of individual athletes.

Lipp (1998) indicated that sports injury prevention should focus on sport participation within the parameters of ability, maturation, and use of proper equipment. Protective equipment is adopted in the hope of reducing the incidence and severity of injuries (Hrysomallis and Morrison 1997). Sports equipment may serve as a source of protection but may also significantly serve as an injury factor. Appropriate sized equipment must therefore be used during training and competition in order to avoid injuries.

2.6 ATHLETIC-RELATED INJURIES

Various studies were done to investigate track and field athletic injuries. Track and field encompasses a variety of events including sprints, hurdles, jumps, middle and long

distance running. However, very few studies exist for South Africa but studies have been conducted in the United Kingdom, America and Australia.

A one year retrospective study done by D'Souza (1994) investigated the incidence, severity and types of injuries of 147 track and field athletes from different clubs within the United Kingdom. A limitation of this study was that the word injury was left to the subjective interpretation of the athlete. The results of the study revealed that more than 60% of injuries occurred during training while about 20% occurred during competition. The different regions injured were classified according to sprints (back=30%), middle distance (shin=47%), long distance (shin=30%), hurdles(shin=25%), jumps (thigh=40%) and throws (ankle=46%). It was also found the track-side injuries were intrinsic injuries which included pulled hamstrings in sprinters and overuse injuries in middle distance runners.

A prospective study conducted in America in 1987 analysed the athletics seasons of 257 track and field high school athletes. This study investigated the most common types of injury, the management of these injuries and a review of the relationship between their incidence and hypothetical etiological risk factors. This study found that the most common type of injury was the posterior tibial syndrome. This was an overuse injury of the tibialis posterior, flexor digitorum and flexor hallicus longus which could be due to factors such as over-pronation (Zuluaga et al 1995). This was followed by ankle injuries

and patellar tendinitis. An injury was only classified once a physical examination was performed. The study also suggested that there was no correlation between exposure time and the injury incidence but there was a positive correlation between performance ability and the injury incidence. This indicated that the higher the level of performance at which these athletes competed, the more likely they were to be injured.

A study done by Bennell et al (1996) in Australia determined the incidence and distribution of stress fractures in competitive track and field athletes. An injury was defined as any musculoskeletal pain or injury that resulted from athletic training and caused alteration of normal training in mode, duration, intensity or frequency for 1 week or more. The results showed that track and field athletes had a high annual rate of stress fracture. Events involving high intensity loading such as sprints, jumps and hurdles were associated with a greater number of long bone and pelvic stress fractures.

A study done by Twellaar et al (1996) revealed that athletics (track and field) had one of the highest reported number of injuries. The exposure time in hours for athletics was 21 633 and the number of injuries reported was 49. The incident rate per 1000 hours for athletics was 2.27. Most injuries were sprains (29%) and contusion (20%). In this study an injury was defined as an episode the athlete reported. It was the opinion of the researchers that the athlete's choice to report a physical discomfort as an injury best corresponds with daily reality.

Another study by Backx et al (1991) revealed that track and field had one of the highest risk ratios in organised sports. In this study an injury was defined as any physical damage caused by an accident during physical education or in any sports activities outside of school. The aim of the study was to determine the incidence and severity of sports injuries occurring during different kinds of sports. The injury incident rate reported for track and field athletes were 295 per 1000 young athletes per year. The incident rate per 1000 practice hours for track and field was 1.0 per 1000 hours.

A one year population-based study was undertaken investigating the incidence of all sports injuries at a large high school (Mc Lain et al 1990). In this study an injury was defined as any incident resulting from athletic participation that keeps an athlete from completing a practice or game, or causes the athlete to miss a subsequent practice or game. It was reported in this study that 7% of boys and 12% of girls participating in track and field events reported with injuries. The most common type of injury recorded were sprains(34%) and strains (23%).

2.6.1 Incidence of track and field related injuries

In the study conducted by Jelsma et al (1997) a total number of 258 injuries were reported during the study of which 74 were athletic injuries (track and field). Thus, 28,7% of injuries reported was as a result of track and field events. The study conducted by De Loës (1990) indicated that 571 injuries were reported of which 2% were athletic

related injuries. Studies done by Mc Clain et al (1987) and Watson and DiMartio (1987), also indicated a high percentage of the number of reported injuries were as a result of athletics. In Table 2.1, a summary of the incidences of athletic (track and field) related injuries from various studies is presented. Only one of the studies (Jelsma et al 1997) was done in Africa.

2.7 IMPACT OF SPORTS INJURIES

Sports injuries affect the sports person in various ways. These include loss of sporting time, psycho-social effects, financial effects and permanent damage leading to withdrawal from sport (van Mechelen 1997a). The psychological impact of injury is an important aspect to consider as part of rehabilitation from sporting injuries (Smith 1996). Injury is often associated with depression, tension, anger and low esteem, particularly in competitive, seriously injured athletes. The rising cost of health care has led to global changes in health care policies which are now taking a primary health care approach rather than one based on therapeutic intervention. In order to assess the sports injury problem, it is necessary to identify the incidence, severity and causative factors of sports injuries. In the literature, the severity of sports injuries is usually described on the basis of nature of sports injury, duration of treatment, sporting time lost, working time lost, permanent damage and monetary loss (van Mechelen 1997a).

Table 2.1 Studies of track and field related injuries

Author and Year	**No of injuries** (N = total number of injuries) n = total number of track and field related injuries
Jelsma et al 1997	N= 258 n = 74 (28.7%)
De Loës 1990	N = 571 n = 11 (1.9%)
Backx et al 1989	N = 1804 n = 54 (3.0%)
McClain et al 1989	N = 135 n = 19 (14.1%)
Jacobssen 1986	N = 293 n = 15 (5.1%)
Watson and DiMartio 1987	N = 88 n = 15 (17.0%)

Injuries in the Netherlands and United States has been reported to be very costly (van Mechelen et al 1992 and Janda 1997). Health costs are not the only effect of injuries. Long term effects of overuse injuries also need to be considered.

2.7.1 Nature of sports injuries

The nature of the sports injury means the type of injury in terms of medical diagnosis. Injuries are classified into categories such as sprain, strain, contusion, abrasion and laceration (Hlobil et al 1987). When assessing literature which determines severity of injury using diagnosis, it is important to know where and by whom the injuries are examined. Recording of the nature of sports injuries are important as it enables us to identify the sports with relatively serious injuries.

The vast majority of sports injuries heal without permanent disability. However, according to Barker et al (1996), injuries resulting from sports make a significant contribution to the prevalence of permanent injury-related disability in young adults. Excessive delay between the occurrence of an injury and the moment at which the sportsman seeks medical assistance can aggravate the injury (Kent 1982). Injuries may only cause an athlete to change his/her level of sporting activity but in some cases the athlete may need to give up the sport altogether. Preventive measures should thus be in place to ensure that permanent disability does not result.

2.7.3 Sporting time lost

Sport and exercise play an essential part in people's relaxation nowadays and thus influence their mental well-being. From the individual's point of view it is important to be able to take up sport again as soon as possible after an injury. The time needed for treatment of an injury is crucial to an athlete. For the elite athletes the loss of sport means a loss of income. Track and field related injuries had the largest number of days lost per injury at 32% according to a study conducted by McLain et al (1990).

2.7.4 Working time lost

As in the case of the cost of medical treatment, the length of working time lost gives an indication of the financial consequences of sports injuries to society. In children, injuries also lead to absenteeism from school and also loss of working time for parents. In a study conducted by Sorenson et al (1998) in a Danish community among school-aged children, it was found that as a result of a sporting injury 37,2% of the children stayed away from school. Of those children injured, 15% of the parents had to stay away from work for a period of time.

2.8 IMPORTANCE OF PREVENTION

Prevention is one of the key aspects of the primary health care approach. In South Africa prevention has been included as part of the comprehensive health care system

(De Haan 1996). Janda (1997) stated that it was the responsibility of every health care provider within the field of sports medicine to make the practice of prevention the rule and not the exception. He further emphasizes that in order to reduce the morbidity, mortality and money spent on sports injuries, emphasis must be placed on the development of preventive techniques that would lead to a significant reduction of injuries. Finch (1997) stated that the increased incidences of injuries are a burden on both individuals and society, and prevention should be a major public health concern. Preventive measures will have the best effect on health care resources, sick leave and especially the cost of treatment.

In February 1996, as part of the Third International Conference on Injury Prevention and Control held in Melbourne, a round table meeting was convened for persons concerned with injury control in Africa. The aims were to assess the injury burden in Africa, and to plan strategies for increased government involvement in injury control (World Health Forum 1996). At this conference the importance of injury prevention was highlighted and the need to bring it to the attention of various governments. One of the strategies decided upon at this conference was the need for established data bases regarding injuries.

With reference to sports injuries specifically, it was in the Council of Europe's document on "Sport for all: Sports injuries and their prevention" that it was highlighted that as

(primary) prevention of sports injuries was not always feasible, attention should focus on early diagnosis and adequate first aid (secondary prevention), and on effective medical treatment and rehabilitation (tertiary prevention). However, Hlobil et al (1987) suggested that advice to sports people, stretching exercises and good warming-up, as well as protective equipment should be classified as primary prevention. Proper rehabilitation following an injury will be classified as secondary prevention.

CHAPTER 3.0

METHODOLOGY

3.1 INTRODUCTION

In the methodology, the research setting, the procedure which deals with the three phases of the study, and the analysis of the data will be discussed.

3.2 RESEARCH SETTING

Children are involved in sports at different levels namely physical education classes at schools, and community organised team sports and non-organised sports. In South Africa, sports forms part of the activities at schools. Children participate in sport in physical education class and also as part of the extra-curricular activities at school. One of the most common sports that children participate in at schools is athletics (track and field events). The major athletic events in schools are the inter-house athletic programs, and the inter-school athletic programs which ultimately lead to the inter-school championships where scholars are selected to represent the provinces.

There are 1184 schools in the Western Cape Province, of which 575 fall in the Cape Metropolitan Area. The limits of the Cape Metropolitan Area include Simons Town in the

south. On the eastern boundary are Strand, Somerset West and Kuilsriver. To the north the boundary is defined by Bellville, Durbanville and Kraaifontein, and the west coast is bounded by Cape Town and Wynberg. In the Cape Metropolitan Area, there are 414 primary schools and 161 high schools.

The general athletics season is October of one year to April of the following year. Inter-house athletics programs take place at the various schools or at suitable venues decided upon by the school. The inter-school athletics programs also take place at central venues decided upon by the schools that participate against each other according to their zones. Some of the most popular venues for athletic events are Athlone Stadium, Greenpoint Stadium, Bellville Stadium, Parow Track and University of the Western Cape Stadium. Schools are divided into different zones depending on the level of their performance throughout the years or the areas in which their schools are situated. Schools compete against each other at zonal levels where athletes are selected to compete in the Western Province Schools Championships. Successful athletes are selected to represent the Province during inter-provincial and national athletic programs. The Physiotherapy Clinic at University of the Western Cape is often

invited to different athletics programs to provide physiotherapy services to injured athletes.

3.3 PROCEDURE

The research study was conducted in three stages.

3.3.1 The first stage of the study

The first stage was a retrospective study. The purpose of the retrospective study was to collect data regarding the injuries sustained by learners during various athletic programmes between 1995 and 1998. Three hundred of the five hundred and seventy-five primary and high schools participated in the study. A data capture sheet (Appendix III) was developed by the Department of Physiotherapy, University of the Western Cape after due consultation with teachers responsible for physical education at various schools. The data collected included number of learners who participated in athletics, number of learners who sustained injuries, types of injuries sustained, cause and common sites of injuries. Based on the history of injury given by the athlete, the mechanism of occurrence of injury was determined by the researcher. A preliminary survey suggested that records of all sports injuries are not routinely documented in schools and not all relevant data is collected e.g. age of the injured athlete is not commonly recorded and nature of event at time of injury is also not recorded i.e. it is not recorded whether the injury occurred during training or competition.

A list of all the schools in the Western Cape Province was obtained from the Department of Education, from where the addresses of the 575 schools in the Cape Metropolitan Area were obtained. Schools with special needs were excluded from the study resulting in 400 schools remaining. The data capture sheet was mailed to the principal in each school with a self-addressed stamped envelope. Three months following the mailing of the data capture sheet and due to the poor response, schools were telephonically contacted to determine the reason for the poor response. In response to the telephone call an additional number of responses were received.

3.3.2 The second stage of the study

The second stage was a prospective study having 2 main objectives. The first objective was to collect data regarding injuries sustained by school children at various athletic programmes in the Cape Metropolitan Area during the 1998 and 1999 athletic seasons. Schools participating in the study were selected on the basis of convenience. Data was collected from which invited the Physiotherapy Clinic at UWC to their athletic meetings. Additional data was also collected during zonal championships and national championships which were held at Greenpoint Stadium, Bellville Stadium, Athlone Stadium and Parow Track. Relevant data of all the injured athletes were captured on a data capture sheet (Appendix IV) which was similar to the one used during the All African Games in Zimbabwe in 1995 but which had been adapted for the current study. The modifications made included limiting the sports events options to track and field events rather than all sports as in the All Africa Games data capture sheet.

The information requested for on the data sheet included age, gender, body weight, height, injury sustained, cause of injury, sites of injury, past history of injury and treatment given. The medical diagnosis of the injured athlete was made by the same qualified physiotherapist following an assessment. The second objective was to identify intrinsic factors that could lead to injury by monitoring of a group of school athletes who participated in athletics at a higher level than just school activities for one athletics season. Early in the athletics season, the athletes were subjected to a series of tests which included flexibility tests, measurement of, Q-angle, explosive power of legs, upper body strength and endurance.

The flexibility test was performed in sitting and tested the athlete reaching as far forward as possible. This stretched the muscles in the back and hip region. The vertical jump which tested the explosive power of the lower limbs involved the athlete jumping three times and the average height reached was recorded. Upper body strength and endurance were measured by recording how many sit ups and push ups the athlete could perform in one minute. A basic test for measuring the Q-angle was performed (Zuluaga et al 1995). The angle between the line drawn from the Anterior Superior Iliac Spine through the centre of the patella and intersecting the line to the tibial tubercle is referred to as the Q-angle. The average angle is 15,8 ± 4,5° for females and 11,2 ± 3.0° for males (Ilahi and Kohl 1998). Clinically measurement above 15° is usually considered excessive in males and 17° in females. The Q-angle was measured in the functional

position of standing so that the effect of all structures in the lower limb is taken into consideration.

These athletes were then monitored during the athletics season to determine if any injuries were sustained in order to ascertain if poor biomechanics contributed to injury occurrence. Injuries sustained were recorded on similar data capture sheet used in the first stage of the prospective study, but additional information such training times, level of competition and whether injury occurred during training or competition was also included.

3.3.3 The third stage of the study:

Based on the data gathered in the first and second stages, injury prevention guidelines were developed to make athletic trainers aware of the predisposing factors to injuries during athletic activities. An information booklet was prepared and made available to the athletic trainers. The information booklet included causes of injuries and possible methods of prevention.

3.4 ANALYSIS OF DATA:

Responses on the data capture sheets were coded and captured on a spread sheet using the Quattro Pro computer programme and were analysed using the Statistical Package for the Social Sciences (SPSS) and consisted of descriptive statistics. In

identifying intrinsic factors that could lead to injury, the elite athletes were divided into 2 groups namely the injured and non injured groups. In order to identify differences in the anthropometric and biomechanical data of the 2 groups, a student's t-tests was carried out using a two-tailed significance level of $p>0.05$.

3.5 ETHICAL CONSIDERATIONS

The purpose of the study was clearly explained in writing to all participating schools and explained to all injured athletes. Each school and athlete retained the right to decide on participation. Informed consent was obtained from all participating schools and injured athletes. All information collected was treated in the strictest confidence and no names were divulged. Injured athletes' access to treatment was not denied if they refused to participate in the study.

CHAPTER 4.0:

RESULTS

4.1 INTRODUCTION

In this chapter the results of the study are presented in three parts namely retrospective study, prospective study and monitoring of elite athletes. Headings used when presenting the results of the various stages includes participants injured, types of injuries sustained, causes and mechanisms of injuries sustained and most common structures injured.

4.2 RESULTS OF THE RETROSPECTIVE STUDY

4.2.1 Response rates

Of the 400 questionnaires sent out, 300 copies were distributed to primary schools and 100 copies to high schools. The response rate was 20.3% (n=61) from primary schools and 34% (n=34) from high schools. Of the schools contacted telephonically (n=50), 12% did not participate in athletics, 35% did not keep detailed records and the rest had lost the questionnaire or promised to reply. The overall response rate to the questionnaire was thus 27%, this included all questionnaires obtained following telephonic conversations.

4.2.2 Participation in Athletics

Table 4.1 shows that a total number of 26 745 athletes from 95 schools participated in athletics for the period of 1995 to 1998. During this four-year period, the number of athletes who participated in athletics increased from 5929 participants (3136 males,

3058 females) in 1995 to 7295 participants (3758 males, 3537 females) in 1998. The number of participants for primary schools increased by 10.7% from 1995 to 1996. For the period of 1996 to 1997, the increase was 5.28%, and for the period 1997 to 1998, the increase was 5.5%. In primary schools there was an overall increase of 24.6% in the number of participants for the four-year period. In high schools, the increase in the number of participants from 1995 to 1996 was 10.8%. From 1996 to 1997 there was an increase of 5.3% and for the period from 1997 to 1998 there was an increase of 4.4%. The overall increase for the number of participants in high schools was 21.8%.

Table 4.1 Number of participants (N= 26 745)

	Primary	Male	Female	High	Male	Female
1995	2590	1334	1265	3339	1802	1537
1996	2867	1487	1380	3698	1973	1725
1997	3061	1551	1510	3895	2072	1823
1998	3228	1645	1583	4067	2113	1954
	11 746	**6017**	**5738**	**14 999**	**7960**	**7039**

4.2.3 Participants injured

With the increase in the total number of participants there was an increase in the total number of athletes injured. During the four-year period a total of 2674 injured athletes was reported (Table 4.2). The number of athletes injured increased from 577 (300

male, 277 females) in 1995 to 759 (373 males, 386 females) in 1998. This indicated an increase of 31.5% in the number of athletes injured or could be due to better reporting of injuries. In primary schools the numbers of athletes injured increased by 8.5% between 1995 and 1996, by 3.1% between 1996 and 1997 and by 12.9% between 1997 and 1998. In primary schools the number of injured female athletes increased by 22.2% for the period between 1995 and 1998 and the number of injured male athletes increased by 19.6%.

The data for the high schools indicated that between 1995 and 1996 there was a 16.7% increase. Between 1996 and 1997 the number of injured athletes increased by 5.5%, and by 9.7% between 1997 and 1998. In the high schools the number of injured females increased by 31.8% and the number of injured male athletes increased by 19.5% for the period of the study.

The injury risk ratio, calculated by the number of injured over the number of participants, for the four-year period was 0.1. In primary schools the injury risk ratio was 0.09 and in high schools the injury risk ratio was 0.1. The overall injury risk ratio for primary school males was 0.09 and for primary school females were 0.08. Among the high school athletes, the overall injury risk ratio for injured males was 0.1 and for injured females was 0.1.

Table 4.2: Number of injured athletes (N= 2674)

	Primary	Male	Female	High	Male	Female
1995	235	123	112	342	177	165
1996	255	138	117	399	211	188
1997	263	130	133	421	213	208
1998	297	153	144	462	220	242
	1 050	**544**	**506**	**1 624**	**821**	**803**

4.2.4 Types of injuries sustained

Figure 4.1 illustrates that the types of athletic related injuries reported were classified as fractures, dislocations, muscle strains, sprains, bruises and contusions. Of the athletes injured, the most common type of injury sustained was a muscle strain (38.4%), which was followed by sprains (28.8%) and bruises (23.3%). Other types of injuries included dislocations, fractures or contusions (n=256). Of the total number of people injured, the types of injuries reported in order of which occurred most were similar in both high and primary schools.

4.2.5 Causes of injuries sustained

The above-mentioned injuries sustained by the athletes were reported as a result of various causative factors or mechanisms in which the injuries occurred. These mechanisms included a twisting motion which resulted in ankle or knee injuries, falling

thus making contact with the ground, contact with opponent, overuse injuries and stretch injuries. Those that could not be classified were grouped into a group called other. The most common mechanism of injury reported by the athletes was stretch injuries to muscles which accounted for 26.5 % of the injured athletes. Twisting motions resulting in injuries to the ankle and knee accounted for 25.7% of injuries. Of the people injured, 19.3% were as a result of falling and 17.9% were either as a result of contact with an opponent or as a result of a reason not reported (Table 4.3)

Figure 4.1 Types of Injuries Sustained

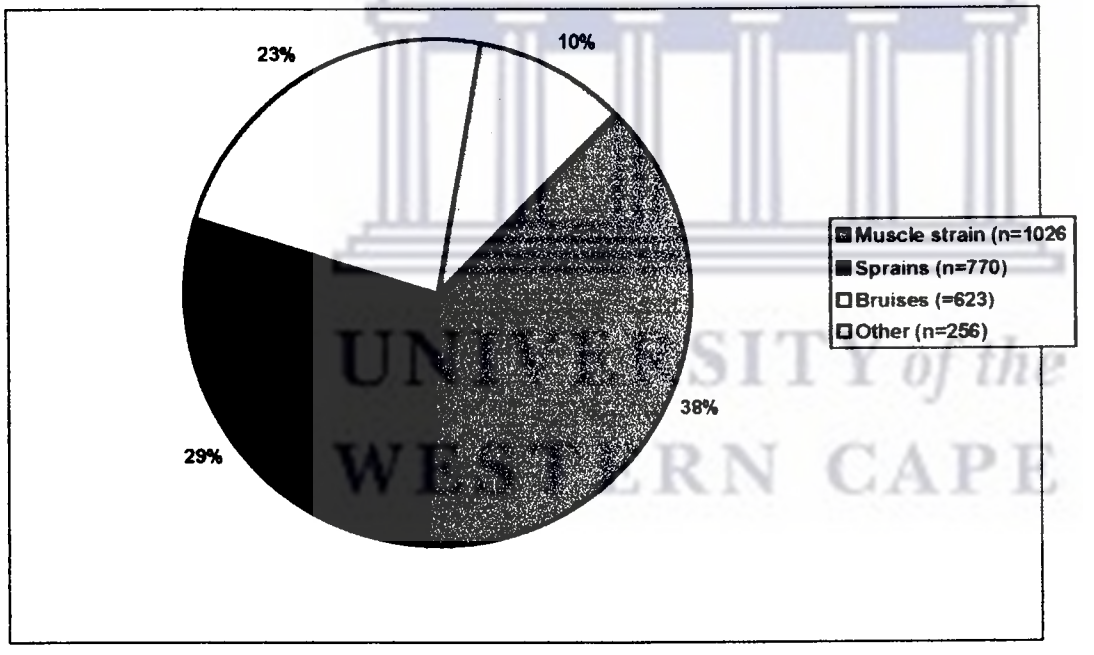


Table 4.3 Causes of Injuries (N= 2674):

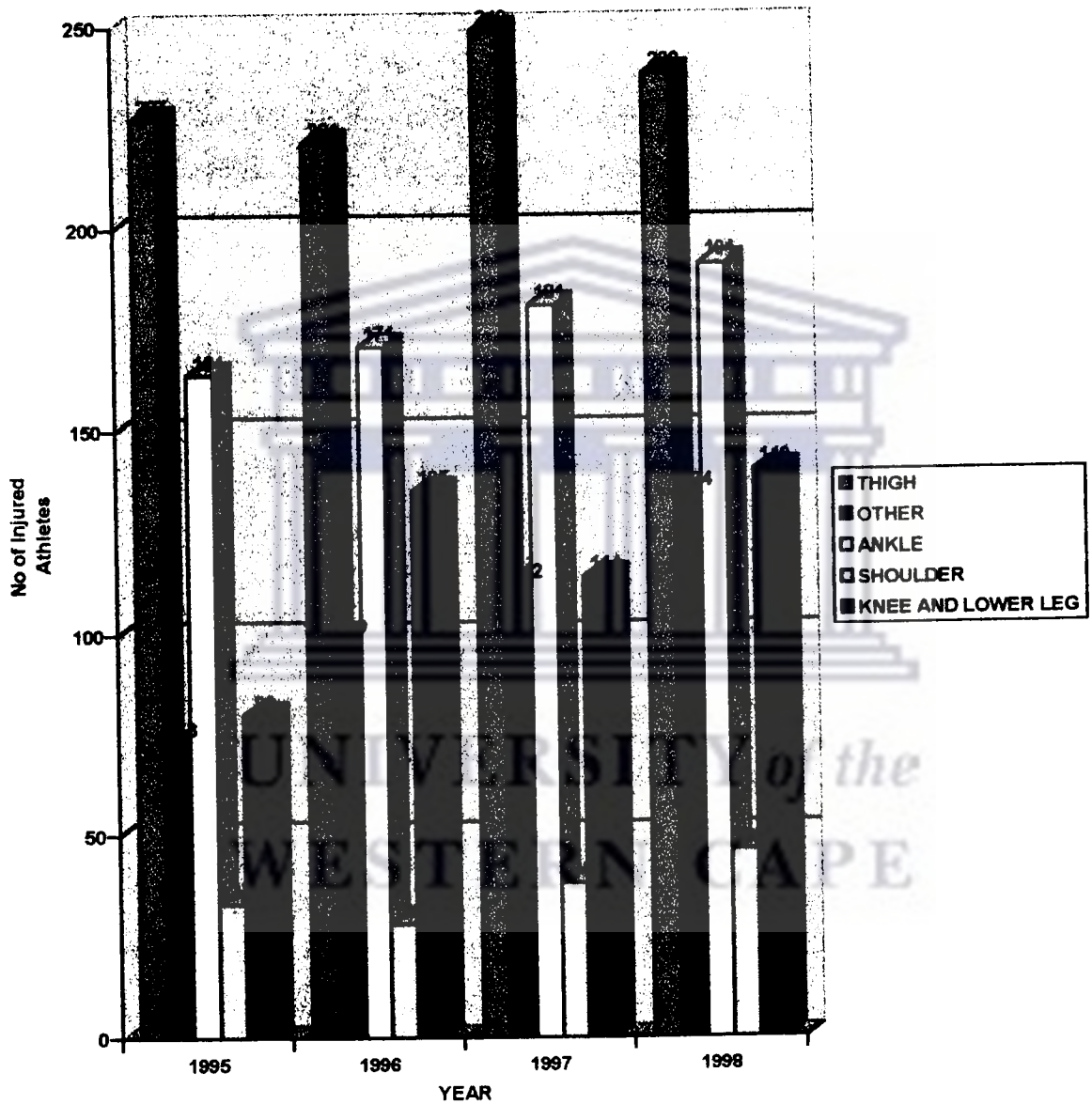
	1995		1996		1997		1998		TOTAL		
	P*	H*	P	H	P	H	P	H	P	H	
Twisting	56	102	68	102	63	110	84	100	**271**	**414**	**685**
Fall	57	68	54	73	47	68	70	79	**228**	**288**	**516**
Opponent	23	23	40	45	42	52	45	72.	**150**	**192**	**342**
Overuse	24	43	28	32	42	45	23	47	**117**	**167**	**284**
Stretch	75	95	64	102	64	122	71	114	**274**	**433**	**707**
Other	0	12	1	45	0	24	3	50	**4**	**131**	**135**

P* = primary schools H* = high schools

4.2.6 Sites of Injuries

Different areas of the body were injured (fig. 4.2). Of the athletes injured, 35% sustained injuries to the thigh, 26.5% to the ankle, 5.4% to the shoulder, 17.5% to the knee/lower leg and 15.6% to other parts of the body including the wrist, head and ribs.

Figure 4.2 Sites of Injuries



4.3 RESULTS OF PROSPECTIVE STUDY

4.3.1 Bio-Demographic data

Data were collected from 2 inter-house athletic competitions, 3 inter-school athletic competitions and 2 provincial championships. The total number of participants for these events was 2750. Table 4.4 reflects the bio-demographic data of the 320 athletes who sustained injuries during the athletic competitions. Fifty-two percent of the injured athletes were from primary schools and 48% from high schools. The injured athletes included 53% males and 47% females. Injured athletes in high schools (n=153) were made up of 57% male athletes and 43% female athletes. Injury athletes in primary schools were made up of 47% male and 53% female. There was no significant difference in the bio-demographic data of injured male athletes and injured female athletes ($p>0.05$). The study population had a uniform age distribution from 9 to 18 years. The mean age of the male participants in high school was 16.2 years (sd=1.2), while in primary schools it was 11.9 years (sd=1.2). The mean age for females in high schools was 15.9 years (sd=1.1), and in primary schools it was 11.9 years (sd=1.2).

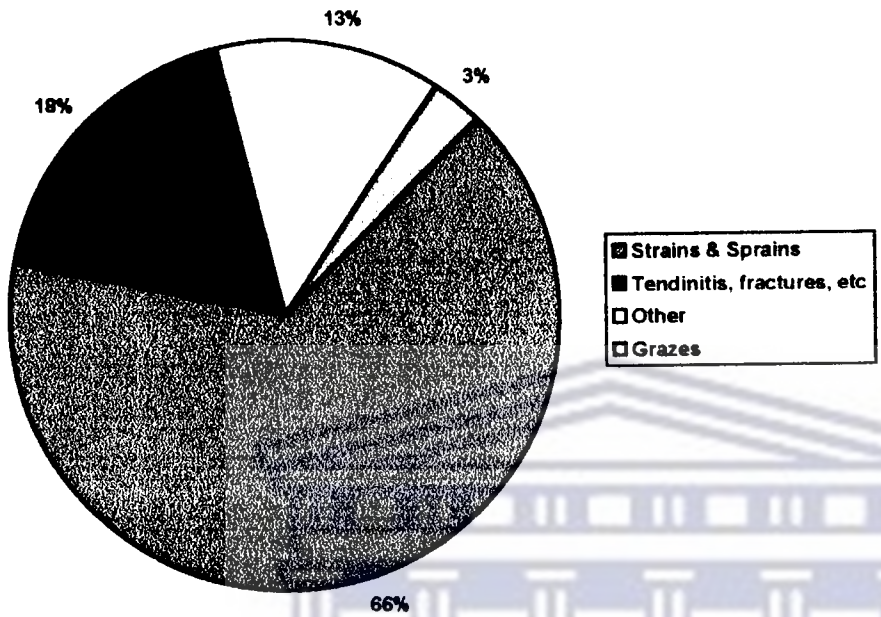
4.3.2 Types of Injuries Sustained:

The total number of injured participants was 320 which meant that 11.6% of the participants sustained injuries. The most frequently recorded injuries were muscle strains and ligament sprains sustained by 65,3% of the injured athletes (Figure 4.3). Approximately 18% sustained injuries such as tendinitis, fractures and shin splints. Three percent of the reported injuries were grazes. Of the others injured, 13.4 % presented with injuries that could not be classified definitely by the researcher.

Table 4.4 Bio-Demographic data

	Male Primary N= 95	Female Prim N = 72	Male High N = 73	Female High N = 80
Age (years):				
Mean	11.9	11.9	16.2	15.9
SD	1.2	1.26	1.17	1.12
Minimum	9	9	14	13
Maximum	14	14	19	18
Range	5	5	5	5
Weight (kg):				
Mean	43.8	43.8	62.1	56.7
SD	4.42	5.06	7.72	6.5
Minimum	35	35	45	39.5
Maximum	55	60	83	78
Range	20	25	38	38.5
Height (m)				
Mean	1.42	1.4	1.65	1.6
SD	0.15	0.14	8.57	6.3
Minimum	1.1	1.1	1.5	1.4
Maximum	1.7	1.63	1.84	1.75
Range	0.6	0.53	.34	.35
BMI ($kg.m^{-2}$)				
Mean	22.16	22.4	22.8	21.9
SD	3.44	3.13	1.62	2.00
Minimum	15.6	15.6	18.7	17.2
Maximum	33.1	31.2	26.4	27
Range	17.5	15.6	7.75	9.8

Figure 4.3 Types of Injuries Sustained



4.3.3 Structures Injured

Most of those injured (57.2%) sustained injuries to the muscles. Others sustained injuries to the ligament (12,8%), joint (10%) and the other sustained injuries to structures such as bone, tendon, nerve etc comprising 20 %.

Table 4.5 Structures Injured

Structure Injured	Frequency	Percentage
Muscle	183	57.2
Ligament	41	12.8
Joint	32	10
Other (bone, tendon, nerve)	64	20

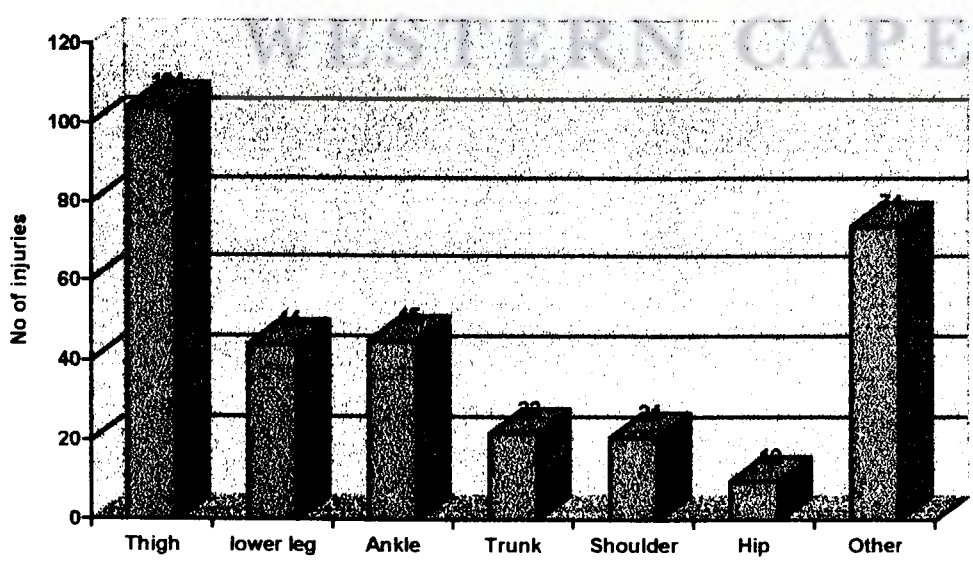
4.3.4 Body Part Injured

Most of the injured had injuries to the lower extremity (77.9%). The most commonly injured part reported was the thigh (32.5%), followed by the ankle (14.1%) and then the lower leg (13.8%). Other injured athletes reported injuries to the trunk (6.9%) and the shoulder (6.6%). The remaining athletes (20%) sustained injuries to other parts of the body e.g. ribs, elbow, etc. (Fig. 4.4).

4.3.5 Mechanisms of injuries sustained by athletes

Table 4.6 lists the mechanisms by which the athletes were injured as determined by the researcher and respondents. Of the injured athletes 32.5 % reported injuries due to overuse. Others reported the mechanism of injury to be by stretch (27.8%), contact with the ground (19.7%), torsion or twist injuries (10.9%), and contact with a person (9%).

Figure 4.4 Distrbution of injuries over body area (N=320)



Seventy two percent of the injured athletes indicated that it was the first time that they had sustained an injury; 17.8 % of the injured athletes reported having had a similar injury within the last month and 8.8% had a similar injury less than two weeks earlier. The rest had similar injuries but to the other limb (1.8%). The injured athletes were also classified according to the various stages of the injury reported. This resulted in athletes with acute injuries accounting for 75.9%, sub-acute injuries (5.9%) and chronic injuries (18.2%). Of the athletes who were classified in the non-acute group, 60% of these athletes reported their injuries as re-injuries.

Table 4.6 Mechanisms by which athletes sustained injuries

Mechanism	N	%
Overuse	104	32.5
Stretch	89	27.8
Contact with surface	63	19.7
Torsion/twist	35	10.9
Contact with person	29	9.1
Total	**320**	**100**

4.3.6 Events in which injured athletes participated

The events in which participants were most frequently injured are presented in Table 4.7. The events in which athletes were injured included sprints (31.4%) and middle distance running (18.1%). Fourteen percent of the injured athletes participated in more

than one event. Other athletes reported injuries sustained during hurdles (8.8%) and long jump (8.2%).

4.3.6.1 Sprints

During the sprints a number of athletes reported injuries (n=100). Of the injured athletes, 48% were male and 52% were female. Of these 56% were high school participants and 44% were primary school participants. The athletes who participated in the sprints commonly sustained strain/sprain injuries (24.5%) to the thigh region (53.1%). The mechanism of injury commonly identified amongst these athletes was stretch (50%) and the structure commonly affected was the muscle (75%). Most of these injured athletes were classified as acute (84%) and 83% of the injured athletes had no history of a previous injury.

4.3.6.2 Middle Distance

The sprint event was followed by the 800 to 1500m event which had a participation rate of 18.1% (n=58). The athletes participating in these events reported a strain/sprain injury (60%) as being the most common. The athletes commonly injured the lower leg (29.3%) and the mechanism of injury identified was overuse (53.4%). Most of these athletes reported injuries that were classified as acute injuries (76%) with 21% classified as chronic injuries. Of these athletes, 74 % had no previous history of an injury and 21% had experienced a similar injury less than one month ago.

Table 4.7 General event distribution of injured athletes

Event	Frequency (n=320)	Percent
100 - 400m	100	31
800 - 1500m	58	18.1
More than one event	43	13.5
100 - 400m hurdles	28	8.8
Long jump	26	8.1
High jump	14	4.4
Javelin	14	4.4
Other	12	3.8
Triple jump	7	2.2
3000 - 10 000m	7	2.2
Relay	5	1.6
Shotput	5	1.6
Discus	1	0.3
Pole vaulting	0	
TOTAL	320	

The athletes which participated in more than one event accounted for 13.5% (n=43). Among these athletes the most commonly reported injured region was the thigh (35%) with the most commonly reported injured structure being the muscle (58.1%). In these athletes mechanisms of injury included contact with ground (33%), stretch (30%) and overuse (28%). Of these athletes injured, 58% were classified as having had no previous injury, 26% had a similar injury in the last month and 16% had a similar injury in the last week. Seventy four percent of these injuries were treated as acute injuries whereas twenty three percent were treated as chronic/overuse injuries.

4.3.6.3 Field Events

The number of injured athletes participating in field events accounted for 21.1% (n=67) of the number of injured athletes. Of the injured athletes participating in field events, 44.8% were female (n=30) and 55.5% were male (n=37). These athletes reported injuries sustained to the thigh (22.4%), ankle (20.9%), shoulder (13.4%), knee (10.4%)and the lower leg (7.5%). The most common type of injury reported by the injured athletes was a muscle strain or ligament sprain 65.7%. The athletes reported the contact with the ground (32.8%) and overuse (22.4%) as the common causes of injury.

Table 4.8: Injured athletes in athletic events

Event	All Athletes n=320	Females n= 152	Males n= 168
Sprints/Hurdles (100m-400m)	128 (40%)	61 (40.1%)	67 (39.9%)
Middle Distance 800m - 1500m	58 (18.1%)	31 (20.4%)	27 (16.1%)
Field Events	67 (20.9%)	30 (19.7%)	37 (22%)
Other (relays, long distance, etc.)	67 (20.9%)	30 (19.7%)	37 (22%)

4.4 MONITORING OF ELITE ATHLETES

Of the 20 athletes monitored at the beginning of the athletics season, 15% (n=3) were female and 85% (n=17) were male. The average age of the athletes monitored was 15.45 years (SD = 1.3, range 14-19 years). All of these athletes participated at school level as well as at club level and 35% of them participated at provincial level. The majority of the athletes were sprinters (n=15), followed by middle distance runners (n=5). The overall data collected from athletes at the beginning of the athletics season are reflected in the Table 4.9. Of the 20 athletes monitored, 5 sustained injuries during the athletics season. All of these athletes were male athletes. Of those who sustained injuries, 60% of the injuries occurred during training and 40% of the injuries occurred during competition. The athletes revealed that injuries occurred during training as a result of an increase in training intensity prior to competitions. The most common injury

sustained was muscle strain to the thigh area (80%) and 20% sustained ligamentous injuries to the knee.

Tables 4.10 and 4.11 reflect the profile of the non-injured athletes and injured athletes respectively. In order to identify possible intrinsic factors which could contribute to occurrence of injury, the profiles of the non-injured and injured athletes were compared.

4.4.1 Anthropometric characteristics

There was no statistically significant difference between the injured and non-injured group in terms of age, height, weight and body mass index ($p>0.05$) (Table 4.10 and 4.11).

Biomechanical Features

There was a difference between the injured and uninjured group for the individual biomechanical measurements or lower limb alignment. There was a significant difference between the flexibility of the injured athletes as measured by the sit-and-reach test and those who were not injured ($p>0.05$) as it showed that athletes who sustained injuries were less flexible than those of the non-injured group ($p>0.5$). There was also a difference in the lower limb alignment of the injured versus the non-injured athletes. The Q-angle of the injured athletes was higher than those of the non-injured athletes, however, the difference was not statistically significant ($p>0.05$). The profile of the non-injured athletes also indicated that there was a difference in the explosive power of the lower limbs (v-jump), and also in the upper body strength as tested using

the push ups and sit ups. The injured athletes displayed less power in both upper and lower body strength.

4.5 INFORMATION BOOKLET

Based on discussions with trainers, teachers during the retrospective study and information gathered, certain areas of deficiency were identified. These areas included lack of knowledge regarding recording of injury data, information to prevent injuries and basic injury management. Included in the information booklet was: a basic data capture sheet to record injuries, guidelines for coaches to help educate children about athletics and the ways to prevent injuries, suitable use of equipment (protective equipment and basic equipment), suitability of grounds/facilities, considerations during training sessions and competitions, common injuries that occur in athletics, injury prevention guidelines and basic injury management (appendix V).

Table 4:9 Profile of all elite athletes

Athletes (N=20)			
Age (years):		**V-Jump**	
Mean	15.45	Mean	52.25
SD	1.3	SD	13.9
Minimum	14	Minimum	35
Maximum	19	Maximum	85
Weight (kg):		**P-Up**	
Mean	55.35	Mean	24
SD		SD	7.3
Minimum	44	Minimum	12
Maximum	72	Maximum	37
Height (m):		**S-Up**	
Mean	1.69	Mean	35
SD		SD	13.3
Minimum	1.62	Minimum	22
Maximum	1.84	Maximum	85
BMI ($kg.m^{-2}$)		**Sprint**	
Mean	19.12	Mean	5.46
SD		SD	0.25
Minimum	15.7	Minimum	4.88
Maximum	23.7	Maximum	5.82
Flexibility (cm)		**Q-Angle**	
Mean	28.45	Mean	13.45
SD	6.6	SD	4.8
Minimum	16	Minimum	10
Maximum	43	Maximum	28

Table 4.10 Profile of non-injured athletes (N=15)

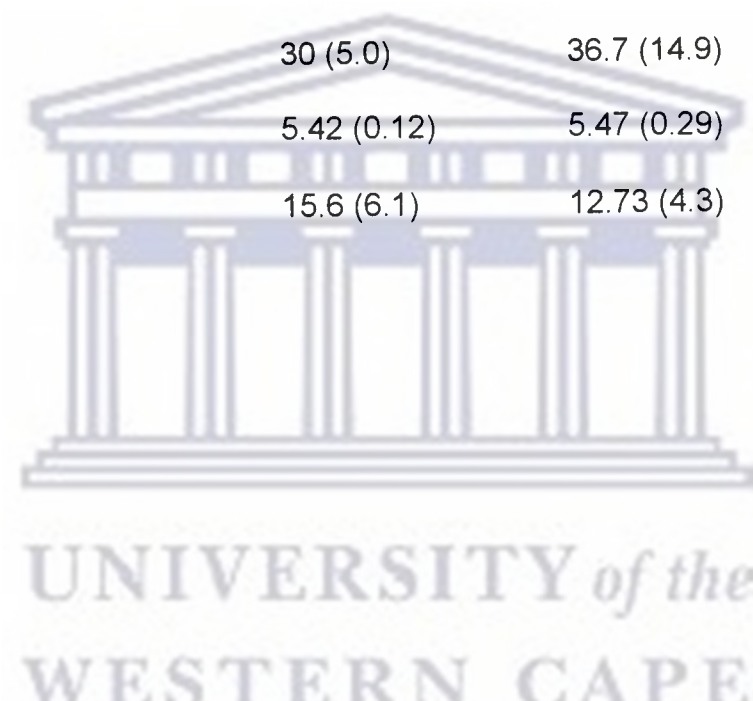
Age (years):		**V-Jump**	
Mean	15.53	Mean	52.87
SD	1.4	SD	14.8
Minimum	14	Minimum	35
Maximum	19	Maximum	85
Weight (kg):		**P-Up**	
Mean	55.35	Mean	24.8
SD		SD	7.2
Minimum	44	Minimum	12
Maximum	72	Maximum	37
Height (m):		**S-Up**	
Mean	1.69	Mean	36.7
SD		SD	14.9
Minimum	1.62	Minimum	22
Maximum	1.84	Maximum	85
BMI ($kg.m^{-2}$)		**Sprint**	
Mean	19.12	Mean	5.47
SD		SD	0.29
Minimum	15.7	Minimum	4.88
Maximum	23.7	Maximum	5.82
Flexibility (cm)		**Q-Angle**	
Mean	30.33	Mean	12.73
SD	5.9	SD	4.3
Minimum	23	Minimum	10
Maximum	43	Maximum	28

Table 4.11 Profile of injured athletes N=(5)

Athletes (N=5)			
Age (years):		**V-Jump**	
Mean	15.2	Mean	50.4
SD	1.3	SD	11.8
Minimum	14	Minimum	40
Maximum	17	Maximum	66
Weight (kg):		**P-Up**	
Mean	55.35	Mean	21.8
SD		SD	7.9
Minimum	44	Minimum	12
Maximum	72	Maximum	32
Height (m):		**S-Up**	
Mean	1.69	Mean	30.00
SD		SD	5.00
Minimum	1.62	Minimum	25
Maximum	1.84	Maximum	37
BMI ($kg.m^{-2}$)		**Sprint**	
Mean	19.12	Mean	5.42
SD		SD	0.12
Minimum	15.7	Minimum	5.28
Maximum	23.7	Maximum	5.56
Flexibility (cm)		**Q-Angle**	
Mean	22.8	Mean	15.6
SD	5.4	SD	6.1
Minimum	16	Minimum	10
Maximum	31	Maximum	26

Table 4.12 Comparison between injured and non injured athletes

	Injured	Non-Injured	P-value
	Mean(sd)	Mean(sd)	
Age (years)	15.2 (1.3)	15.5 (1.3)	0.638
Flexibility (cm)	22.8 (5.4)	30.3 (5.9)	0.0307
V-Jump	52.8 (11.8)	50.4 (14.8)	0.7149
P-up	21.8 (7.9)	24.8 (7.2)	0.4812
S-up	30 (5.0)	36.7 (14.9)	0.1468
Sprints	5.42 (0.12)	5.47 (0.29)	0.5792
Q-Angle	15.6 (6.1)	12.73 (4.3)	0.3727



CHAPTER 5.0

DISCUSSION

5.1 INTRODUCTION

This discussion focuses on some of the issues raised from the results of the study. The results of the study are discussed under the following headings:

- Retrospective study
- Prospective study
- Monitoring of Elite Athletes

5.2 RETROSPECTIVE STUDY

Athletics has been identified as one of the six areas of activity in the national curriculum of physical education in various countries (O'Neill 1992). The beneficial aspects of physical activity has been well documented and far outweighs the cost of injuries which is often considered an inevitable part of exercise (Williams et al 1998). However, a greater understanding of the level of risk to health incurred by sports related injuries is required to inform policy relating to both injury prevention and health promotion, and to further help reduce the health costs associated with sports injuries. It would thus be foolhardy to overlook the impact that sports injuries could have on the participatory rate of athletes in sport.

With this knowledge available, it could be expected of schools to realise the importance of keeping accurate sports injury data in order to assist in the promotion of injury

prevention programs. However, out of 400 schools approached for information, only 95 were able to give accurate information regarding sports injuries occurring at their schools. This indicated that only 25 % of the schools in the Cape Metropolitan Area in the Western Cape kept accurate records. The lack of information at the other 75% of schools poses a serious problem as effective sports injury surveillance programs will not be able to be implemented effectively. The study also revealed that from the 95 schools there was a participatory rate of approximately 27 000 over a four-year period. The current study also revealed that there was a 19% increase in participation over this same period. If this information is extrapolated to include the other 75% of schools in the Cape Metropolitan Area, there could have been a possible 81 000 athletes participating in athletics at schools over the four-year period.

The study further reveals that with the increase in participants, there was a 24% increase in injuries over the same period of time. If this information was extrapolated this could mean that instead of approximately only 2700 injuries reported over the four-year period, there may have been 8100 injuries and this could have led to a higher injury risk ratio. The current study reveals an overall injury risk ratio of 0.1. In comparison to studies such as Beachy et al (1997), the injury risk ratio in this study appears low. The study conducted by Beachy et al (1997) revealed an injury ratio of 0.5 over an eight-year period in a prospective, longitudinal study among students in a private school in the United States.

The above information highlights the problem that poor record keeping and also lack of general awareness of the problem causes. This could be influenced by the lack of knowledge amongst teachers and trainers regarding the importance of accurate record keeping. The need for the development of sports injury surveillance programs at schools highlighting accurate record keeping is highlighted and also educational programs to educate or promote awareness among teachers and trainers at the various schools.

The types of injuries sustained by the athletes in the four year period included muscle strains(38%), sprains (29%), bruises (23%) and other (grazes, fractures). The most common sites of injuries reported were to the lower limb (75%) with the thigh (49%) being the most common region of injury, followed by the ankle (26%). The high percentage of injuries to the lower limb was similar to the study conducted in Australia (Bennell and Crossley 1996). In the Australian study all the injuries sustained were to the lower limb. However, it is important to note that in the Australian the most common site of injury was the leg (calf and shin area), followed by the thigh (22%) and the ankle accounted for (7%) of the injuries. This difference in sites of injury could be due to the fact that in South Africa, factors such as poor training surfaces and poor training shoes may contribute to injuries.

The causes of injuries reported were as a result of stretch injuries (27%), followed by twisting motion injuries to the knee and ankle (27%) and overuse accounted for 10% of the injuries. According to a study by van Mechelen et al (1992), it was stated that most

running injuries are musculo-skeletal injuries associated with overuse, as running involves the constant repetition of the same movements. The causative factors related to musculo-skeletal running injuries can roughly be divided into factors related to runners, factors related to running and factors related to the running environment. It was also suggested that stiffness of the muscles of the lower limb and subsequent lack of range of motion of adjacent joints could be person-related causative factors for musculo-skeletal injuries. Van Mechelen et al (1992) further stated that the hamstring muscle and triceps surae muscle tended to shorten due to the mechanics of running leading to muscle stiffness. This could possibly account for the high incidence of injuries due to stretch.

A study conducted by Barker et al (1997), stated that ankle injuries commonly occur during athletic events. The twisting motion injuries could as a result of various factors. Barker et al (1997) identified extrinsic as well as intrinsic factors that could contribute to these common ankle injuries. The extrinsic factors include shoe type, length of activity and also intensity of the activity (competition vs training), and activity surface (turf, grass, uneven surface). The intrinsic factors which could contribute to twisting motion injuries resulting in ankle injuries include previous ankle injuries, foot type and size, ankle instability, height, weight, lower limb strength, anatomical malalignment and generalised joint laxity. Injuries could be prevented by training on surfaces that are suitable and also training on the same type of surface as used in the competition. Other ways of preventing these ankle injuries include education about complete rehabilitation following an injury.

From the results of the retrospective stage of the study it was clear that information regarding the importance of record keeping in schools was important. The study also revealed that relevant information such as the age of the athlete and information regarding when the injury occurred was not available. Age plays an important role in determining whether growth spurts influenced the type of injuries sustained. The need for the development of sports injury surveillance programs at schools highlighting accurate record keeping is emphasised. Although this was not one of the aims of the study, it was one of the deficiencies identified by the results of the retrospective study. This information would become essential if further accurate studies is to be done in schools with regards to sports injuries. However, the increase in the number of injuries sustained highlights the need for sports injury prevention strategies at schools. In order to develop these sports injury prevention strategies there must be knowledge of the importance of sports injury data and there must be an understanding of the nature, incidence and mechanism of sports injuries that occur at schools.

5.3 PROSPECTIVE STUDY

The prospective study was a community-based study. De Loës (1997) indicated that community-based studies are the least complicated, the reports are current and offer the possibility of easy comparisons with the results of other studies. However, the potential for generalisation exists due to differences in the populations being compared. The need for community-based surveys on the risks of exercise has been documented (Lindqvist et al 1996). This need was further highlighted by the results of the retrospective stage in the current study which raised various relevant concerns.

Maffuli et al (1996) stated that participation by children in competitive sport has become an established feature in modern society. The authors further state that with the large increase in numbers of participants and the increase in time spent in training and competitions has meant that children now present with injuries that were previously seen almost exclusively in adults.

From the results of the prospective stage of the study, it was found that an injury risk ratio of 0.22 existed among athletes participating in selected athletic competitions in the Cape Metropolitan Area during the 1998 and 1999 athletics season. The findings of the prospective study is in keeping with other studies such as D'Souza (1994) which also reported an injury risk ratio of 0.2 during competition and 0.6 during training. It is observed that the injury risk ratio in the prospective study is higher than the injury risk ratio observed in the retrospective study. This indicated that if accurate records were kept at athletic competitions, a true reflection of injury status may be obtained. The discrepancy in injury risk ratios between the retrospective and prospective studies could have been due to lack of knowledge of the importance of accurate record keeping. Another possible reason could have been that during the prospective study the presence of medical assistance at athletic competitions could have contributed to injured athletes seeking immediate medical assistance. The injuries could thus be accurately documented.

The types of injuries reported in the prospective stage of the study were similar to studies by Cunningham and Cunningham (1995),Bennell and Crossley (1996) and

Maffulli et al (1996). Of the injuries reported in the current study, approximately 67% were recorded as ligament sprains and muscle strains, followed by 18% for fractures, ligament tears and shin splints. In the study by Maffulli et al (1996), sprains and strain accounted for 85% of the injuries and fractures, ligament tears etc. accounted for 15% of the injuries. Cunningham and Cunningham (1995) in their study in Australia reported that musculo-tendon injuries accounted for 68% of the injuries reported. As speculated in the Australian study, the possible reasons for the high incidence of musculo-skeletal injuries could be as a result of inadequate warm up prior to events. The high incidence of soft tissue injuries also highlights the need for medical staff who can make an early, accurate diagnosis. It is known that early treatment reduces inflammation, decreases pain and improves range of motion thus enabling the athlete to return to competition as soon as possible (Cunningham and Cunningham 1995). A delay in treatment can result in loss of performance.

The results of the study also revealed that 33% of the injuries reported were due to overuse injuries. Brukner and Khan (1993) defines overuse injuries as chronic tissue inflammation resulting from repetitive microtrauma which overloads the capacity of a tissue to repair itself. Krivickas (1997) reported that approximately half of all sports injuries in both adults and children may be attributed to overuse or repetitive microtrauma rather than to a single traumatic event. There is often various contributing biomechanical and physiological factors. These results were similar to the findings of the study by Bennell and Crossley (1996). In that study it was found that 50% of lower limb injuries reported in sprinters were overuse injuries. In the current study the high

incidence of overuse injuries could be related to the fact that 14% of the athletes participated in more than one event per competition. In some cases events were subdivided into preliminary heats followed by the finals. This meant that athletes not only participated in more than one event but in more than one heat per event. This high incidence of overuse injuries could also be linked to the fact that 18% of the injured athletes reported having had a similar injury less than one month ago and 9% had a similar injury less than two weeks ago.

The most common sites of injuries reported was to the lower limb (75%) with the thigh being the most common area of injury, followed by the ankle. The high percentage of injuries to the lower limb was similar to the study conducted in Australia (Bennell and Crossley 1996). In the Australian study all the injuries sustained were to the lower limb. However, it is important to note that in the Australian study the most common site of injury was the leg (calf and shin area), followed by the thigh (22%) and the ankle accounted for 7% of the injuries. It is significant to note the low incidence of ankle injuries in the Australian study. This difference in sites of injuries and incidence of ankle injuries could be due to the fact that in South Africa extrinsic factors such as incorrect running surfaces, incorrect training methods and incorrect equipment or shoes are frequently present.

Relatively low grade musculo-skeletal injuries were the most frequently reported types of injuries. Most of the injuries could be classified as moderate to mild injuries. However, it is significant to note that approximately 27% of all the injured athletes

participating in the competitions had an injury that had either not been treated effectively, been hidden or had not been allowed enough time to heal effectively. This point is further highlighted by the fact that of the injured athletes that did not sustain an acute injury, 60% had reported re-injuries.

These results highlight the need to emphasise injury prevention and also injury rehabilitation before return to sport. These needs are important as untreated injuries and persistent re-injuries could lead to lifelong disability (Michelli 1994). These factors should be of concern to us in South Africa as the white paper of the Department of Sport and Recreation (1997) has a program which attempts to identify talent at a young age and later mould these athletes into elite athletes for the future. This program will never be implemented fully if young athletes are not educated effectively about injury prevention and current injuries are not treated effectively. A further responsibility is placed on coaches and trainers to acquire the necessary knowledge to be able to identify injuries early and understand the need to prevent athletes from participating with injuries.

The study further highlights that of the athletes injured, 40% of the athletes participated in sprints. According to Cunningham and Cunningham (1995), sprinters require good flexibility and good explosive powers of the lower limbs. Intrinsic factors which could contribute to overuse injuries in athletes include poor flexibility and poor alignment. The study by Cunningham and Cunningham (1995) found that the majority of athletes participated in sprints. They report that it is commonly known that most muscle-tendon

injuries occur as a result of inadequate warm-up prior to an event. This may provide an explanation for the high incidence of muscle strains found in the study. The fact that the lower limb featured prominently is important to note as the lower limbs are important in weight bearing activities as well as for speed and power in athletics. The current study reported that 53% of the athletes sustained injuries to the thigh region. Most of the injuries sustained were acute injuries and could have been as a result of poor flexibility and poor explosive power of the lower limbs. This differs from the study conducted by D'Souza (1994) which indicated that the most commonly injured area in sprinters was the back (30%), and athletes participating in jumps reported the thigh (40%) as being the most commonly injured structure. However, D'Souza did indicate that hamstring injuries in sprinters were commonly reported. This could be due to the explosive and dynamic nature of these events and the fact that these muscles are of importance during high speed running.

According to Macera and Wooten (1994), the physiological mechanisms of injury is predicted by the skeletal immaturity of a young athlete. Injuries differ depending on the age group - pre-puberty, adolescents and post-puberty. Because of the physiological differences of the musculoskeletal system, injuries in adolescents are not the same as those in children. In this study the researcher did not find that the incidence rate of injuries was affected by gender. There was also no clear distinction as to athletes being more prone to injuries at a certain age. This was different to studies conducted by D'Souza (1994) and Bennell et al (1994). These studies reported that the number of injuries increased in the older athlete. According to Van Mechelen (1992), it is possible

that injuries in the early years select out those athletes suited to continuance of training into middle age or that advanced age results in long-term musculoskeletal adaptation to running. By this van Mechelen means that if certain types of injuries are recurrently reported by athletes at a young age, it will help determine whether the athlete is suitable to continue with the sport or if based on the type of injuries his intrinsic factors will always lead to injuries. Alternatively the body will make musculo-skeletal adaptations to prevent further injuries.

5.4 MONITORING OF ELITE ATHLETES

The second stage of the prospective study also revealed that the most common injuries in track and field athletes were musculo-skeletal injuries. Of the athletes injured the injuries sustained were to the lower limb. The lack of upper limb injuries is not unexpected as the athletes were all track athletes. Most of these athletes were sprinters and it was thus not surprising to find the predominant site of injury to be the thigh. This was similar to the findings of Bennell and Crossley (1996) which found that the predominant injury site in sprinters/hurdlers was the thigh with these athletes sustaining significantly more injuries to the hamstring than other athletes. This could probably be due to the explosive and dynamic nature of these events and the fact that this muscle group is of particular importance during high speed running.

Literature indicated that physical build, flexibility and malalignment of the lower limbs, predisposed athletes to injury (Backx et al 1991, Hahn and Foldspang 1997, Neely 1998). However, the study by Bennell and Crossley (1996)conducted in Australia

indicated that the Australian athletes who were injured had greater overall flexibility. In the current study, the injured athletes were less flexible according to the sit-and-reach-test and this was statistically significant, however, the injured athletes also had a lower explosive power of the lower limbs and a lower endurance and strength for the upper body in comparison to the uninjured athletes, but the differences were not statistically significant.

It is therefore difficult to draw conclusions as to the impact that the anthropometric and biomechanical parameters had on the injuries sustained by athletes. Further research is needed to determine the factors which influenced or predisposed athletes to injury. This was similar to the findings of Hahn and Foldspang (1997) which stated the use of the Q-angle measurements to determine its association with sports injuries is questionable. Knapik et al (1992) concluded from their study that there are few well conducted studies examining relationships between strength, flexibility and athletic injuries.

Researchers should bear in mind that residual effects of prior injuries may be the cause of both strength and flexibility imbalances and causes of current injuries. Severe or past injuries may lead to structural weaknesses that predispose to injury. Taimela et al (1990) stated that previous injuries may not necessarily cause repetitive injury if treated adequately, but athletes may be at higher risk of injury due to injury prone biological characteristics.

5.5 BENEFITS OF THE INFORMATION BOOKLET

According to Backx (1991), in order to reduce the incidence and severity of sports injuries in school-aged children, an educational program for intervention should be constructed to improve knowledge and attitude with regard to injury prevention. Prevention in general is divided into three levels namely: primary prevention, secondary prevention and tertiary prevention (Van Londen 1990). Primary prevention is aimed at reducing the incidence of disease and other departures from good health; secondary prevention is aimed at reducing the prevalence of the disease by reducing the severity of the disease by early detection; and tertiary prevention is aimed at reducing the complications that may develop as a result of the disease.

If one translates these levels of prevention into levels concerning sports injuries it would entail the following: primary prevention will aim at preventing the occurrence of sports injuries; secondary prevention will aim at reducing the severity of the sports injury or preventing irreversible structural damage; and tertiary prevention will aim at implementing all relevant measures to eliminate or reduce long term impairments and disabilities. As examples of primary prevention the following information should be included: importance of warming up, stretching exercise and cooling down; ensuring a safe environment; protective equipment or appropriate equipment and adaptation of rules and regulations.

Taimela et al (1990) suggested strategies to reduce injury rates and these included:

- informing sports participants of injury risk factors through various publicity campaigns

- improving the knowledge of coaches, physical education teachers and others supervising training programs
- influencing legislation and safety rules for sports

The information booklet designed in this study was based on the results of the current study. It is hoped that with increased knowledge the coaches/teachers will start playing an active role in the prevention of athletic-related injuries. In countries such as Australia, safety guidelines for children have received national focus and importance and one of their principles is 'Prevention of injury is better than cure' (Sports Medicine Australia, 1997). Based on the results of this study it is evident that there is thus a need to promote safer sport practices in our communities and schools. This will help prevent injuries as most of the injuries sustained in the study could be prevented.

The researcher realises that with any sport there is a risk of injury but it is the intention of the researcher to create a more positive sporting experience for the children and thus through this positive attitude hope that the children will continue to be active into adulthood. The researcher also hopes that the booklet will empower the coaches/teachers with additional knowledge and thus ensure that at schools a positive attitude towards sport is created.

CHAPTER 6.0

SUMMARY, CONCLUSION , RECOMMENDATIONS and LIMITATIONS

6.1 SUMMARY

The main objective of the study was to initiate the development of a data bank on athletic sports –related injuries using the information obtained from the study. The specific aims of the study was to determine the prevalence and incidence of sports-related injuries among school children taking part in athletics at both high and primary school levels. The study further investigated the nature, extent and severity of sports-related injuries among school children, the mechanism of occurrence of the sports-related injuries and to identify intrinsic risk factors that could lead to injury.

The study was divided into two parts namely a retrospective and a prospective study. The retrospective study attempted to determine if injuries did occur during athletics at schools and whether data of injuries was kept at schools. The study revealed that no accurate data concerning sports injuries in school athletics was kept. This highlighted the need to introduce appropriate injury surveillance systems at schools in order to ensure that accurate data will be kept in order to conduct valuable future research regarding sports injuries at schools. The injury risk ratio revealed by the retrospective study was low but this could have been due to the poor data keeping at schools. Hence the first most important finding of the study was that injury records are not kept.

The results for the prospective study was collected at various competitive athletic events for primary and high schools. Medical services in the form of physiotherapy services was offered at the various athletic competitions. The results revealed that the injury risk ratio was higher than that revealed during the retrospective study. The higher injury risk ratio could have been due to the fact that medical services was available at the chosen competitions and athletes was aware of the service available to them. Another reason could be the level of competition. The study revealed that a high percentage of musculo-skeletal injuries were sustained and with appropriate early management the impact of the injury on the athlete could be reduced. The types of injuries sustained and the mechanism of the injury sustained gave rise to concerns that possible intrinsic factors such as height, weight, lower limb alignment and lower limb strength could be predisposing factors to athletic injuries. Hence the second important conclusion was increase in the injury incidence in comparison to the retrospective study.

The second part of the prospective study was the monitoring of twenty elite athletes from the beginning of an athletics season to the end. The athletes were tested for various factors that could contribute to injuries e.g. Q-angle, flexibility and explosive power of lower limbs at the beginning of the athletics season. During the season they were monitored for any injuries. A large percentage of the injuries reported occurred during training as they increased their training intensity prior to competitions. The third most important finding was the high incidence (25%) of injury amongst elite athletes and this highlighted the need for special medical attention at these events.

Based on the findings of the study, a sports injury prevention guideline booklet was designed for school coaches and teachers to assist in minimising injuries during athletics at schools. The booklet highlighted the types of injuries sustained by athletes participating in athletics, predisposing factors to these injuries and recommendations to prevent the injuries from occurring.

6.2 CONCLUSION

Although the study was able to highlight the incidence of injuries in athletics at schools, the nature and type of injuries and the mechanisms of the injuries, there still exists a great need to introduce sport injury surveillance system at schools in order to be able to obtain accurate information from all schools regarding sports injuries. Most of the injuries sustained are musculo-skeletal injuries that could be treated effectively and quickly if monitored correctly. This would thus enable the athlete to return to the sport as soon as possible thus minimising the cost that the injury have on the athlete.

The management and prevention of the injuries would be easier if athletes, teachers and coaches had a better understanding of the types of injuries that occur and why they occur. This again highlights the need to educate schools about injury surveillance systems and how to utilise these surveillance systems to produce good and better athletes by reducing the number and type of injuries that the athlete sustain. In educating the athlete from a young age, the identification process of talented athletes by the government will be facilitated as the athletes will progress to an elite level and not be lost due to persistent or recurrent injuries due to lack of knowledge.

6.3 RECOMMENDATIONS

Based on the findings of this study, the following short term and long term recommendations can be made:

Short term:

1. A large number of schools in the study did not keep data regarding sports injuries. Educational programs addressing the importance of keeping accurate data regarding sports injuries and how it would assist the sports program of the school should be held at schools.

2. Community based sports injury and prevention programs should be introduced and this may have a positive effect on the adoption of sports injury prevention programs at schools.

3. Schools need to be linked to institutes such as the Sports Science Institute of South Africa so that all data can be centralised at one point and access to this data is then facilitated to introduce prevention programs.

Long term:

4. Further research needs to be carried out regarding all sports injuries at schools to have a holistic picture of the incidence of sports injuries at primary and high schools. This knowledge would help in the development of sports injury prevention programs relevant to schools.

5. Further research is needed to be able to accurately assess predisposing factors for sports injuries.

6. Additional research is also needed to evaluate the effect of the sports injury prevention guidelines booklet in order to see its effectiveness and whether a booklet for all sporting codes would be suitable.

6.4 LIMITATIONS OF THE STUDY

1. The fact that only a small number of schools was able to supply information regarding sports injuries during the retrospective study. This factor could affect the findings of the results as the researcher needed to postulate as to what could have been if more schools had relevant data.

2. The researcher has no idea as to the accuracy of the data provided by schools during the retrospective study.

3. The questionnaire used in the retrospective study would have been more valuable if the schools were able to supply information such as age of the injured athlete as well as whether the injuries occurred during training or competition.

4. Data obtained during the retrospective study was not cross-validated.

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Appendix 1

The Principal

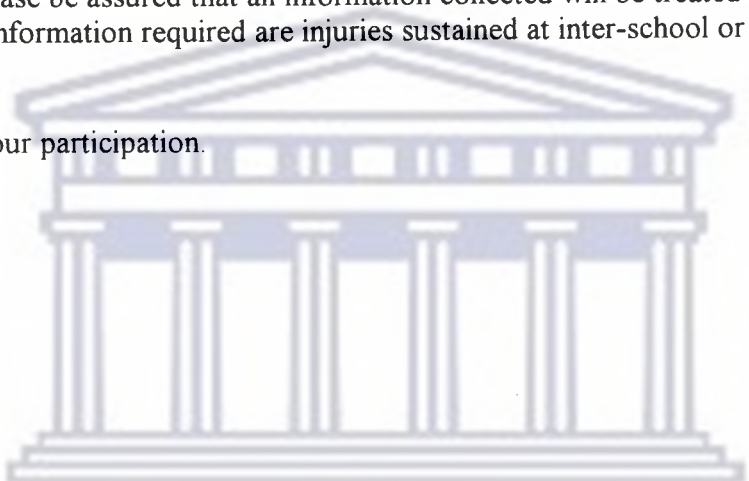
I am a graduate from and presently a lecturer at the University of the Western Cape, Physiotherapy Department. I am currently studying towards a Masters degree and the study I am doing is to determine the prevalence and incidence of athletic sports related injuries in high and primary school children.

Please give me a few minutes of your valuable time in order to complete the attached questionnaire. Please be assured that all information collected will be treated in confidence. The information required are injuries sustained at inter-school or inter-house athletic meetings.

Thank You for your participation.

Yours Sincerely

Jose Frantz



Appendix 11

The Athlete

I am a graduate from and presently a lecturer at the University of the Western Cape, Physiotherapy Department. I am currently studying towards a Masters degree and the study I am doing is to determine the prevalence and incidence of athletic sports related injuries in high and primary school children.

Please give me a few minutes of your valuable time in order to complete the attached data capture sheet regarding your injuries. Please be assured that all information collected will be treated in confidence.

Thank you for your participation.

Yours Sincerely

Jose Frantz

Appendix 3

QUESTIONNAIRE:

1.

SCHOOL	

2. Number of school children participating in athletics:

1995		1996		1997		1998	
Male	Female	Male	Female	Male	Female	Male	Female

3. Number of school children who sustained sports-related injuries:

1995		1996		1997		1998	
Male	Female	Male	Female	Male	Female	Male	Female

4. Types of injuries sustained:

TYPE	1995	1996	1997	1998
Fractures				
Dislocations				
Muscle Strains				
Sprains				
Bruises				
Contusions				

Appendix 3contd.

5. Causes of injuries:

CAUSES	1995	1996	1997	1998
Mis-step / Twisting				
Falling				
Opponent				
Overuse				
Unknown				

6. Identify three of the most common locations of injury e.g. ankle, thigh, shoulder etc.

SITES	1995	1996	1997	1998

Appendix . : **DATA CAPTURE SHEET**

School:	Age:	Gender: M / F
Weight:	Height:	Body Mass Index:

Sport Type:

☐ 1. Athletics Track ☐ 3. Both
☐ 2. Athletics Field

Event:

☐ 1. 100 - 400m	☐ 2. 100- 400m hurdles	☐ 3. Long Jump
☐ 4. 800 - 1500m	☐ 5. 3 000 - 10 000m	☐ 6. Relay
☐ 7. Triple Jump	☐ 8. High Jump	☐ 9. Pole Vaulting
☐ 10. Discus	☐ 11. Shotput	☐ 12. Javelin
☐ 13. Other	☐ 14. More Than One	

SIDE: ☐ 1. Left-side ☐ 2. Right-side ☐ 3. Both sides
DOMINANCY: ☐ 1. Dominant ☐ 2. Non-dominant

Anatomic location/Region of injury:

☐ 1. Head	☐ 2. Face	☐ 3. Neck	☐ 4. Spine
☐ 5. Trunk	☐ 6. Shoulder	☐ 7. Upper Arm	☐ 8. Elbow
☐ 9. Forearm	☐ 10. Wrist	☐ 11. Hand	☐12. Finger
☐ 13. Pelvis	☐ 14. Groin	☐ 15. Hip	☐16. Thigh
☐ 17. Knee	☐ 18. Lower Leg	☐19. Foot	☐ 20. Toe
☐ 21. Ankle	☐ 22. Other	☐ 23. More Than One	

Primary injured structure:

☐ 1. Bone	☐ 2. Joint	☐ 3. Muscle	☐ 4. Ligament
☐ 5. Tendon	☐ 6. Other	☐ 7. More than one	

Mechanism of injury:

☐ 1. Contact/person	☐ 2. Contact/surface	☐ 3. Stretch
☐ 4. Overuse	☐ 5. Torsion/twist	☐ 6. Other

Relevant History:

☐ 1. No previous injury	☐ 2. Similar inj < 2wks ago	☐ 3. Similar inj > 2wks ago
☐ 4. Other injury same limb	☐ 5. Other injury opp. limb	☐ 6.Other

Classification of injury:

☐ 1. Acute/< 36hrs ☐ 2. Sub-acute ☐ 3. Chronic/overuse

Main problem on assessment:

☐ 1. Pain	☐ 2. Swelling	☐ 3. Weakness	☐ 4. Decreased ROM
☐ 5. Instability	☐ 6. Neuro impairment	☐ 7. Sensory loss	☐ 8. Muscle stiffness
☐ 9. Other	☐ 10. More than one		

Type of injury:

☐ 1. Strain/sprain	☐ 2. Rupture	☐ 3. Dislocation	☐ 4. Subluxation
☐ 5. Effusion	☐ 6. Haemarthrosis	☐ 7. Fracture	☐ 8. Graze
☐ 9. Haematoma	☐ 10. Nerve compression	☐ 11. Ligament tear	
☐ 12 Other			

Physiotherapy action:

☐ Ice	☐ Compression	☐ Elevation	☐ Heat
☐ Ultrasound	☐ TENS	☐ Interferential	☐ Massage
☐ Joint mobs	☐ Deep frictions	☐ Soft tissue stretch	☐ Strapping
☐ Advice	☐ Referral	☐ Other	

1. Soft tissue treatment
2. Joint treatment
3. Other

Advice:

☐ Rest/no sport activity	☐ Limited sport activity	☐ Full sport activity

Return to sport:

☐ Immediately after treatment	☐ Later on same day	☐ Next day

Appendix 5:

INFORMATION BOOKLET

FOR ATHLETIC COACHES

AND TRAINERS

Guidelines for Children and Coaches in Athletics

1. GUIDELINES FOR CHILDREN AND COACHES IN ATHLETICS

" Prevention of injury is better than cure". There continues to be a need to promote safer sport practices within our communities and schools. Many injuries sustained during sport can be prevented. The following guidelines provide information relevant to athletics, to provide a safer and more enjoyable experience when participating in the sport.

All people involved in children's sport should be aware of techniques to prevent injuries. Children play sport to have fun, make new friends, play the game and learn new skills. Everyone involved in children's sports must remember that children are not 'little adults'. Children should not be expected to perform as adults do nor perform under the same conditions as adults do.

2. SUMMARY OF THE STUDY

In a study conducted among schools in the Cape Metropolitan Area of the Western Cape it was found that:

- ► schools do not keep accurate data of injuries sustained by athletes

- ► a high incidence of injury exists among children participating in athletics

3. INFORMATION FOR COACHES AND TEACHERS

Coaches and teachers educate children in the fundamentals and various techniques of sport.

Coaches should:

- remember that irrespective of the level of involvement, children are involved for the fun and enjoyment.
- be aware of the of the principles of children's growth and development
- encourage the development of skills relative to the child's age
- promote the benefits of fitness and an active lifestyle
- be reasonable in the demands on young athlete's time, energy and enthusiasm
- show concern towards injured players and seek medical advice when needed
- not allow injured players to compete or train
- be aware of potential hazards in the sport
- take into consideration the child when scheduling the length of practice times and competitions

3.1 Training Sessions to Help Prevent Injuries

Training sessions should be planned in advance, well structured and contain the following points. These points will assist you in preventing injuries in your sport:

- Warm up
- Stretch
- Skills practice
- Activity/Fitness
- Cool down (include stretching)

All sessions should be designed to:

- be fun
- allow children to learn
- vary to ensure an interesting programme
- suit the players age and maturity level
- challenge children
- be flexible to deal with the available facilities and environmental conditions

A: **Warm Up**

Aims to:
1. prepare the mind and body
2. Increase body temperature
3. Increase heart rate
4. Increase breathing rate

The warm up should include activities that have the same movement patterns as the activities to be performed during the session. The warm up must begin at a low intensity and gradually build in intensity to the level required in the competition/session.

The warm up usually takes approximately 5-10min however you need to consider the environment when planning this. For example if the temperature is cold the warm up should be longer than usual.

The warm up should be continuous and lead into the training session. The stretching activities should be interspersed throughout the warm up. Warm up, stretching and cool down programs should be closely supervised.

B. **Stretching**

Stretching is important for both training and competition as it reduces the chance of injury. Without stretching, muscles lose flexibility and may not respond properly when being used and injury may result.

Stretching activities should be included in the overall warm up and involve all muscle groups that will be used in the activities to come. The stretching activities should move the muscles through the full range of movement to be performed.

To ensure safety:

1. Warm up prior to stretching
2. Stretch before and after exercise
3. Stretch all muscle groups that will be involved in the activities
4. Stretch gently and slowly
5. Encourage static stretching
6. Never bounce or stretch rapidly
7. Stretch to the point of tension or discomfort but never pain
8. Do not hold your breath when stretching

C: **Skills Practice**

The higher the level of skill the lower the rate of injury. It is important in children's sport that a high level of skill is attained in order to prevent injury now and while playing the sport later in life.

D. Activity/Fitness

This session of the training program is as important as the rest. This session lasts for about 20 - 40 minutes. This session should include aerobic training, strength training and flexibility training. Poor flexibility can be a cause of overuse injuries and imbalance

between muscle strength and flexibility may result in muscle or joint injury. This session should also aim to improve the child's fitness level. Many injuries occur late in the game, competition or training session due to fatigue. This means that a good level of fitness for a particular sport is of the utmost importance. This is especially important with athletes returning from injury. Weight training as part of the strength training program should not be introduced into a training program until the athlete is 15 years of age.

E. Cool Down

At the completion of every training session, players should complete a cool down routine consisting of:

- activity of significantly reduced intensity, such as 3-5 minutes of easy jogging or walking
- 5 minutes of gentle stretching exercises

The cool down helps to overcome muscle soreness and stiffness. Stretching after activity helps to ensure maximum flexibility, relax the muscle, return them to their resting length and helps to develop long term attitudes to maintaining healthy lifestyles.

3.2 Competitions

- In order to reduce the risk of injury, it is important to keep competitions balanced.
- Consideration should be given to age, sex, strength, skill and psychological maturity of the athlete.

4. INJURY MANAGEMENT

The most common injuries are muscle strains, joint and ligament sprains, contusions and bruises. Although these injuries are classified as minor injuries, inadequate or inappropriate first aid may aggravate the injury or cause an increase in the time necessary before returning to play. If an injury should occur, it is important to prevent further injury. The following rules should be followed if an injury does occur:

1. Prevent further Injury:

   a) *Minor Injury* (an injury which does not impair performance)

   - e.g. bumps, bruises
   - athlete may play on
   - monitor such injuries
   - use the RICER principle to manage these injuries

   b) *Less Severe Injuries* e.g. soft tissue injuries such as sprains, strains and muscle bruises. The first 48hrs are vital in the effective management of soft tissue injuries. The immediate management should include the RICER regime.

   Rest - immobilise the affected area and allow patient to lie down

   Ice - apply ice for 20 minutes every 2 hours for the first 48 hours. The ice helps to decrease swelling, pain, muscle spasm and prevents further damage to the injured area. It is important not to apply ice directly to the skin as it could cause an ice burn. The conventional methods are: crushed ice in a plastic bag/towel or even cold water from the tap.

   Compression - apply a large bandage over the injured area. This helps to reduce swelling and bleeding. It also provides support for the injured part.

   Elevation - raise the injured area above the level of the heart at all times. The

elevation helps to reduce bleeding, swelling and pain.

Referral - refer the patient to a suitably qualified professional in order ascertain a definite diagnosis and proper treatment.

c) *Severe Injuries* such as suspected head, facial, spinal, chest, abdominal injuries or fractures.

- get help
- do not move the athlete unless absolutely necessary
- immobilise and support injured site
- comfort athlete until professional help arrives

Managing existing injuries properly is important. Returning to sport too early after injury can make the child susceptible to further injury. The coach should ensure that the risk of recurrence of injury is reduced by requesting that the child has a doctor or physiotherapist's clearance to play. If this is not possible, the coach should make sure that the athlete is able to answer the following questions:

1. Do you still experience pain in the injured are?
2. Can you do movements without pain and is it the same as the other side?
3. Has the injured area regained its full strength, compare to the other side?

5. RESOURCES AVAILABLE

Further information can be obtained from:

1. Mrs Jose Frantz
   Department of Physiotherapy
   University of the Western Cape
   Private Bag X17
   Bellville
   7535
   Tel: 9592542
   Fax: 9592804
   E-mail: jfrantz@uwc.ac.za

2. Mr Wayne Weitz
   Outreach and Development (Mobile Unit)
   Sports Science Institute of South Africa
   Newlands
   7800
   Tel: 6866968
   Fax: 6866969

6. SAMPLE OF INFORMATION FOR AN INJURY DATA CAPTURE SHEET

AGE:

GENDER:

GRADE:

ATHLETIC EVENT: sprints

LEVEL OF COMPETITION: e.g.schools/provincial

TYPE OF INJURY: e.g.ligament sprain/ bruise

BODY PART INJURED: e.g. thigh muscle

TREATMENT GIVEN: e.g referred to doctor/ ice/ immobilised