THE EPIDEMIOLOGY OF, AND RISK FACTORS TO SOCCER RELATED INJURIES AMONG MALE HIGH SCHOOL STUDENT SOCCER PLAYERS IN KIGALI, RWANDA.

By

J. Bosco NSHIMIYIMANA

Student Number: 2974977

A full thesis submitted in partial fulfilment for the degree of Master Scientiae Physiotherapy in the Faculty of Community and Health Sciences, Department of Physiotherapy University of the Western Cape.

June 2011

Supervisor: Prof. José M. FRANTZ
KEY WORDS

EPIDEMIOLOGY
RISK FACTORS
SOCCER
INJURY
HIGH SCHOOL
STUDENTS
RWANDA
Abstract

Soccer is the most popular sport in the world with 270 million active soccer players. Among all sports, soccer causes many injuries in high school players. Soccer injuries are due to the influence of intrinsic risk factors like age, the immature musculoskeletal system, previous injuries, overuse injuries, inadequate rehabilitation, aerobic fitness, body size, limb dominance, flexibility, muscle strength, muscle imbalance and reaction time, level of competition, skill level and extrinsic risk factors like use of protective equipment, playing surface and shoes type. Information on soccer injuries can help in preparing proper preventing programs in high schools. Despite the importance in providing enough information, no study has been done on soccer related injuries in Rwandan high schools. The aim of this study was to determine the epidemiology of, and risk factors to soccer related injuries among male high school student soccer players in Kigali, Rwanda. A cross-sectional retrospective quantitative study design using quantitative method is used. Among 30 high schools identified in Kigali only 12 had male soccer teams. All 12 teams participated in this study with 336 soccer players. A self-administered questionnaire using closed-ended questions was used. SPSS software program 19.0 version was used for data analysis. Descriptive statistics were used to analyze the data. Inferential statistics such as cross-tabulations were used to test for significant risk factors contributing to injuries. Chi-square test was used to test for significant relationship between risk factors and injuries at level of significance p-value<0.05. Permission and ethical clearance was requested from Senate Research Grant and Study Leave Committee (UWC) and the Ministry of Education. Informed consent were signed by participants and the parents of those who were under 18 years. Participation was voluntary and participants could withdraw from the study at any time.
The injury prevalence was high during matches (77.5%) compared to training (32.5%). The ankle was the most affected joint (26.6%). Defenders were the most affected players (22.6%). The majority of injuries were the result of collision (24.2%).

The majority of participants did not perform warming-up and cooling-down exercise during training (71.2%) and during matches (56.3%). Most of participants did not wear protective equipment (61.6%). Of those who did, only 7% wore it always. A significant number of injuries occurred because no protective equipment was worn. Only 33.7% soccer players received professional injury management. Of the 33.7% that received professional management, only 39% were medically cleared to return to play. The results of the study confirm that many Rwandan high school soccer players sustain more injuries during match sessions. The poor performance of warm-up and cooling-down, starting age, surface condition and not using protective equipment are significant risk factors for injury in male soccer players in high school. The study highlighted the need to start prevention efforts at club level in order to curtail the high injury prevalence at provincial and national levels.
DECLARATION

I declare that “The epidemiology of, and risk factors to soccer related injuries among male high school soccer players in Kigali, Rwanda” is my own work, that has not been submitted for any degree for examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged by means of complete references.

J.Bosco Nshimiyimana

Signature…………………………………….. May 2011

Witness

...........................................

Professor José M. Frantz
DEDICATION

To my mother Asterie Nyirahabimana and my father Jean Baptiste Komeza.
To my beloved wife Yvonne Murebwayire and children Oren B. Iradukunda and Boris S. Mugisha. To my sisters and brothers.
ACKNOWLEDGMENT

• Firstly, I would like to acknowledge my Lord Jesus Christ, whose grace and mercy carried me through. I find myself in awe because with God nothing is impossible.

• I highly recognize and appreciate the contribution extended to me by:
  
  • The Government of Rwanda, through the Ministry of Education and the Ministry of Health for granting me a scholarship for further studies.
  
  • My supervisor, Prof. José M. Frantz for her guidance and pertinent research advices.
  
  • Prof. Richard Madsen and Mr. Innocent Karangwa for their guidance and input with the statistical analysis.
  
  • My gratitude to Mr. J. Damascène Niyonsenga, Bernardin Umuvandimwe, Eric Abizeyimana and Francis Nshimiyimana for their support, advice and encouragement.
  
  • To my beloved wife Yvonne Murebwayire and my children Oren B. Irankunda and Boris S. Mugisha. I appreciate your encouragement and patience.
  
  • To my sisters Agnes Mukabirasa, Ester Uwimana and Jacqueline Mukandayambaje, my brothers J. Claude Komeza, Emmanuel Ndagijimana and Augustin Ndayishimiye.
  
  • To my colleagues for your support and advice.
  
  • To my friends and family..... Words seem inadequate to express my feelings of appreciation for many years of support, encouragement and prayers. Thanks for your unwavering love.
  
  • Lastly, but not leastly to all sport educators and soccer players of high schools that participated in this study. I appreciated your contribution.
# Table of Contents

Title page.......................................................................................................................................................I

Key Words.......................................................................................................................................................II

Abstract.......................................................................................................................................................III

Declaration...................................................................................................................................................V

Dedication...................................................................................................................................................VI

Acknowledgement.....................................................................................................................................VII

Table of contents......................................................................................................................................VIII

Appendices.................................................................................................................................................IX

List of figures..............................................................................................................................................XIII

List of tables..............................................................................................................................................XIV

Abbreviation..............................................................................................................................................XV

1 CHAPTER ONE ....................................................................................................................................... 1

1.1 INTRODUCTION TO THE CHAPTER ................................................................................................. 1

1.2 BACKGROUND TO THE STUDY....................................................................................................... 1

1.3 PROBLEM STATEMENT .................................................................................................................. 7

1.4 THE AIM OF THE STUDY ................................................................................................................ 8

1.5 OBJECTIVES ................................................................................................................................... 8

1.6 SIGNIFICANCE OF THE STUDY ..................................................................................................... 8

1.7 DEFINITION OF THE KEY TERMS USED .......................................................................................... 9

1.8 SUMMARY OF CHAPTERS ............................................................................................................ 10

2 CHAPTER TWO .................................................................................................................................... 13

2.1 INTRODUCTION ........................................................................................................................... 13

2.2 THE ROLE OF SPORT AND THE BENEFITS OF PARTICIPATION..................................................... 13

2.3 SOCCER AND THE PREVALENCE OF INJURIES AMONG YOUTHS ................................................. 15

2.4 TYPES, LOCATION, MECHANISMS AND SEVERITY OF SOCCER INJURIES.............................. 17
APPENDICES

APPENDIX A Permission letter from UWC
APPENDIX B Permission letter from Ministry of Education
APPENDIX C A request to carry out a study (MINEDUC)
APPENDIX D A Request to participate in the study (Soccer player)
APPENDIX E A request to participate in the study (Parent/guardian)
APPENDIX F Parent/guardian information sheet (In English)
APPENDIX G Player information sheet (In English)
APPENDIX H Parent/guardian information sheet (In Kinyarwanda)
APPENDIX I Player information sheet (In Kinyarwanda)
APPENDIX J Parent/guardian consent form (In English)
APPENDIX K Player consent form (In English)
APPENDIX L Parent/guardian consent form (In Kinyarwanda)
APPENDIX M Player consent form (In Kinyarwanda)
APPENDIX N Questionnaire for soccer players (In English)
APPENDIX O Questionnaire for soccer players (In Kinyarwanda)
LIST OF FIGURES

Figure 2.1: The components of Complex interaction between intrinsic and extrinsic risk factors leading to an inciting event and resulting in injury 26
LIST OF TABLES

Table 2.1: Potential risk factor for injury in soccer 25
Table 4.1: The percentage distribution of socio-demographic characteristics 53
Table 4.2: Frequency distribution of injury prevalence 54
Table 4.3: Distribution of injury prevalence according to age, weight, height and starting age 56
Table 4.4: Distribution of injury prevalence and player position 57
Table 4.5: Location of injuries to different body parts 58
Table 4.6: Frequency distribution of location of injuries and player position 59
Table 4.7: Distribution of mechanism of injuries 60
Table 4.8: Injury characteristics 61
Table 4.9: Severity of soccer injuries 62
Table 4.10: Use of protective equipment 63
Table 4.11: The frequency distribution of use of protective equipment 64
Table 4.12: Frequency distribution of surfaces of play and injury occurrence 64
Table 4.13: Frequency distribution of surface condition 64
Table 4.14: The training and match surfaces when the injury contrasted 65
Table 4.15: Participants who received injury professional management and medical clearance to return to play 66
Table 4.16: Technique used to minimize soccer injuries and injury prevalence 68
Table 4.17: Frequency distribution of number of playing sessions per week and injury occurrence 69
Table 4.18: Frequency distribution of use of recovery protocol 70
Table 4.19: Intrinsic risk factors associated with injury occurrence 72
### Abbreviation

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAP</td>
<td>American Academy of Pediatrics</td>
</tr>
<tr>
<td>FIFA</td>
<td>Federation of International Football Association</td>
</tr>
<tr>
<td>MINEDUC</td>
<td>Ministry of Education</td>
</tr>
<tr>
<td>RICE</td>
<td>Rest, Ice, Compression, Elevation</td>
</tr>
<tr>
<td>PRICE</td>
<td>Protection, Rest, Ice, Compression, Elevation</td>
</tr>
<tr>
<td>RSSF</td>
<td>Rwanda School Sport Federation</td>
</tr>
<tr>
<td>UNICEF</td>
<td>United Nations International Children’s Emergency Fund</td>
</tr>
<tr>
<td>SD</td>
<td>Standard Deviation</td>
</tr>
<tr>
<td>KHI</td>
<td>Kigali Health Institute</td>
</tr>
</tbody>
</table>
CHAPTER ONE
INTRODUCTION

1.1 INTRODUCTION TO THE CHAPTER
This chapter presents the background of the present study which is about “the epidemiology of, and risk factors to soccer related injuries among male high school soccer players in Kigal, Rwanda” The chapter also contains the statement of the problem, aim of the study, objectives of the study, significance of the study as well as a definition of terms used in the study. The chapter ends with the summary of other chapters of the thesis.

1.2 BACKGROUND TO THE STUDY
In the pre-Christian era, the development of sport was used as a technique of preparing young people for war. Now the motivation of participating in sports in modern day is very different (FIFA, 2011; McIntosh, 1976). According to FIFA (2011), McIntosh (1976) at the end of 19th century the momentum of the sport movement has been increased by the founder of the modern Olympic Games, Pierre De Coubertin. Thus, it resulted in sport participation of more and more people today, whether for professional reasons or for recreation. Therefore, sport is no longer just a recreational phenomenon but a significant part of community life (Williams, 1979; Bergon, 2007). McEntere (2011) mentioned that through sport participation, people meet within a defined and controlled situation, thus allowing them to get to know each other. In addition soccer is a great way to build endurance, improve speed and maintain fitness while enjoying the camaraderie of a team sport.
Global data highlights soccer to be the most popular sport in the world with 270 million active soccer players. The total number of soccer players has increased by 10% over a 6 year period (FIFA big count, 2006). Interest and participation in soccer continues to grow in every part of the globe (Canadian Soccer Association, 2003; Leininger, Knox & Comstock, 2007; Yoon, Chai & Shin, 2004). According to Howard and Gillis (2009) soccer is the most popular sport in high school. In the United States there were about 15.5 million players engaged in soccer of which 3.2 million were registered in high school (National Sport Good Association, 2008). Reilly and Cabli (2005) acknowledged that the most popular sport in England is soccer with 1.75 million soccer players registered in high school. FIFA's big count (2006) report stated that there were 46 million soccer players in Africa. Soccer is accessible almost everywhere in Africa and can be played by almost any healthy young person (Junge & Dvorak, 2004). The authors explained that the rules of soccer are the same no matter where it is played and the pattern of play does not differ. In African high schools, soccer is the most popular sport (Giovanni, 2006). According to Oliphant (2001), 54% of school going adolescents, registered soccer as their sport of choice in South Africa. FIFA (2011) reported that the number of people participating in soccer has increased in Rwanda. Although limited data on high school soccer players in Rwanda is available, the number of participants in soccer is estimated to be high, because most of the high schools in Rwanda have soccer teams. Most of these teams participate in high school tournaments as well as in international competitions (MINEDUC Rwanda, 2008). In addition the government of Rwanda through the Ministry of Education (MINEDUC) in collaboration with UNICEF has significantly increased its involvement in high school sports, e.g. the creation of
Rwandan School Sports Federation (RSSF). The Rwandan School Sports Federation was sponsored by the government for organizing school tournaments some years back which strengthened the participation of high school students in sport activities. Soccer became the fastest growing team sport in high schools (UNICEF, 2006).

As soccer participation increases, so does the risk of injury to players, both at the competitive and recreational level (Junge & Dvorak, 2004). High school soccer players are skeletally immature and when participating in sport, are susceptible to a range of hard and soft tissue injuries (Frank, Jarit, Bravman & Rosen, 2007). Spinks and McClure (2007) highlighted the increase of injury incidence among soccer players in schools. In a study by Spinks and McClure (2007), it was found that the injury rate was as high as 51.2 injuries per 100 players per season in the 11 to 14 year old age group. McGrath and Ozanne-Smith (1997) acknowledged that soccer is characterized as a vigorous, high intensity, intermittent ball and contact sport. The author further mentioned that the characteristics of soccer, along with the required functional activities, place great demands on the technical and physical skills of the individual player.

Drower and Fuller (2002) mentioned that compared to other contact sports, soccer is associated with a high injury rate, and the injury rate is considered as high risk because it can reach up to 1000 times higher than injuries in industrial occupations. In 2006 among 400,000 soccer related injuries found in the United States, 186544 were found in players of school going age, 44% of injuries were found in soccer players younger than 15 years (Kourtures & Gregory, 2010). Goga and Gongal (2003) indicated that severe
injuries have been found among soccer players in South Africa. They recommended that taking serious preventive measures as soon as possible is crucial. A study done by Twizere and Frantz (2007) on amateur soccer players in Rwanda, found soccer to have an injury prevalence of 68%. Soccer injury rates are higher in games than in training sessions and the most exposed body parts are found in the lower extremities (Sports injury clinic, 2010; Tegnander, Olsen, Moholdt, Engebretsen, & Bahr, 2008).

Various studies have proven that young male soccer players seem to suffer certain types of injuries more often than their older male counterparts (Biedert & Bachmann, 2005; Murphy, Connolly & Beynnon, 2003). The same authors continue to mention that, the injuries are due to the influence of intrinsic risk factors like age, the immature musculoskeletal system, previous injuries, overuse injuries, inadequate rehabilitation, aerobic fitness, body size, limb dominance, flexibility, muscle strength, muscle imbalance and reaction time. The authors concluded by acknowledging that, extrinsic risk factors like level of competition, skill level, use of protective equipment, playing surface and shoes type affect both sides.

According to Twizere (2004) there are no companies sponsoring sport in Rwanda, Rwandan high school teams are self sponsored and consequently the state of playing surfaces, appropriate equipment, proper coaching, and intervention received by soccer players following injury (may not be of good quality), thus soccer players are more exposed to soccer injuries. In addition, Finch (1997) mentioned that the injury prevalence in Africa could be the same or higher than the cases observed in the developed countries. The reason may be due to financial factors.
Soccer injuries are very expensive to treat. The estimation of expenses spent on soccer injury each year in medical costs by FIFA is estimated to be 30 billion Dollars annually worldwide (Dvorak & Junge, 2000). Furthermore the same authors acknowledged that the average cost for medical treatment per injury is estimated at US $ 150 in Europe. Although this amount may far exceed the cost incurred by Rwandan high school teams, players sustain more or less the same injuries. Thus, there is a need for preventive measures as Rwandan high school soccer players might have more difficulties managing their injuries due to minimal resources, thereby making them spend long periods without being able to play and might end their careers prematurely because of injury.

The Rwandan high school soccer players play at club level in their respective schools. National soccer players are more competitive than high school soccer players. However some high school soccer players play at provincial or national level and they participate in regional as well as international competitions. The national under-17 team is mostly selected from high school soccer players. Therefore, there could probably be an expectation of more injuries in high school soccer players playing at national level. In addition we have to consider that players who are not selected from high school soccer teams, are competing to get a place in the national team. After each high school tournament season, the best players are selected to play at national or provincial level. As all players are in continuous competition, the researcher believes that there might be a high risk of both acute and overuse soccer injury occurrence. In addition the participation of some high school soccer players in competition at both national and
international level, exposes them to more risk of injury. Thus there is a need to conduct an epidemiology study about the common soccer injuries in Rwandan high school.

Leininger, Knox & Comstock (2007) stated that epidemiologically valid studies which analyze soccer injuries are required to help reduce the rate of soccer-related injury at the lowest possible level. One isolated study, which assessed the epidemiology of soccer injuries in Rwanda and the need for physiotherapy intervention (Twizere, 2004), concluded that ankle injuries accounted for 38.5% of all injuries, with knee related injuries accounting for 26.7%. The most common causes of injury identified were being tackled, collisions, landing, and overuse injuries. However, this study did not exhaustively illustrate the causes, severity, and the management of soccer injuries sustained by high school soccer players. The present study attempted to widely investigate these gaps.

In order to combat this injury risk and implement prevention strategies Van Mechelen (1997) acknowledged that the extent of injury must be identified and described, then the factors and mechanisms that play a part in the occurrence of injuries have to be identified. This was confirmed by Watkins and Peabody (1996) who mentioned that there is a need to understand the causes of soccer injuries, in addition to knowing the risk factors which contribute to soccer injuries as the starting point of minimizing soccer injuries in young soccer players. Furthermore they mentioned that special attention must be put on risk factors related to immature musculoskeletal systems in young soccer players. Sports injury clinic (2010) acknowledged that more than 75% of all soccer injuries can be prevented with proper coaching, sufficient management of sports
injuries, correct use of protective equipment, and warming-up and cooling-down are respected. Although 75% of soccer injuries can be prevented Saavedra (2003) mentioned that little research has been done regarding the epidemiology of, and risk factors related to soccer injuries locally or on the African continent to assess the status of injuries incurred in high school learners.

According to Brukner and Khan (2003a) a set of sporting programmes such as warm-up, stretching, protective and suitable equipment, appropriate surface as well as appropriate training, adequate recovery, psychology and nutrition have been designed as main components of injury prevention and rehabilitation. The misuse of these sport components may play a big role in injury occurrence (Dvorak & Junge, 2000). Although proper use of protective equipment can help in soccer injury prevention studies conducted by Hakizimana (2002), Nuhu (2004) and Twizere (2004) in Rwanda have shown that many soccer players were not implementing the proposed control measures available for reducing the risk of injuries. However these studies have not been done in high school. Little is known about what soccer community members in high school actually know regarding the epidemiology and risk factors related to soccer injuries. Thus there is a need to conduct an epidemiological study in Rwandan high schools.

1.3 PROBLEM STATEMENT

There is no data on the epidemiology of, and risk factors related to soccer injuries among male high school soccer players in Rwanda. Those who are at high risk of being injured are the school going youth (Koutures & Gregory, 2010). In addition to this,
Frank, Jarit, Bravman and Rosen (2007) stated that one of the causes which can lead to long-term functional disability and deformity is the first injury sustained by a young player. Moreover, soccer-related injury expenses are a large problem nationally and internationally. It is in this regard that this study has been done for identifying ways of preventing soccer related injuries in high school soccer players.

1.4 THE AIM OF THE STUDY

The aim of this study was to determine the epidemiology of, and risk factors related to soccer injuries among male high school student soccer players in Kigali, Rwanda.

1.5 OBJECTIVES

1. To determine the prevalence of soccer related injuries among male high school student soccer players in Kigali, Rwanda.
2. To determine the risk factors to soccer related injuries among male high school student soccer players in Kigali, Rwanda.
3. To determine the mechanism, location and severity of soccer injuries among male high school student soccer players in Kigali, Rwanda.
4. To determine interventions received by male high school student soccer players in Kigali, Rwanda, following injuries.

1.6 SIGNIFICANCE OF THE STUDY

This study will be carried out in order to increase awareness of high school soccer players, sport educators and the departement of sport in the Ministry of Education about
the epidemiology and risk factors related to soccer injuries in high school. Cabbie, Brunell, Finch, Wajswelner and Orchard (2006) described the preventative management of injuries as firstly identifying and describing the extent of the injuries incurred and secondly identifying the mechanisms involved in the injury occurrence. The information obtained from this process will be used to generate a comprehensive list of injuries sustained by players, possibly endemic, to Rwandan high school soccer players. The data from this study add to the existing information on most affected anatomical sites, prevalence, causes and severity of soccer injuries sustained by players and create more awareness for the need for a preventative injury program. The study will hopefully establish baseline data of injuries sustained by high school soccer players and lay the ground work for more comprehensive studies of this kind.

1.7 DEFINITION OF THE KEY TERMS USED

**Soccer:** Is a game played by two teams on a rectangular field. Players attempt to propel a ball through the opponents’ goal post using any part of the body except the arms below the elbow. Generally, players use their feet and heads as they kick, dribble, and pass the ball toward opponents the goal. One player on each team guards the goal and is called the ‘goalkeeper’. This player is the only player allowed to touch the ball with the hands while it is in play (Encarta Encycropedia, 2011).

**Injury:** Any physical complaint sustained by a player that results from a football match or football training, irrespective of the need for medical attention or time-loss from football activities (Fuller et al., 2006).

**Risk factors:** Conditions that influence a person’s health status and are capable
of causing illness or injury, including genetic or biological risk factors, lifestyle, or environmental conditions (Burt, 2011).

1.8 **SUMMARY OF CHAPTERS**

Chapter One provides an overview of the epidemiology of soccer injuries worldwide, at African level and in Rwanda, specifically. The possible causal factors of soccer injury occurrence in Rwanda are highlighted. The gaps in previous soccer-related studies in Rwanda are reported. The stages of injury prevention to focus on in this study are described: identifying and describing the extent of injury and identifying factors and mechanisms that play a part in the occurrence of injuries.

In Chapter Two, the literature illustrates the components of epidemiology study. Thereafter, the literature reviews the main issues to be addressed in connection with the current study. These include, soccer injury prevalence, type of common soccer injuries, the anatomical sites prone to soccer injury, severity of soccer injuries, mechanisms and factors influencing soccer injury occurrence and injury prevention programmes. The chapter ends by addressing the relationship of physiotherapy and sport injuries.

In Chapter Three the research setting is described. It shows the geographical view of Rwanda as well as the location of Rwandan high school soccer teams. The chapter presents the design of this study, which is a cross-sectional retrospective study design. It thereafter gives the details concerning the study population. The need and procedures of pilot studies as well as problems encountered are highlighted. An in-depth description
of data collection methods is concisely presented. This includes, tools used in data collection, data collection procedures and issues of reliability and validity of questionnaires for soccer players. The chapter ends by giving the data analysis and by showing how the issues of ethical considerations were addressed.

In Chapter Four, the demographic characteristics of Rwandan soccer players are reported. The presentation and a brief description of the main findings in this study are displayed. These include the prevalence of soccer injuries in Rwanda, most common anatomical sites prone to injury, mechanisms of sustained injuries, severity of sustained injuries. The chapter further shows the results from investigation on the use of protective equipment and performance of some sporting programmes as possible factors, which could influence injury occurrence. The chapter also displays the results on management following injury. Finally, the risk factors which could influence injury occurrence are reported.

In Chapter Five, the entire discussion focuses on the interpretation of the main findings in this study. The identification and description of injury prevalence in this study is discussed on the basis of comparing, where possible, the findings of this study with the ones of previous similar studies. The use of protective equipment as well as investigated sporting programmes are discussed in consideration with their evidence in influencing injury occurrence as revealed in previous studies. The limitations of this study are also reported. The last chapter provides a summary, conclusions and suggested recommendations. These are based on the main findings of this study.
CHAPTER TWO
LITERATURE REVIEW

2.1 INTRODUCTION

This chapter presents a review of literature regarding soccer injury studies. This chapter will also attempt to link the researcher’s topic of “the epidemiology of, and risk factors to soccer related injuries among high school soccer players in Kigal, Rwanda” into the global context. Initially a comprehensive, web-based search of existing soccer injury literature was performed. The search encompassed all reported studies, including European journals and texts, which served as a basis of comparison to more recent work. Citations from the reference section in textbooks of sports medicine, family practice and other primary care specialties, orthopaedics, and general surgery were then identified. This was followed by a search of electronic data bases (MEDLINE from 1970 to 2011) and dissertation abstracts in all languages using the following subject terms: soccer injuries, football injuries and sport injuries. The search was then limited using the terms epidemiology, risk factors, aetiology.

2.2 THE ROLE OF SPORT AND THE BENEFITS OF PARTICIPATION

According to Timpka, Ekstrand and Svanstrom (2006) participation in sport is an effective way for children to increase their level of physical activity and fitness, because it requires intensive physical effort over an extended period of time through practice. They further stated that among all sport, soccer is the most popular sport in the world. Playing soccer is a way to make friends and being involved promotes self-esteem. In
addition, athletes are often more careful about taking care of themselves and avoiding habits that can detract from their game. Self confidence and pride are other positive results of soccer. Soccer players develop a team spirit and become protective of each other. Furthermore, they mentioned the beneficial effects of regular participation in exercise and sport on fitness and a sense of wellbeing is well-established. They concluded by acknowledging that the physical effects of strengthening muscles, improving mobility and balance, increasing stamina and better weight control are evident from research.

Soccer is a very popular sport and is played around the world with millions of participants playing at different levels. Soccer is a great way to build endurance, improve speed and stay fit while enjoying the camaraderie of a team sport. In addition soccer players reap many benefits from being physically active, including improved physical fitness, increased productivity, and enhanced academic performance (Colorado Health Organization, 2000). McEntere (2011) confirmed this by stating that sport is a good way to relieve stress and reduce depression. The same author continued to mention that kids who play sports quickly learn that sometimes you win and sometimes you lose. They learn to be a good sport in both situations. It also helps them learn to deal with disappointment and so on. Furthermore the same author acknowledged that statistics show that kids who are involved in sports while in high school are more likely to experience academic success and graduate from high school. In addition to physical fitness and social interaction achieved through sport participation, Grubbs and Carter (2002) stated that sport participation can be a strategy for the
prevention of disease and improvement of health through individual participation in adequate amounts of regular physical activity. In medical terms there is strong evidence that regular physical activity contributes towards preventing cardiovascular disease and delaying the onset of degenerative changes associated with inactivity and aging. The same authors contend that sport is no longer only considered as a recreational activity but a significant part of community life. They further stated that sport enables people to meet within a defined and controlled situation, thus allowing them to get to know each other, but with the help of new communications and mass media technologies. Grubbs and Carter (2002) conclude by saying that sport is now considered to be a big, lucrative business providing high profile entertainment to the masses. Also generates massive financial interest in many rich countries and also in developing countries.

2.3 SOCCER AND THE PREVALENCE OF INJURIES AMONG YOUTHS

Prevalence is the measure of injuries in a population at a given point in time and can also be measured over a period of time. The formula used to calculate the prevalence is the existing cases divided by population at risk over a specified period of time (Friis & Sellers, 1999). Injury is a possible result of participation in soccer and decreases numerous health benefits associated with participation in sports. Thus soccer injury is an important public health problem (Knowles et al., 2006). The same authors conducted a study in 12 high schools in different sports in USA and the authors found that soccer had the highest injury rate among 10 high school sports at 8.1 per 1,000 athletes’ exposure. Another study done on a comparison of USA high school sports injuries by Rechel, Yard and Comstock (2008) concluded that, most injuries occurred in boys'
soccer 75.7%, girls’ soccer 73.2%, and the highest rate occurred in soccer (12.09 per 1000 athletes’ exposure).

The strength of the above studies was their sampling methodology, inclusion of different high school sports, and the use of a denominator that reflected athlete exposures. High school sports have been examined in many studies but few examined multiple sports at the same time. However there is difference in exposure rate of 4.8 from the previous study which may be due to different study design and setting. The weakness of both studies was that injury was analyzed according to different sports instead of comparing among players.

A study done by Peterson, Junge, Chomiak, Graf-Baumann and Dvorak (2000) revealed that there is a higher injury incidence in younger players, especially those under the age of sixteen. This was confirmed by Goga and Gongal (2003) which showed that 60% of the injuries being sustained were by players under the age of 20 years. Although the study was done on young soccer players it was only done at club level, which has proper prevention programs compared to high school soccer teams. The current study will see if there may be different findings.

Mtshali, M bambo-Kekana, Stewart and Musenge (2008) concluded that female soccer players from 13 South African high schools had an injury prevalence ranging from 38% to 48%. Another study done in Rwanda on amateur soccer players by Twizere and Frantz (2007) found a prevalence of 68.1%. Between the two studies, there is a difference in injury prevalence of 30%. This may be due to the fact that women soccer players do not have the same predisposing factors of injuries compared to male soccer
players. The first study was limited only to women soccer players, whereas the second study was limited to amateur soccer players of all ages, who have different preventive programs compared to those found in high school teams.

According to Murphy, Connolly and Beynnon (2003) players of an older age are more exposed to injury. The same author contended that because older players have been in the game longer, this may predispose them to more injuries. However, Backous (1988) found the incidence of injury to double over the age of 14 in his study done on youth soccer players.

2.4 TYPES, LOCATION, MECHANISMS AND SEVERITY OF SOCCER INJURIES

2.4.1 TYPES OF SOCCER INJURIES

Soccer is a sport where most injuries occur in the lower extremity (Emery & Meeuwisse, 2006; Junge et al., 2006). When studying adolescent sport participation and injury in high schools, Emery, Meeuwisse & Hartmann (2005) found the lower extremities to be involved in 78.2% of all soccer injuries. This is consistent with other studies (Faude, Junge, Kinderman & Dvorak, 2005; Giza, Mithofer, Farrell, Zarins & Gill, 2005) which found the lower extremities to be the most commonly injured part of the body.

Various authors stated that ligament strains, contusions, followed by sprains and muscle strains are by far the most common injury types sustained during a game of soccer (Fuller et al., 2004; Quinn, 2008). Nevertheless, similar findings are identified in a prospective epidemiological study of an audit of injuries in professional soccer player
in the English league by Hawkins, Hulse, Wilkinson, Hodison and Gibson (2001) who indicated that sprains and strains are the major types of injuries that were commonly identified among other types of injuries in their study with a prevalence rate of 66% of the total injuries. In another study, findings by Brun and Maffulli (2000) concur with the findings of Hawkins et al. (2001) where they indicated that the acute injuries such as sprain, strains, contusions, and lacerations accounted for about 60% of all injuries in their study though the prevalence rate varies at 6% different. However, they found that most of the thigh injuries were muscular strains (81%). 39% of knee injuries were of ligament sprains, and 75% of them were to the medial collateral ligament. Of all injuries found in the ankle 67% were ligament sprains. Finally, the authors mentioned that 80% of the injuries found were to the lateral ligament complex. Among all the injuries found, strains, contusions or sprains represented 69-81% of all injuries (Hawkins and Fuller, 1999; Rahnama, Reilly & Less, 2002). Other injuries, such as fractures (relatively uncommon), heat-related injuries, tendonitis, overuse injuries, and dislocations also occur in sport (AAP, 2000). In the study conducted by Frantz, Amson & Weitz (1999), bruises and joint swelling or inflammation were recorded among the commonest types of soccer injuries. However, muscle strains specifically to the hamstrings are now as common as or more frequent than joint sprains (Walden, Hagglund & Ekstrand, 2005). Thus it is evident from the studies reported that although the majority of the injuries reported may not seem severe, there is a large number of injuries occurring.
2.4.2 LOCATION OF INJURY

Kucera, Marshall, Kirkendall, Marchak and Garrett (2004) in their study done on 905 soccer players, most of the injuries were found in lower extremities. Of the injuries reported, 66.9% of incident injuries were to the lower leg and 10.2% were to the upper extremity. Drawer and Fuller (2002) were of the opinion that in soccer, the majority of injuries are found in the lower extremity. Of the lower leg injuries, 16.5% were to the knee and 26.4% were to the ankle. The same findings have been found in a study done on both sexes. This study has shown that lower extremity injuries represent 60-87% of the total injuries incurred by soccer players of both sexes (Rahnama et al., 2002).

According to Lyon (2001), Morgan and Oberlander (2001) the knee is the most affected joint followed by the ankle joint. However Frantz et al. (1999), Hawkins and Fuller (1999) acknowledged that the most affected joint is the ankle (26.6%) followed by the knee (21.7%). From the studies reported it is evident that the lower limb is commonly affected with the most common areas affected ranging between the ankle and the knee.

Few studies have looked at the injuries sustained in the upper limbs among soccer players. This would most likely be due to the nature of the game and the minimal involvement of the arms in the game activity. The goalkeeper is generally the most susceptible to injury due to the nature of his position. Upper limbs account for a very small amount of soccer injuries. Delaney and Drummond (2000) found a prevalence of 12.1% for upper limb injuries in their study. The same findings have been found by Twizere (2004) among soccer players in Rwanda. In his study he reported an injury frequency of 11.4% in the upper limbs. On the other hand, the head is also affected by
soccer injuries e.g: The goalkeeper when diving at the feet of players for a ball, will often sustain a blow to his head or strike his head on the ground.

A study conducted by Gionnoti, Al-Sahab and Mc-Faul (2011) reported a total of 123 concussions which accounted for 7.0% of all male injuries in their study. The researchers reported that male soccer players were at a 17.7 times greater risk of suffering a concussion during matches than in practices. Common sites of lacerations include the scalp, eyebrows and lips. Nosebleeds, nasal and cheekbone fractures and damage to teeth are seen mostly as a result of a direct blow (Williams, 1979).

2.4.3 MECHANISM

Most of soccer injuries occurred as result of direct contact with a player of the opposite team (Yard, Schroeder, Fields, Collinsa & Comstock, 2008). The high percentage of soccer injuries result from tackling, being tackled and/or collision with other players (DeLee, Drez & Miller, 2009). They stated further that poor landing, sudden cutting, kicking the ball, or changing speed are responsible for non-contact injuries. Similarly, Fuller, Smith, Junge and Dvolak (2004) found that most the common mechanism of injury is the physical contact between players, followed by foul play.

According to the findings of Hawkins et al. (2001) 38% of soccer injuries are caused by contact with another player or the ball, and 58% from a non-contact mechanism. The authors continued to acknowledge that half of the injuries are caused by player to player contact actions, like running, turning, tackling, receiving a tackle, and collision.
Furthermore, the authors mentioned that turning, heading, shooting, jumping, falling and running are by far the non contact actions which cause soccer injuries. Similar findings are identified by Le Gall, Carling, Vandewalle, Church and Rochcongar (2006) who stated that direct contact with another player was reported in most studies as being the mechanism of injury. In their survey study of sport participation and injury in Calgary high schools, 40.4% of the injuries in soccer were due to direct contact with the opponent and 44.9% were non-contact injuries, whilst contact injuries with something else or a teammate was significantly low. This agree with other studies done in adult males (Walden et al. 2005). Traumatic injuries (52%) were caused by direct contact with another player and 48% of injuries occurred without any contact (Emery et al., 2006). However, Walden et al. (2005) found in his study 16 soccer-specific playing actions which are, goal catch, goal punch, goal throw, heading the ball, kicking the ball, making a tackle, dribbling the ball, jumping to head, making a charge, passing the ball, receiving a ball, receiving a tackle, receiving a charge, shot on goal, throw in the ball, and set kick. Among the above mentioned actions each has its own definition in their study. Data available from their studies suggested that some playing actions were associated with higher injury risk. In particular, receiving a charge, making a tackle, and receiving a tackle were actions with a substantial risk of injury. In other studies foul play is cited as the cause of traumatic injuries (Rahnama et al., 2002; Wong & Hong, 2005). It is thus evident that a range of mechanisms of injuries among soccer players exist and this information is useful in identifying appropriate intervention mechanisms.
2.4.4 SEVERITY OF INJURIES

Severity of injury can be defined in various ways. It is defined as slight, minor, moderate or major, depending on the length of time needed for recovery, with over 65% being minor, 25% moderate and 10% serious (Rahnama. et al., 2002). Fuller et al. (2006) describe injury severity as the number of days that elapse between the date of injury to the date the players return to full participation in soccer. The severity of injury is categorized as minor (1-7 days of absence), moderate (8-28 days) and severe (more than 28 days) (Hagglund, 2005).

Various studies reported minor injuries to be more common among soccer players. Seventy two percent of injuries to high school boys’ soccer players were of minor severity (Powell & Barber-Foss, 2000). This is supported by Le Gall et al. (2006), where 60.3% of all the injuries in different age groups were minor. During the 2004 Olympic Games where soccer was one of the team sports, 35% of injuries resulted in an absence of one week from soccer (Junge et al. 2006); these were minor injuries according to the definition.

Severe injuries were found to be common in the 18-25 year age group. These included fractures; ligament sprains and muscle rupture (Chomiak, Junge, Peterson & Dvorak, 2000). In the study done by Faude et al. (2005), 51% of injuries were of minor severity, 36% moderate and 13% severe. More than half (58%) of the severe injuries were located in the knee. More moderate and major injuries were reported in the under 14
players accounting for 42.4% compared to 38% (under 15) and 38.5% (under 16) (Le Gall et al. 2006).

The severity of the injury is also linked to the level of skill of the players. Male soccer players sustain more severe injuries, possible due to the aggressiveness of this population (Sharma, Luscombe & Maffulli, 2003). Thirty two patients were admitted to King Edward VIII hospital in Durban with severe soccer injuries and all had a low level of skill or were amateur players. These injuries were skeletal related injuries of the lower limb (Goga & Gongal, 2003). In their study all the injuries were traumatic and 75% of them were as a result of foul play or bad/dangerous tackles. Chomiak et al. (2000) agrees with the study above as the incidence of severe injuries per 1000 hours of exposure was twice as high in the group with low skill compared to the high skill group. The high skill level groups incurred 22.7% severe injuries and 27.5% were incurred by players in the low level skill groups.

The latest consensus discussions in FIFA (Federation of International Football Associations) and UEFA (Union of European Football Associations), injury severity is categorized in four categories, slight (1-3 days absence), minor (4-7 days absence), moderate (8-28 days absence) and major (>28 days absence) (Hägglund et al., 2005; Fuller et al., 2006). This classification system is a further development from that of Ekstrand et al. (1983) which combined slight and minor injuries in one category, “minor” with 1-7 days absence from play. The later two injury classifications have primarily been used in investigations with elite players, in male (Hagglund et al., 2005) and female football (Jacobson & Tegner, 2006), although the exact number of days of absence varies slightly between studies. It is now strongly recommended, regardless of playing
level, to follow the football consensus statement (Fuller et al., 2006) and split the first week (1-7 days absence) into “slight” and “minor”. Due to the fact that different literature presents controversial information concerning the nature, mechanisms, severity and anatomical sites of common soccer injuries, an epidemiological study in Rwandan high schools will enhance the provision of a guide in injury prevention activities, in setting and monitoring sports safety policies and interventions, and serve as the basis for sports injury prevention research (Nuhu, 2008).

2.5 ASSOCIATED RISK FACTORS FOR SOCCER INJURIES
The cause of injury is generally complex, risk factors must be clearly defined before interventions can be planned (Emery, Meeuwisse & Hartmann, 2005). The authors further mentioned that the important basis for planning preventive measures of soccer injuries is firstly to understanding the individual risk factors. According to Hackney (1994), analysis of risk factors for sports injuries is required as a prerequisite to define high-risk populations and to develop prevention programmes (Willems et al., 2005).

A prospective study done by Dvorak et al. (2000) on potential injury predictors, created a range of multidimensional predictors for football injuries. These risk factors covered a wide spectrum of issues such as age, gender, previous injuries, acute complaints, inadequate rehabilitation, poor health awareness, life-event stress, playing characteristics, slow reaction time, low endurance and insufficient preparation for the game. This shows how the causes of injuries are multi-factorial. Therefore, there is a need to evaluate risk factors for injury, using a multivariate approach. Examining each
risk factor separately without controlling other risk factors will not give a complete picture of how each contributes to the development of injury (Meeuwisse, 1994).

Chapter 1 Table 2.1 Potential risk factors for injury in soccer

<table>
<thead>
<tr>
<th>Extrinsic risk factors</th>
<th>Intrinsic risk factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Non-modifiable</strong></td>
<td><strong>Non-modifiable</strong></td>
</tr>
<tr>
<td>Soccer (contact sport)</td>
<td>Previous injury</td>
</tr>
<tr>
<td>Level of play (elite)</td>
<td>Age</td>
</tr>
<tr>
<td>Position played</td>
<td>Sex</td>
</tr>
<tr>
<td>Weather</td>
<td></td>
</tr>
<tr>
<td>Time of season/Time of day</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Potentially modifiable</strong></td>
</tr>
<tr>
<td>Rules</td>
<td>Fitness level</td>
</tr>
<tr>
<td>Playing time</td>
<td>Pre-participation sport specific</td>
</tr>
<tr>
<td>Playing surface (type/condition)</td>
<td>Flexibility,</td>
</tr>
<tr>
<td>Equipment (protective wear)</td>
<td>Biomechanics (joint stability, strength)</td>
</tr>
<tr>
<td></td>
<td>Balance/Proprioception</td>
</tr>
<tr>
<td></td>
<td>Psychological/Social factors</td>
</tr>
</tbody>
</table>

Willems et al. (2005)

According to Bahr and Holme (2003) injuries mainly result from a complex interaction of multiple risk factors and events. The figure 2.1 illustrates the components of Complex interaction between intrinsic and extrinsic risk factors leading to an inciting event and resulting in injury.
Figure 2.1 Comprehensive model for injury causation. Complex interaction between intrinsic and extrinsic risk factors leading to an inciting event and resulting in injury (Meeuwisse, 1994).

### 2.5.1 INTRINSIC FACTORS

Arnason, Sigurdsson, Gudmundsson, Holme, Engebretsen and Bahr (2004), reported that intrinsic risk factors which lead to soccer injuries include abnormal joint kinetics and kinematics, joint laxity, mechanical or functional instability, muscular imbalances, decreased range of motion, previous injuries and inadequate rehabilitation. According to Reilly and Williams (2003) among the risk factors which can induce soccer injuries to occur, we can include negative psychological problems. The same author contends that psychological problems have a negative impact on concentric muscle and eccentric
muscle ratio which in turn will cause muscles to fail during intense workout, thus injury occurs. However, in the study done by Ekstrand and Gillqvist (1982) on personal risk factors 42% of all injuries were caused by joint instability, muscle tightness, inadequate rehabilitation and lack of training. Previous injuries are believed to be among the main reasons for soccer injuries (Dvorak & Junge, 2000). Arnason, Sigurdsson, Gudmundsson, Holme, Engebretsen and Bahr (2004) confirmed this by reporting that previous injury is one of the strongest independent risk factor for sports injury, with an odds ratio of 9.41 (95% confidence interval 2.80 to 3.58). Similarly, Powell and Barber-Foss (2000) found in their studies that a previous injury is a risk factor of sport injury. Among all injuries found in high school soccer 8.4% of injuries occurred in boys and 10.4% of injuries occurred in girls were reinjuries. However, Bahr and Holme (2003) stated that the age, sex, weight, strength, and flexibility of the athlete are the intrinsic risk factors of soccer injuries.

2.5.1.1 Age

In a study done by Morgan and Oberlander (2001) with interest in analysing the potential risk factors for muscle strain injury by means of data obtained prospectively from an injury surveillance system, the authors conducted a study involving players and matches. In this study, age (when considered independently of past history) was found to be a risk factor for hamstring and calf muscle strains but not for quadricep muscle strains. Furthermore the authors acknowledged that these findings were consistent with the theory that abnormalities of the lumbar spine are implicated in the development of muscle strains, since the lumbar nerve roots of L5 and S1, which supply the hamstring
and calf muscles, are more likely to be affected by age-related spinal degeneration than the nerve supply of the quadriceps muscles (L2, 3 and L4). Morgan and Oberlander (2001) concluded their study by mentioning that hamstring muscle and calf muscle injuries are common in older players while quadricep muscle injuries are common in the dominant leg and are related to kicking in Australian football. However, Orchard (2001) did not find age to be a risk factor in his study done on the role that age may play in injury rates and severity. The author divided players into three age groups. The first group was composed of players less than 25 years of age, the second group 25 to 30 years and the third group over 30 years. The results of this study revealed that player age did not play a role in the occurrence or severity of injury. However, in the study done by Backous et al. (1988) the incidence of injury was double in players over the age of 14.

The conclusion of six studies showed an increase in the incidence of injury in older athletes compared to younger athletes (Murphy et al., 2003). Adolescents are more at risk of injury than younger children and the peak injury rate is common in the older adolescents’ age group (Emery, 2003). However, the review by Schmidt-Olsen, Jørgensen, Kallund (1991) reports that some studies did not reach the same conclusion, as they found younger athletes to be more at risk of injury. The incidence of injuries seems to suddenly increase in the 14-16 year old age group. There are great differences among age groups, skill levels and incidences of injury.
2.5.1.2 Muscle flexibility

Muscle tightness is included among the risk factors for the development of muscle injury. In the study done by Witvrouw, Danneels, Asselman, D'Have and Cambier (2001) during the 1999-2000 Belgian soccer competition. The findings show that soccer players with an increased tightness of hamstring or quadriceps muscles have a statistically higher risk for subsequent musculoskeletal lesions. In their conclusion they recommended that pre-season testing of flexibility of hamstring and quadriceps could identify soccer players at risk of developing muscle injuries.

2.5.2 Extrinsic risk factors

Reilly and Williams (2003) acknowledged that the extrinsic factors which lead to the cause of soccer injuries include inadequate equipment, environmental and climatic conditions. The same author contends that muscles more susceptible to injury in extreme heat, cold or little light. Players are often injured severely during collisions when playing under inadequate lighting. In the morning muscles are stiffer and this may be a contributing risk factor of injury. Furthermore, the author states that altitude and scheduled time of the match are other variables that can make supra-normal demands on soccer teams that can induce soccer injuries. The author concludes by saying that improper playing surfaces are also among the influencing risk factor in injury prevalence.

Brukner and Khan (2001) found that hard surfaces generate greater forces through the musculoskeletal system than a forgiving surface such as grass. These generated
greater forces induce muscle tension, and thus risk of injury becomes high. According to Bahr and Holme (2003) Extrinsic factors, also called external environmental risk factors, include training methods, the surface upon which the sport is played, equipment such as footwear and padding, and environmental factors such as the weather. In addition to these, McGrath and Ozanne-Smith (1997) added pre-season conditioning.

2.5.2.1 Stretching

Stretching promotes better performances and decreases the number of injuries (Witvrouw, Danneels, Asselman, D’Have & Cambier, 2004). In their reviews (Herbert & Michael, 2002; Thacker, Gilchrist, Stroup & Kimsey, 2004; Weldon & Hill, 2003) found conflicting evidence and could not decide whether to endorse or discontinue stretching before or after a game to prevent injuries. This is mainly due to the quality of studies conducted and different types of stretching techniques applied in the studies. Thacker et al. (2004), Witvrouw et al. (2004), agree that part of the contradiction can be explained by a lack of understanding of the type of sporting activities in which the individual is participating.

Soccer is one of the sporting activities that involve bouncing and jumping activities with high intensity of stretching-shortening cycles that require a muscle-tendon unit that is compliant enough to store and release the high amount of elastic energy that benefits performance (Witvrouw, Danneels, Asselman, D’Have & Cambier, 2003). If participants of the sports have insufficiently compliant muscle-tendon units, this may lead to increased risks of injury. There is also little evidence whether stretching pre or post
participation prevents injuries, decreases muscle soreness and improves performance, but these concepts are included in injury prevention programmes (Andersen, 2005). Hartig and Henderson (1999) assessed whether stretching the hamstrings in military recruits affected risk injury at the beginning of basic training. They found that the number of lower extremity overuse injuries was significantly lower in the intervention group compared to the control group. The result in this population showed 43 hamstring injuries (29%) in the control group and 25 hamstring injuries (17%) in the intervention group.

2.5.2.2 Player position

In most studies the position in which a player plays, does not have an influence on injury or the incidence of injury. However some studies found defenders to have a greater risk of injuries than other players and goalkeepers had more upper extremity injuries (Dvorak & Junge, 2000). Midfielders (34.1%) sustained the most injuries followed by defenders (28.1%) in the study of soccer players done by Giza et al. (2005). Wong and Hong, (2005) they attempt to explain the risk of injury of defenders and midfielders. The defenders try to prevent the opponents from scoring, therefore tackling, jumping and landing will increase the risk of injury whether there is contact or not. LeGall et al. (2006) argues that comparing different populations of adolescent players in different positions of play may be difficult, as the players may not yet have settled into definitive positional roles. They agree that the defenders sustain more injuries compared to players in other positions.
2.5.2.3 Exposure

Exposure includes all the training sessions and matches with a team. A training session is defined as a coach-directed scheduled activity carried out with the team. A match is defined as any scheduled friendly or competitive match with teams from different clubs (Fuller et al., 2006; Walden et al., 2005). In the study of injuries in the UEFA Champions League during the 2001-2002 seasons, done by Walden et al. (2005), 69 matches were recorded as the average for a single player in the competition. In total 85% (225/266) of players incurred 658 injuries, which means 7.3 to 11.5 injuries per 1000 hours of exposure. During the study period 56% of the players were exposed to some national fixtures on at least one occasion and almost 4% of all injuries occurred when playing for their national team. This means that these players were exposed to more matches than other players.

Junge, Dvorak, Chomiak, Peterson & Graf-Baurmann (2000) in a study comparing two European regions to establish the incidence of injuries, reported that the Czech Republic spent more time training and playing football than the players from the Alsace region in all age and skill levels, with the exception of the amount of training in the 14 to 16-year-old players. In both regions, the number of training and game hours were higher in high-level players than in low-level players of the same age. The frequency of injuries were higher at 50% in the Czech Republic region compared to the Alsace region at 35.1%. Studies done in the female population to determine the level of exposure in relation to injuries are limited, but one could possibly conclude that more exposure to matches and training will increase the risk of injury. The difficulty in measuring exposure
in soccer studies is evident in the literature. Although there is consensus in defining exposure (Walden et al., 2005; Fuller et al., 2006), the studies prior to this did not use the same methods.

### 2.5.2.4 Level of skill

The level of skill is based on the league in the team plays (Peterson et al., 2000). When comparing two European regions of high and low skilled level players, Junge et al. (2000a) found that the incidence of injury in low-level skill players of 14–16 years and 16–18 years was higher than in the high-level skill players of similar age groups. Peterson et al. (2000) had similar results for the same age groups. The high level 14 – 16 years age group incidence of injuries was low (Alsace: 2.2 per 1000 hours and Czech Republic: 2.5 per 1000 hours). There was a notable difference in incidence of injuries for the 14 – 16 year low-level players for Alsace region (0.9 injuries per 1000 hours) and Czech Republic (4.9 injuries per 1000 hours). This may be because the Czech Republic spent a greater amount of time in training (135.6 hours) and in games (32.2 hours), whereas the Alsace region spent 97.1 hours in training and 28.9 hours in games.

Emery et al. (2005) compared boy and girl soccer players for under-14, under-16, and under-18 in an evaluation of risk factors. The under-14 girls (7.92 per 1000 hours) and 19 boys (7.88 per 1000 hours) both had a higher incidences of injuries compared to the other age groups. However, Emery and Meeuwisse (2006) when comparing outdoor and indoor soccer injuries in both males and females, found that the under-14 age group had a lower rate of injury incidence, which was higher in the under-16 and under
- 18 age groups for outdoor soccer. The exposure to matches may be a reason for the lower incidence of injuries in this study, although this possibility was not explored. Murphy et al. (2003) reported that some studies found that young players with low skill levels had a twofold increased incidence compared to the older high skilled level. The contradictions in these studies may be attributable to different study techniques as well as the level of exposure in different age groups. There are however, great differences between different age groups and skill levels.

2.5.2.5 Playing surface

Traditionally, soccer is played on a rectangular field, not more than 68m wide and 105 m long. The surface less commonly consists of sand, artificial turf or gravel but predominantly consists of grass surfaces. A player covers approximately 10 km of ground per game. The player suffers significant impact forces of three times his body weight due to the fact that over the 10km covered by a player, 8-18% is at the highest individual speed (McGrath & Ozane-Smith, 1997).

In a study of National Football League athletes between 1980 and 1985, Murphy et al. (2003) mentioned that playing on artificial turf increased the incidence of knee and foot / ankle injuries. The authors acknowledged that there is more than a two fold increase of incidences of injuries on artificial turf compared to grass or gravel. The authors concluded that more injuries may be incurred on artificial turf than on other surfaces because of its stiffness and the increased friction force at the shoe / surface interface. Stiffness of a surface affects impact forces and can result in overload to tissue such as bone, cartilage, muscle, tendon, and ligament. Normally, friction is necessary for rapid
starting, stopping, cutting, and pivoting inherent in sports such as soccer. However increased friction force may contribute to the increased incidence of injury among athletes who play on artificial turf (Murphy et al., 2003).

Orchard, Seward, McGivern and Hoods (1999) in their studies conducted in the National Football League (US) and the Australian Football League revealed that hard surfaces generate greater forces through the musculoskeletal system than a forgiving surface such as grass. The authors also found that dry fields increased the risk of anterior cruciate ligament injury. Uneven playing surfaces is another cause of injuries in soccer players. The uneven playing surfaces may result in more loading on the ligaments and muscles. When the external loading is greater than what the ligaments and muscles can tolerate, injury usually follows (Wong & Hong, 2005).

2.5.2.6 Protective equipment

According to McGrath and Ozanne-Smith (1997), in 1990 protective equipment such as appropriate footwear and shinguards was made compulsory for both competition and training for FIFA. Before FIFA regulations came into force, the voluntary use of shinguards was limited. In the study concerning the evaluation of the effectiveness of shinguards in protecting against tibia fractures in soccer players Fransisco, Nightingale, Guilak, Glisson and Garret (2000); Murphy et al. (2003) found in their studies that shinguards are very important in the prevention of tibia fractures. The authors further stated that the average shin-guard reduced force by 11% to 17% and strain by 45% to 51% compared to an unguarded leg. In football, wearing edge style cleats increased the risk of sustaining ACL injury compared to other cleat designs. One prospective study
investigated the relationship between cleat design and the incidence of ACL tears in 3119 high school American Football athletes participating on natural turf (Murphy et al., 2003). This study has shown significantly more ACL tears occur in athletes wearing edge cleat designs with longer irregular cleats positioned at the periphery of the shoe.

2.5.2.7 Adequate warm-up and cool down

Hedrick (1992), Kannus (1993) defined warm-up in sport as a period of preparatory exercise in order to enhance subsequent competition or training performance. The authors continued to contend that the aim of warm-up exercise is to prepare the mind, heart, muscles and joints for the physical activity. They further stated that its benefits would include improved performance, greater psychological preparation, and injury prevention.

Prentice (1999) mentioned that programmes such as physical fitness, a warm-up period of 15-20 minutes, stretching during cool-down, strengthening, endurance and power are imperative in pre-season conditioning for soccer players in order to cope with the requirements of competitions. According to Maughan (2000) fatigued athletes have low skill performances, which can lead to injury. The author explained the benefits of each period of warm-up, stating that a period of aerobic exercise increases body temperature, a period of sport-specific stretching prepares the muscles to be used in the subsequent performance and a period of activity, incorporating movements similar to those to be used in the subsequent training or competition, prepares the athlete for the game.
In the study done by Olsen, Myklebust, Engebretsen, Holme and Bahr (2005) reported significant reductions in the number of injuries during physical activity after performing warm-up exercises. However, in the study done by Van Mechelen, Hlobil, Kemper, Voorn and De Jongh (1993) did not show any significant difference among players who did physical activities after performing warm-up and those who did not perform warm-up exercises. Only one of these studies reported the intensity level of the warm-up. It would be better if the intensity level of the warm-up was determined because in some studies there was a great variation in the total time reserved for warm up which varied from 3 to 40 minutes. If all of these studies used the same intensity level of warm-up, it could be a crucial factor in determining whether or not warm-up exercises are effective for reducing the risk of injury.

Stamford (1995) stated that cooling down enhances the wash out of waste products of muscle metabolism thus shortening the recovery time. The author recommended performing light aerobic exercise at the end of the sporting activity for starting the cool-down process. Jogging is ideal for most team sports as well as low-intensity cycling and rowing particularly after gym training sessions. Flexibility or stretching exercises are the other important component of the cool-down session since the muscle temperature is still high and the exercises can be performed safely and easily (Blum, 2000).
2.5.2.8 Adequate rehabilitation

Inadequate rehabilitation following sports is a causal factor in the recurrence of sports injuries in sports (McGrath & Ozanne-Smith, 1997). They recommended that players should undergo controlled rehabilitation before returning to play after injury. A rehabilitation programme should be sport-specific and should involve gradual increases in the stress and adaptation up to full recovery. Furthermore, the authors acknowledged that a return to play should be decided by team medical personnel, in collaboration with the coaches, and they should ensure that the risk of further injury is reduced.

2.6 PREVENTIVE MEASURES IN SOCCER

Injuries are considered the result of a culmination of sets of circumstances and pre-existing conditions that may best be understood as a chain of events: pre-event, event and post-event. Injury prevention programmes can be divided in primary, secondary and tertiary prevention (Brukner & Khan, 2001).

2.6.1 Primary injury prevention programmes

According to McGrath and Ozane-Smith (1997), primary injury prevention programmes are viewed as measures taken before an event or incident that could potentially lead to injury, to prevent the event from occurring in the first place. The primary injury programmes consist of conditioning, protective equipment and environmental conditions. Adequate warm-up and strengthening exercises, good nutrition, correct use and maintenance of equipment, awareness of environmental factors and personal limits all help to prevent sports injuries.
2.6.2 Secondary injury prevention programmes

McGrath and Ozanne-Smith (1997) stated that secondary injury countermeasures are viewed as measures acting during the event to prevent the injury from occurring or to reduce the severity of injury. There are different ways in which authors define the first aid management of soft tissue injuries, namely RICE, PRICE, RICER or PRICER. The common first aid is called RICE, which means Rest, Ice, Compression, and Elevation. If a part of the body is injured, the body’s reaction will cause damage to the tissue surrounding that part.

Brukner and Khan (2003b) stated that whenever possible, the injured athlete should cease activity immediately following injury. Continued active movement of the injured part will result in increased bleeding and swelling. For example, with a thigh contusion, bleeding will be increased by contraction of the quadriceps muscle during running. The application of ice immediately after injury results in a reduction of pain and causes local vasoconstriction (contraction of blood vessels), thus reducing bleeding and swelling. Ice reduces the metabolic rate of the tissue, thus lowering demands on oxygen and nutrients. Ice may also decrease inflammation and muscle spasm. Compression of the injured area with a firm bandage reduces bleeding and, therefore, minimizes swelling too. Elevation of the injured part reduces blood flow to the injured area and encourages return of venous blood and lymph (Flegel, 1997).

2.6.3 Tertiary injury prevention programmes

Tertiary injury prevention programmes are viewed as measures acting after the chain of events, or incidents, leading to injury and help to minimize the consequences of injury.
This stage is considered to be the rehabilitation stage. Rehabilitation is both for other injuries and the prevention of re-occurrence (McGrath & Ozane-Smith, 1997). Many techniques such as mobilization, traction technique, proprioceptive neuromuscular facilitation, therapeutic exercise, regaining muscular strength, endurance and power, were discussed by Prentice (1999). The principal aim of the rehabilitation is to restore full muscle power, extendibility, range of motion and skill patterns. Moreover, Brukner and Khan (2003b) mentioned that injury injury prevention can be divided into:
- Primary prevention: dealing with health promotion and disease prevention
- Secondary prevention: dealing with early diagnosis and treatment to limit disability
- Tertiary prevention: which focuses on rehabilitation to reduce and correct existing disability. In addition they reported components that could be regarded in terms of injury prevention. These are correcting biomechanics, warm up, stretching, taping and bracing, protective equipment, appropriate surfaces, adequate recovery, psychological and nutrition.

According to Prentice (1999) the principle aim of rehabilitation is to restore full muscle power, range of motion, skill patterns and extendibility. The author continued by stating that the following techniques are very essential in rehabilitation restoration: Mobilization, traction technique, proprioceptive neuromuscular facilitation, therapeutic exercise, regaining muscular strength, endurance and power.

### 2.7 ROLE OF PHYSIOTHERAPY IN PREVENTION OF SPORT INJURIES

In soccer, safety interventions and improved treatment of injuries and rehabilitation may help prevent future injury (Hagglund, Walden, Bahr & Ekstrand, 2005). Physiotherapy
has an important role in the management and prevention of sport injuries. They further stated that there are many therapeutic techniques used in the treatment of sports injuries by physiotherapists, such as manual therapy, electrotherapy, exercises, specific soft tissue mobilizations, rehabilitative exercises, taping and bracing. Furthermore the authors acknowledged that these techniques are very important in helping the injured tissues to recover strength before the player returns to the game.

According to Zuluaga (1995), one of the skills of physiotherapists in dealing with team sport, is to utilize experience and/or information about the sport and relevant literature, in order to formulate and implement injury preventive conditioning programmes for that sport. The authors contend that Physiotherapy plays an integral part in the multi-disciplinary approach to the management of sports injuries. The aim of physiotherapy is to treat and fully rehabilitate the athlete post-injury, post-operatively, to prevent further injury and to return the athlete to active participation in the shortest possible time. If proper rehabilitation is not undertaken, the athlete may compete too soon, with residual instability, proprioceptive disturbance and muscle weakness and imbalances. Individual programmes must be planned and implemented for each athlete. This would include sport-specific exercises, adaptation to new postures to correct muscle imbalance, taping and strapping and a home exercise programme.

Hadara and Barrios (2009) stated that physiotherapists, with their expertise in body mechanics, anatomy, and physiology could play a fundamental role in helping people develop appropriate and safe exercise programmes and injury prevention advice. The
authors acknowledged that Physiotherapy has an important role to play in the prevention of soccer injuries. Physiotherapists encapsulate many therapeutic techniques used in the treatment of sports injuries. These include manual therapy, electrotherapy and exercise physiology such as specific soft tissue mobilizations, re-education of proprioception, stretching, rehabilitative specific exercises for flexibility, strength, endurance and power, and taping and bracing. Furthermore the authors concluded by acknowledging that other techniques include massage, cryotherapy and other electrotherapy modalities such as heat, TENS, ultrasound and inferential therapy. All these techniques contribute greatly to sports injury treatment as well as injury prevention and enable the athlete to regain his pre-injury level of sport through a well-scheduled rehabilitation programme.

Conclusion

All the studies reviewed agree that the prevalence of soccer injuries is high in soccer players, regardless of age, gender and skill level. The ankle in adolescent soccer players was the most commonly injured location followed by the knee. Some studies reported shin injuries in adolescent soccer players. Not using protective equipment was found to be directly related to the risk factors of soccer injuries. The recommendation in the study done by Fuller et al. (2006) is that prospective cohort designs should be followed to minimize the occurrence of errors associated with recall in retrospective studies. However, cohort designs require the medical personnel to assess and record injuries. In Rwanda there is still a lack of such resources in high schools therefore this study was conducted retrospectively to achieve the objectives.
CHAPTER THREE
METHODOLOGY

3.1 INTRODUCTION
This chapter describes the research setting, the study design and the rationale of the study as well as the implementation of sampling techniques in the targeted group. The methods of data collection and data analysis are explained as well as the description of the pilot study. This chapter ends with the ethical considerations of the study.

3.2 RESEARCH SETTING
The study was conducted in public and private high schools situated in Kigali, Rwanda. Currently there are 5 public high schools and 25 independent high schools in Kigali and each high school has a soccer team. Public high schools are the schools that are fully supported by the government, whereas private schools are the schools to which the government contributes 50% and the schools founders 50%. Each government high school has ± 1200 students compared to ± 900 students in the private school. Altogether the schools accommodate ± 28500 students (UNICEF, 2010).

3.3 STUDY DESIGN
A descriptive quantitative study design was used to describe and quantify the epidemiology of, and risk factors to soccer related injuries in high school. A cross-sectional survey was used to collect information on epidemiology and risk factors at a point in time. This study design is best suited to studies aimed at finding the prevalence of a situation, problem, attitudes or issues as it requires only one contact with the study
population (Katzenellenbogen & Joubert, 2002). The data were retrospectively collected from the previous season of 2010.

3.4 STUDY POPULATION AND SAMPLE

The eligible study participants were high school students from selected high schools who were soccer players in their respective schools. The study used only male soccer teams at the selected schools. Among the 30 high schools identified, only 12 schools had male soccer teams. Each school had only one soccer team. All 12 school teams participated in this study. Each team had 30 soccer players which gives a total sample of 360 players that participated in this study. At the time of data collection 10 participants were sick and 14 were no longer studying at the selected schools. Finally, a total of 336 soccer players were contacted to participate in the study and every soccer player had an equal chance of participating in the study.

1.5 DATA COLLECTION

3.5.1 TOOLS OF DATA COLLECTION.

To address the objectives of the study, a self-administered questionnaire using closed-ended questions was used to collect data. The researcher had pre-established questions and pre-set response categories in the form of spreadsheets on which quantitative data had to be recorded. The pre-established questionnaire was adapted from a validated one which has been used in a previous study on amateur male soccer players in Rwanda by Twizere and Frantz (2007). The content of this validated questionnaire included demographic data, injuries sustained, injury dates, injury status,
management received, availability of and need for physiotherapy services, preventive programmes and nutritional advice. The questionnaire constructed by the researcher highlighted almost the same information as that reported in the validated one.

The questionnaire was comprised of five different sections, all with close-ended questions. Section “A” comprised of seven questions about basic personal information. Section “B” only has a single question about the frequency of play, Section “C” also has a single question about the players position, section “D” comprised of four questions requesting the information related to injury prevention programmes, section “E” comprised of two questions about the surface, and section “F” comprised of six questions about the injury history. The questionnaire had an identification number for reference purpose. The questionnaire was made up of 19 questions. 6 were fill in type questions and 13 were “yes” or “no” questions.

3.5.2 PILOT STUDY

A pilot study was carried out to assess whether the participants understood questions asked and also how long it would take to complete the questionnaire. The pilot study was conducted on twenty players conveniently selected from different teams. The subjects of the pilot study were automatically excluded from the main study in order to avoid biased responses. According to De Vos, Strydom, Fouché and Delport (2002), a pilot study offers the researcher the opportunity of testing the effectiveness of the questionnaire. The changes which were noted helped to design a more appropriate instrument that was well understood by the participants. The major changes were on the section assessing the injury history as previously constructed, there was not a part
indicating whether the injury occurred during training sessions or competitive matches. In order to allow good flow, the missing part has been added. Minor modifications were made to a small number of questions to improve their clarity.

3.5.3 VALIDITY

Validity determines the extent to which an instrument measures what it is supposed to measure (Sarantakos, 2005). The validity of the original questionnaire was ensured in previous studies (Twizere & Frantz, 2007). To check content validity of the instrument, it was sent to experts in the field of sport medicine for review. Few changes were made in the questionnaire concerning its quality, clarity and understanding.

3.5.4 RELIABILITY

Reliability is referred to as the ability of the instrument to produce consistent results when the measurement is repeated on more than one occasion (Sarantakos, 2005). The instruments were adapted from one which had their validity and reliability established. The adapted questionnaire was tested and retested during the pilot study. The retest was done after one week and a comparison was made between the two measurements. Spearmen’s correlation coefficient ranging between 0.896 and 1 was reported. There were high similarities between the two sets of data collected. Therefore, the results of the data extracted ascertained that the instrument was reliable for the exercise.
3.5.5 Translation

Prior to the fieldwork the instrument for this study had to be translated. The questionnaire originally constructed in English by the researcher, was translated into Kinyarwanda to enhance the understanding for the respondent. To ensure the validity of the tool, one linguistic professional did translations from English to Kinyarwanda and one other translator translated it back into English. To ensure validity of the translated questionnaires in Kinyarwanda, the questionnaires were taken to the Department of Linguistics in the Ministry of Education, Rwanda to be examined and the translated version was found to be accurate.

3.6 PROCEDURE

3.6.1 Training of assistants

Two physiotherapists were provided with a two day training programme. The purpose of the training was to explain the study in general, the aim of the study, as well as all ethical considerations. They were provided with a detailed explanation of the data collection procedures and their role in the study. After the pilot studies, the researcher held a meeting with the assistants to discuss the difficulties encountered and the way forward.

3.6.2 Data collection

After obtaining ethical clearance from the University of the Western Cape (5 October, 2011) and permission from relevant authorities in Rwanda (27 December, 2010) participants were found in their respective schools. Sport educators were met for an
introduction and appointment. The researcher introduced himself and the research assistants and explained what the study was all about. The objectives of the study as well as all ethical issues were explained to them. Once agreed, appointments were made, often after consulting the sport educator in order to avoid any interference with their training sessions. Despite the fact that the participants information sheet of each questionnaire requested the respondents to participate in the study, verbal explanations were provided either in a group or individually to obtain consent. Most of the questionnaires were administered during the free time of the participants in training camps. Questionnaires were distributed and collected on the same day to ensure maximum response rate. The questionnaires were administered and collected by the researcher and his assistants. The data collection started on 20th January and ended on 10th March 2011.

3.7 DATA ANALYSIS

Prior to data entry, questionnaires were checked for completeness. Double data entry was done to ensure correct entry of data using a Microsoft Excel spreadsheet. Thereafter, the clean data was transferred into Statistical Package for Social Sciences (SPSS) software program 19.0 version for data analysis. Descriptive statistics was employed to summarize the demographic data of the study sample. The demographic data was presented using frequency tables and expressed as percentages, means and standard deviations. Chi-square test was used to test if any associations existed between soccer injuries and social-demographic variables as well as surfaces played on. All tests were done at level of significance $P < 0.05$. The choice of this modal is
based on the fact that the dependent and independent variables are categorical. Codex
(2009) acknowledged that the chi-square test is used to identify any significant
difference between the expected frequencies and observed frequencies in one or more
categories.

3.8 ETHICAL CONSIDERATIONS
Permission was obtained from the Senate Research Grant and Study Leave Committee
of the University of the Western Cape (UWC) to conduct the study. Thereafter,
permission was also obtained from the Rwandan Ministry of Education. In addition the
following guide lines were followed:

- The purpose of the study was explained to the participants by means of
  information sheets.
- Participants were assured of strict confidentiality of the information provided.
- Informed, written consent was required from each participant and from
  parents/guardians for participants younger than eighteen years.
- Participation in the study was voluntary and participants were assured of
  anonymity, as well as their right to withdraw from the study at any time without
  any prejudice.
- All participants were treated with respect and dignity.
- Questionnaires were available in English and Kinyarwanda as these are the
  official language of Rwanda.
- Anonymity was assured by using instead of names for identification.
- Completed questionnaires were stored in a secure place.
The participants were informed that the findings would be made available to The Rwandan Ministry of Education (MINEDUC).
CHAPTER FOUR

RESULTS

4.1 INTRODUCTION
In this chapter, the descriptive and inferential statistic results of the study are presented. The descriptive results mainly present the demographic and background characteristics of the study participants. The headings reflect a general picture of the epidemiology of soccer injuries in Rwandan high schools by giving injury prevalence, affected body parts, mechanisms, severity of injuries sustained and professional management received by soccer players. Finally the section ends by illustrating the risk factors related to soccer injuries.

4.2 Description of study population and sample
Three hundred sixty (N=360) self administered questionnaires were distributed to high school soccer players in Kigali city. 336 questionnaires were answered; yielding an overall response rate of 93% (336 players). The respondents were aged between 11 and 26 years with the mean age, being 16.8 years; (SD= 3.38 years) only males were included. The team’s median age was 17 years and modal age 18 years. About 87.5% of the players were younger than 19 years. The participant’ weights ranged from 35kgs to 82kgs with a mean weight of 59.7kgs (SD=7.8). The majority of the participants were in a weight group from 57kgs to 67kgs (n=184, 54.8 %). The participants' height ranged from 1.37m to 1.95m with a men height of 1.6m (SD=0.1) the majority of participants were in a height group ranging from 1.59m to 1.69m (n=144, 42.9%). Table 4.1 illustrates sociol demographic information.
Table 4.1: The percentage distribution of socio-demographic characteristics

(N=336)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency (n &amp; %)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
</tr>
<tr>
<td>11-15 years</td>
<td>98 (29.2%)</td>
</tr>
<tr>
<td>16-20 years</td>
<td>223 (66.3%)</td>
</tr>
<tr>
<td>20 years and above</td>
<td>15 (4.5%)</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td></td>
</tr>
<tr>
<td>35-45 kgs</td>
<td>12 (3.6%)</td>
</tr>
<tr>
<td>46-56 kgs</td>
<td>87 (25.6%)</td>
</tr>
<tr>
<td>57-67 kgs</td>
<td>184 (54.1%)</td>
</tr>
<tr>
<td>68-78 kgs</td>
<td>49 (15.5%)</td>
</tr>
<tr>
<td>79 kgs and above</td>
<td>4 (1.2%)</td>
</tr>
<tr>
<td><strong>Height</strong></td>
<td></td>
</tr>
<tr>
<td>1.37-1.47 m</td>
<td>10 (3.0%)</td>
</tr>
<tr>
<td>1.48-1.58 m</td>
<td>65 (19.3%)</td>
</tr>
<tr>
<td>1.59-1.69 m</td>
<td>144 (42.9%)</td>
</tr>
<tr>
<td>1.70-180 m</td>
<td>103 (30.7%)</td>
</tr>
<tr>
<td>1.81 m and above</td>
<td>14 (4.1%)</td>
</tr>
<tr>
<td><strong>BMI</strong></td>
<td></td>
</tr>
<tr>
<td>Under weight</td>
<td>30 (9.2)</td>
</tr>
<tr>
<td>Normal weight</td>
<td>275 (81.8)</td>
</tr>
<tr>
<td>Over weight</td>
<td>26 (7.7)</td>
</tr>
<tr>
<td>Obese</td>
<td>4 (1.3)</td>
</tr>
<tr>
<td><strong>Playing position</strong></td>
<td></td>
</tr>
<tr>
<td>Defenders</td>
<td>92 (27.4%)</td>
</tr>
<tr>
<td>Midfielders</td>
<td>62 (18.4%)</td>
</tr>
<tr>
<td>Wingback</td>
<td>47 (14.1%)</td>
</tr>
<tr>
<td>Strikers</td>
<td>87 (25.9%)</td>
</tr>
<tr>
<td>Goal keepers</td>
<td>48 (14.2%)</td>
</tr>
<tr>
<td><strong>Leg dominance</strong></td>
<td></td>
</tr>
<tr>
<td>Right footed</td>
<td>294 (87.5)</td>
</tr>
<tr>
<td>Left footed</td>
<td>42 (12.5)</td>
</tr>
<tr>
<td><strong>Starting age</strong></td>
<td></td>
</tr>
<tr>
<td>6-10 years</td>
<td>134 (39.5%)</td>
</tr>
<tr>
<td>11-15 years</td>
<td>180 (53.7%)</td>
</tr>
<tr>
<td>16 years and above</td>
<td>22 (6.8%)</td>
</tr>
<tr>
<td><strong>Highest playing level</strong></td>
<td></td>
</tr>
<tr>
<td>Club</td>
<td>294 (87.5)</td>
</tr>
<tr>
<td>Provincial</td>
<td>25 (7.5%)</td>
</tr>
<tr>
<td>National</td>
<td>17 (5.0%)</td>
</tr>
</tbody>
</table>
4.3 INJURY PREVALENCE

Injury prevalence was calculated from the total number of players in the teams who sustained one or more injuries at any time, while participating in training or in competitive soccer activity during the last season. Of the participants, 251 reported that they had sustained an injury during the past season. However, among those who reported having sustained an injury, 337 injuries were reported. The overall injury prevalence revealed within the sample of this study was 74.7% (251 players), 77.2% of all injuries sustained were recurrent. Of the players injured, 69.7% (n=235) were injured during matches and 30.3% (n=102) during training sessions the results are presented in Table. 4.2.

Table 4.2 Frequency distribution of injuries (N=337)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>N/n &amp; (%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants injured</td>
<td>251 (74.7)</td>
<td></td>
</tr>
<tr>
<td>Injury sustained in training</td>
<td>102 (30.3)</td>
<td>0.3</td>
</tr>
<tr>
<td>Injury sustained in match</td>
<td>235 (69.7)</td>
<td>0.8</td>
</tr>
<tr>
<td>Recurrent injury</td>
<td>260 (77.2)</td>
<td>0.04*</td>
</tr>
</tbody>
</table>

*Level of significance, p < 0.05

Players were divided into three age categories, namely 11-15 years, 16-20 years and 21 and above and into four weight categories namely 35-45kgs, 46-56kgs, 57-67kgs and 68 and above. The majority of the injuries (n=124, 49.6 %) were sustained by the 16-20 years old category. No relationship between injury prevalence and age categories was found as indicated by the chi-square test (p >0.05). According to weight category, the majority of injuries were found in the weight group of 57kg-67kg (n=101, 40.2%). No relationship between injury prevalence and weight categories was found as indicated by chi-square test (p>0.05). Concerning the height category, the majority of injuries were in
height group of 1.59m-1.69m (n=72, 28.8%). The chi-square test indicated a significant relationship between injury prevalence and height of players (p-value < 0.05). The body mass index (BMI) was calculated from measured height and weight for the participants in the study. The sample was divided into four categories according to their BMI, i.e. under weight (<18.5), normal (18.5-24.9), overweight (25-29.9 and obese (>30). The mean BMI for the study sample was 21.9 (SD= 2.6) as illustrated in table 4.4. The majority of participants had normal weight (61.0%, n=153). Furthermore, the BMI did not shown a significant relationship with injury occurrence (P=0.2>0.05). According to the starting age group, the majority of injuries were found in the starting age category of 11-15 years old (n=93, 36.9%). The chi-square test did not show a significant relationship between injury and starting age of players (p-value=0.05) the results are shown in Table 4.3.
Table 4.3: Distribution of injury prevalence according to age, weight, height, BMI and Starting age (n=251)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Injured (n &amp; %)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Agegroup</strong></td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>11-15</td>
<td>53 (21.1)</td>
<td></td>
</tr>
<tr>
<td>16-20</td>
<td>124 (49.6)</td>
<td></td>
</tr>
<tr>
<td>21 and above</td>
<td>10 (3.9)</td>
<td></td>
</tr>
<tr>
<td><strong>Weightgroup</strong></td>
<td></td>
<td>0.1</td>
</tr>
<tr>
<td>35-45</td>
<td>8 (3.3)</td>
<td></td>
</tr>
<tr>
<td>46-56</td>
<td>45 (17.9)</td>
<td></td>
</tr>
<tr>
<td>57-67</td>
<td>101 (40.2)</td>
<td></td>
</tr>
<tr>
<td>68-78</td>
<td>31 (12.2)</td>
<td></td>
</tr>
<tr>
<td>79 and above</td>
<td>3 (1.2)</td>
<td></td>
</tr>
<tr>
<td><strong>Heightgroup</strong></td>
<td></td>
<td>0.01*</td>
</tr>
<tr>
<td>1.37-1.47</td>
<td>6 (2.3)</td>
<td></td>
</tr>
<tr>
<td>1.48-1.58</td>
<td>37 (14.6)</td>
<td></td>
</tr>
<tr>
<td>1.59-1.69</td>
<td>72 (28.8)</td>
<td></td>
</tr>
<tr>
<td>1.70-1.80</td>
<td>64 (25.6)</td>
<td></td>
</tr>
<tr>
<td>1.81 and above</td>
<td>9 (3.6)</td>
<td></td>
</tr>
<tr>
<td><strong>BMI categories</strong></td>
<td></td>
<td>0.2</td>
</tr>
<tr>
<td>Under weight</td>
<td>18 (7.1)</td>
<td></td>
</tr>
<tr>
<td>Normal weight</td>
<td>153 (61.0)</td>
<td></td>
</tr>
<tr>
<td>Over weight</td>
<td>14 (5.7)</td>
<td></td>
</tr>
<tr>
<td>Obese</td>
<td>2 (0.9)</td>
<td></td>
</tr>
<tr>
<td><strong>Starting age group</strong></td>
<td></td>
<td>0.05</td>
</tr>
<tr>
<td>6-10</td>
<td>81 (32.4)</td>
<td></td>
</tr>
<tr>
<td>11-15</td>
<td>93 (36.9)</td>
<td></td>
</tr>
<tr>
<td>16 and above</td>
<td>14 (5.4)</td>
<td></td>
</tr>
</tbody>
</table>

*Level of significance, p < 0.05
4.4 Injury prevalence and player position

The majority of players injured were defenders (n=57, 22.6%) as illustrated in Table 4.4. The chi-square test did not show any significant relationship between injury occurrence and player position (p-value=0.1 >0.05).

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Injured (n &amp; %)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defender</td>
<td>57 (22.6)</td>
<td>0.1</td>
</tr>
<tr>
<td>Striker</td>
<td>48 (19.0)</td>
<td></td>
</tr>
<tr>
<td>Midfielder</td>
<td>34 (13.7)</td>
<td></td>
</tr>
<tr>
<td>Wingback</td>
<td>26 (10.4)</td>
<td></td>
</tr>
<tr>
<td>Goalkeeper</td>
<td>22 (8.9)</td>
<td></td>
</tr>
</tbody>
</table>

*Level of significance, p < 0.05

4.5 Body part injured

The most affected part in the lower extremities and in the whole body in general was the ankle (26.5%). The injuries reported in this study showed that the lower extremities were more commonly affected than upper extremities. 78% of all injuries were found in lower extremities. The results are presented in Table 4.5.
Table 4.5 Location of injury to different body parts (n=251)

<table>
<thead>
<tr>
<th>Body part injured</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ankle</td>
<td>26.5</td>
</tr>
<tr>
<td>Knee</td>
<td>19.4</td>
</tr>
<tr>
<td>Shin</td>
<td>18.3</td>
</tr>
<tr>
<td>Thigh</td>
<td>4.6</td>
</tr>
<tr>
<td>Arm</td>
<td>3.6</td>
</tr>
<tr>
<td>Toes</td>
<td>3.4</td>
</tr>
<tr>
<td>Foot</td>
<td>3.6</td>
</tr>
<tr>
<td>Head</td>
<td>3.4</td>
</tr>
<tr>
<td>Back</td>
<td>2.8</td>
</tr>
<tr>
<td>Elbow</td>
<td>2.8</td>
</tr>
<tr>
<td>Calf</td>
<td>2.4</td>
</tr>
<tr>
<td>Shoulder</td>
<td>2.2</td>
</tr>
<tr>
<td>Hand</td>
<td>1.8</td>
</tr>
<tr>
<td>Wrist</td>
<td>1.7</td>
</tr>
<tr>
<td>Neck</td>
<td>1.5</td>
</tr>
<tr>
<td>Chest</td>
<td>1.5</td>
</tr>
<tr>
<td>Buttock</td>
<td>0.5</td>
</tr>
</tbody>
</table>
**Table 4.6: Frequency distribution of location of injuries and player position**  
(n=251)

<table>
<thead>
<tr>
<th>Location of injury</th>
<th>Defender</th>
<th></th>
<th>Striker</th>
<th></th>
<th>Midfielder</th>
<th></th>
<th>Wing Back</th>
<th></th>
<th>Goal Keeper</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Ankle</td>
<td>21</td>
<td>8.4</td>
<td>17</td>
<td>6.7</td>
<td>13</td>
<td>5.2</td>
<td>6</td>
<td>2.4</td>
<td>7</td>
<td>2.8</td>
</tr>
<tr>
<td>Knee</td>
<td>16</td>
<td>6.4</td>
<td>13</td>
<td>5.2</td>
<td>8</td>
<td>3.2</td>
<td>4</td>
<td>1.5</td>
<td>4</td>
<td>1.5</td>
</tr>
<tr>
<td>Shin</td>
<td>11</td>
<td>4.4</td>
<td>8</td>
<td>3.2</td>
<td>16</td>
<td>6.4</td>
<td>11</td>
<td>4.4</td>
<td>5</td>
<td>2.0</td>
</tr>
<tr>
<td>Thigh</td>
<td>4</td>
<td>1.5</td>
<td>4</td>
<td>1.5</td>
<td>2</td>
<td>0.8</td>
<td>1</td>
<td>0.4</td>
<td>2</td>
<td>0.8</td>
</tr>
<tr>
<td>Arm</td>
<td>3</td>
<td>1.2</td>
<td>3</td>
<td>1.2</td>
<td>1</td>
<td>0.4</td>
<td>2</td>
<td>0.8</td>
<td>2</td>
<td>0.8</td>
</tr>
<tr>
<td>Toes</td>
<td>4</td>
<td>1.5</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1.2</td>
<td>1</td>
<td>0.4</td>
<td>2</td>
<td>0.8</td>
</tr>
<tr>
<td>Foot</td>
<td>3</td>
<td>1.2</td>
<td>2</td>
<td>0.8</td>
<td>3</td>
<td>1.2</td>
<td>1</td>
<td>0.4</td>
<td>2</td>
<td>0.8</td>
</tr>
<tr>
<td>Head</td>
<td>4</td>
<td>1.5</td>
<td>1</td>
<td>0.4</td>
<td>1</td>
<td>0.4</td>
<td>2</td>
<td>0.8</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Back</td>
<td>2</td>
<td>0.8</td>
<td>1</td>
<td>0.4</td>
<td>1</td>
<td>0.4</td>
<td>1</td>
<td>0.4</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Elbow</td>
<td>2</td>
<td>0.8</td>
<td>1</td>
<td>0.4</td>
<td>1</td>
<td>0.4</td>
<td>1</td>
<td>0.4</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Calf</td>
<td>1</td>
<td>0.4</td>
<td>2</td>
<td>0.8</td>
<td>1</td>
<td>0.4</td>
<td>1</td>
<td>0.4</td>
<td>2</td>
<td>0.8</td>
</tr>
<tr>
<td>Shoulder</td>
<td>1</td>
<td>0.4</td>
<td>3</td>
<td>1.2</td>
<td>2</td>
<td>0.8</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Hand</td>
<td>2</td>
<td>0.8</td>
<td>2</td>
<td>0.8</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Wrist</td>
<td>2</td>
<td>0.8</td>
<td>1</td>
<td>0.4</td>
<td>2</td>
<td>0.8</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Neck</td>
<td>2</td>
<td>0.8</td>
<td>1</td>
<td>0.4</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0.4</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Chest</td>
<td>2</td>
<td>0.8</td>
<td>1</td>
<td>0.4</td>
<td>1</td>
<td>0.4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Buttock</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0.4</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>80</strong></td>
<td><strong>30.8</strong></td>
<td><strong>60</strong></td>
<td><strong>22.5</strong></td>
<td><strong>56</strong></td>
<td><strong>21.3</strong></td>
<td><strong>32</strong></td>
<td><strong>12.3</strong></td>
<td><strong>33</strong></td>
<td><strong>13.1</strong></td>
</tr>
</tbody>
</table>

The results show that defenders had the highest number of ankle injuries 8.4% (n=21) followed by strikers 6.7% (n=17), Midfielders 5.2% (n=13), Goal Keepers 2.8 (n=7) and Wing Back 2.4 % (n=6). The Defenders had more knee injuries 6.4% (n=16) followed by the strikers 5.2% (n=13), midfielders 3.2% (n=8) and wing backs 1.5% (n=4). The Midfielders had the highest number of injuries at the shin 6.4% (n=16), followed by
defenders and Wing Back 4.4 (n=11), Strikers 3.2% (n=8) and goal keepers 2.0% (n=5).
The other body parts had a low percentage of injury, the buttock being the lowest part
injured regardless of player position.

4.6 MECHANISM OF SOCCER RELATED INJURIES

Table 4.7 lists the mechanisms by which the players were commonly injured during
training and matches. Players could indicate more than one mechanism. The majority
of injuries (n=61, 24.2%) were due to colliding with another player, followed by tackled
(n=51, 20.2%), tackling (n=40, 15.8%), falling (30, 11.8%) and landing (23, 9.2). The
results are shown in table 4.7.

Table 4.7 Distribution of mechanism of injuries (n=251)

<table>
<thead>
<tr>
<th>Mechanism</th>
<th>Injured (n&amp;%)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collision</td>
<td>61 (24.2)</td>
<td>0.2</td>
</tr>
<tr>
<td>Tackled</td>
<td>51 (20.2)</td>
<td>0.6</td>
</tr>
<tr>
<td>Tackling</td>
<td>40 (15.8)</td>
<td>0.5</td>
</tr>
<tr>
<td>Falling</td>
<td>30 (11.8)</td>
<td>0.04*</td>
</tr>
<tr>
<td>Landing</td>
<td>23 (9.2)</td>
<td>0.3</td>
</tr>
<tr>
<td>Turning</td>
<td>14 (5.6)</td>
<td>0.4</td>
</tr>
<tr>
<td>Heading</td>
<td>14 (5.5)</td>
<td>0.01*</td>
</tr>
<tr>
<td>Shooting</td>
<td>11 (4.3)</td>
<td>0.6</td>
</tr>
<tr>
<td>Jumping</td>
<td>7 (3.4)</td>
<td>0.7</td>
</tr>
</tbody>
</table>

*Players could choose more than one mechanism, *Level of significance, p < 0.05
The test chi-square test revealed a significant relationship between heading (p= 0.01 < 0.05) as well as falling (p= 0.04 < 0.05) and injury occurrence. All other mechanisms of injury did not show a relationship between injury occurrence and injury mechanism (p> 0.05).

4.7 Injury characteristics

Table 4.8 Illustrates the characteristics of injuries sustained by Rwandan high school soccer players. As reported by soccer players, these characteristics were classified as swelling, pain, unable to bear weight through the injured site, unable to move the injured part, cracking/popping sounds, knee locking and visible internal bruising. The majority of injuries were characterised by pain 71 (28.4%), followed by swelling 52 (20.6%). All other information regarding the injury characteristics is presented in Table 4.8.

<table>
<thead>
<tr>
<th>Injury characteristics</th>
<th>Injured</th>
<th>(n &amp;%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td>71</td>
<td>28.4</td>
</tr>
<tr>
<td>Swelling</td>
<td>52</td>
<td>20.6</td>
</tr>
<tr>
<td>Unable to bear weight through the injured site</td>
<td>42</td>
<td>16.2</td>
</tr>
<tr>
<td>Unable to move the injured part</td>
<td>27</td>
<td>10.6</td>
</tr>
<tr>
<td>Cracking/popping sounds</td>
<td>26</td>
<td>10.2</td>
</tr>
<tr>
<td>Visible internal bruising</td>
<td>17</td>
<td>7</td>
</tr>
<tr>
<td>Knee locking</td>
<td>16</td>
<td>6.5</td>
</tr>
</tbody>
</table>

*Player could choose more than one injury characteristic
4.8 Severity of soccer injuries

According to the latest consensus discussions in FIFA (Federation of International Football Associations) and UEFA (Union of European Football Associations), injury severity is categorized in four categories, slight (1-3 days absence), minor (4-7 days absence), moderate (8-28 days absence) and major (>28 days absence) (Hägglund et al., 2005a; Fuller et al., 2006). The most prevalent types of injuries in terms of severity for 12 teams as illustrated in Table 4.9 is slight with 53.9% (n=135) followed by moderate injury 26.1% (n=66), minor injury accounting for 16.7% (=42) and major accounting for 3.3% (n=8).

Table 4.9 Severity of soccer injuries (n=251)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Injured (n &amp; %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severity of injury:</td>
<td></td>
</tr>
<tr>
<td>Slight</td>
<td>135 53.9</td>
</tr>
<tr>
<td>Moderate</td>
<td>66  26.1</td>
</tr>
<tr>
<td>Minor</td>
<td>42  16.7</td>
</tr>
<tr>
<td>Major</td>
<td>8   3.3</td>
</tr>
</tbody>
</table>

4.9 Use of protective equipment

Participants were requested to report on the use of protective equipment in this study. The majority of participants 61.6% reported that they did not use protective equipment. 62.0% of the participants who used protective equipment used appropriate foot wear, only 45.7% wore shin guards and 37.2% wore ankle protection as illustrated in Table 4.10.
### Table 4.10 Use of protective equipment (N=336)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Frequency (n)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of protective equipment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>129</td>
<td>38.4%</td>
</tr>
<tr>
<td>No</td>
<td>207</td>
<td>61.6%</td>
</tr>
<tr>
<td>Use of protective equipment in match</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>273</td>
<td>81.4%</td>
</tr>
<tr>
<td>No</td>
<td>63</td>
<td>18.6%</td>
</tr>
<tr>
<td>Use of protective equipment in training</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>162</td>
<td>48.1%</td>
</tr>
<tr>
<td>No</td>
<td>174</td>
<td>51.9%</td>
</tr>
<tr>
<td>Use of Shin guard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>154</td>
<td>45.7%</td>
</tr>
<tr>
<td>No</td>
<td>182</td>
<td>54.3%</td>
</tr>
<tr>
<td>Use of ankle protection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>125</td>
<td>37.2%</td>
</tr>
<tr>
<td>No</td>
<td>211</td>
<td>62.8%</td>
</tr>
<tr>
<td>Use of appropriate foot wear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>208</td>
<td>62.0%</td>
</tr>
<tr>
<td>No</td>
<td>128</td>
<td>38.0%</td>
</tr>
</tbody>
</table>

Players who wore protective equipment were also asked to report how often they wore protective equipment. Only 7.0% always wore ankle protection in training whereas 40% always wore it in match, 12.4% wore it very often in training whereas 46% very often wore it in match, 17.1% wore it often in training whereas 34.6% often wore it in match.
and 31.8% wore it sometimes in training whereas 59.3 some times wore it in match, the results are illustrated in Table 4.11.

Table 4.11 The frequency of use of protective equipment in training and matches (N=336)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Training</th>
<th>Matches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Always</td>
<td>24</td>
<td>7.0</td>
</tr>
<tr>
<td>Very often</td>
<td>42</td>
<td>12.4</td>
</tr>
<tr>
<td>Often</td>
<td>57</td>
<td>17.1</td>
</tr>
<tr>
<td>Sometimes</td>
<td>107</td>
<td>31.8</td>
</tr>
</tbody>
</table>

4.10 The playing surfaces and their condition when injury occured

The participants were requested to indicate the types of playing surface and its condition at the time of injury. The majority of players were injured on grass surface 55.4% (n=186), followed by artificial 18.5% (n=62) and hard 0.9% (n=3). The chi-square test did not show a significant relationship between playing surfaces and injury prevalence (p-value= 0.5 > 0.05). A dry surface had more injuries 40.8% (n=137) compared to a wet surface 33.9% (n=114). The chi-square test showed a significant relationship between the condition of playing surfaces and injury prevalence (p-value=0.00 < 0.05). The results are presented in Table 4.12 and 4.13.
Table 4.12 Frequency distribution of surfaces of train and injury occurrence
(n=251)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Injured (n &amp; %)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface</td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>Grass</td>
<td>186 (55.4)</td>
<td></td>
</tr>
<tr>
<td>Artificial</td>
<td>62 (18.5)</td>
<td></td>
</tr>
<tr>
<td>Hard</td>
<td>3 (0.9)</td>
<td></td>
</tr>
</tbody>
</table>

*Level of significance, p < 0.05

Table 4.13 Frequency distribution of surface condition (n=251)

<table>
<thead>
<tr>
<th>Surface condition</th>
<th>Injured (n &amp; %)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>137 (40.8)</td>
<td>0.00*</td>
</tr>
<tr>
<td>Wet</td>
<td>114 (33.9)</td>
<td>0.00*</td>
</tr>
</tbody>
</table>

4.11 The training and match surfaces when the injury occurred

Participants were requested to indicate the type of playing surface at the time of injury during both training and matches. The majority of the participants indicated grass as a surface of more injuries for both training (23.1%) and matches (58.3%) as outlined in the Table 4.14.
Table 4.14 The training and match surfaces when the injury occurred

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency (n)</th>
<th>Percentage (%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training surface</td>
<td></td>
<td></td>
<td><strong>0.6</strong></td>
</tr>
<tr>
<td>Artificial</td>
<td>1</td>
<td>8.3</td>
<td></td>
</tr>
<tr>
<td>Hard</td>
<td>1</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>Grass</td>
<td>53</td>
<td>23.1</td>
<td></td>
</tr>
<tr>
<td>Match surface</td>
<td></td>
<td></td>
<td><strong>0.4</strong></td>
</tr>
<tr>
<td>Artificial</td>
<td>45</td>
<td>18.4</td>
<td></td>
</tr>
<tr>
<td>Floor</td>
<td>1</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>Grass</td>
<td>143</td>
<td>58.3</td>
<td></td>
</tr>
</tbody>
</table>

*Level of significance, p < 0.05

The chi-square test did not show a significant relationship between playing surface and injury occurrence (p>0.05). However most soccer injuries occur on grass surfaces.

4.12 Injury professional management and medical clearance to return to play

The participants were asked to report if they had received professional management of their injuries and if they were medically cleared to return to play. Among 251 injured participants, only 33.7% (n=85) received professional treatment. Eighty five (33.7%) of participants received professional management, only 39.8% (n=35) were medically cleared to return to play. The majority of participants who did not receive professional management had recurrent injuries 66.3% (n=166). The results are shown in Table 4.15
Table 4.15 Participants who received Injury professional management and medical clearance to return to play (n=251)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Characteristic</th>
<th>Injured (n &amp; %)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional management received</td>
<td>Physiotherapy</td>
<td>40 16.1</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>Doctor consultation</td>
<td>65 25.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Postoperative rehabilitation</td>
<td>19  7.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operation</td>
<td>23  9.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medication</td>
<td>69 27.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bracing</td>
<td>35 14</td>
<td></td>
</tr>
</tbody>
</table>

*team has neither a physiotherapist nor a medical doctor, *Level of significance, p < 0.05.

4.13 Techniques used to minimize soccer injuries

Participants were requested to report the techniques they performed in their soccer practices to minimize injury occurrence. Only 28.6% reported that they did warming up and cooling down exercises before and after training. The chi-square test did not show a relationship between injury occurrence and warm up and cooling-down before and after training (p= 0.1> 0.05). 43.7% participants reported that they performed warming-up and cooling-down exercises before and after matches. The chi-square test showed a significant relationship between injury occurrence and doing warm-up before and cooling-down exercises before and after matches (p=0.03 < 0.05). However among all participants who did warming-up and cooling-down exercises 24.7% did it for less than 15 minutes, 30% did it for about fifteen minutes, and 13.3% did it for more than 15
minutes. The test chi-square did not show a relationship between injury occurrence and duration of warm up and cooling down (p=0.7 > 0.05). The increase of injury prevalence was found in players who did not do warming-up and cooling-down exercises in training 61.6% as well as in matches 71.4%. The participants also reported about the activities they performed during warm-up and cooling-down. 13.3% did running, 19.2% did jogging, 22.6 did static stretching, 15.7% did dynamic stretching, 18.1% did soccer specific drills and 11.3 % did walking. The chi-square test did not show a relationship between warm-up and cool-down in training as well as in matches. Among the activities reported above the test chi-square showed a significant relationship only between static stretching (p=0.00 <0.05) and dynamic stretching (p=0.04 <0.05). The results are presented in Table 4.16.
Table 4.16 Techniques used to minimize soccer injuries (N=336)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Frequency (n)</th>
<th>Percentage%</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warming-up and Cooling-down before And after training</td>
<td>94</td>
<td>28.6</td>
<td>0.1</td>
</tr>
<tr>
<td>Warming-up and Cooling-down before And after match</td>
<td>147</td>
<td>43.7</td>
<td>0.03</td>
</tr>
<tr>
<td>Duration of warm-up And cooling-down &lt;15 min</td>
<td>30</td>
<td>24.7</td>
<td>0.7</td>
</tr>
<tr>
<td>About 15 min</td>
<td>36</td>
<td>30.0</td>
<td></td>
</tr>
<tr>
<td>&gt;15 min</td>
<td>16</td>
<td>13.3</td>
<td></td>
</tr>
</tbody>
</table>

**Activities performed During cool down and Warm up**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Frequency (n)</th>
<th>Percentage%</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static stretching</td>
<td>27</td>
<td>22.6</td>
<td>0.00*</td>
</tr>
<tr>
<td>Jogging</td>
<td>23</td>
<td>19</td>
<td>0.6</td>
</tr>
<tr>
<td>Soccer specific drills</td>
<td>23</td>
<td>19.2</td>
<td>0.05</td>
</tr>
<tr>
<td>Dynamic stretching</td>
<td>19</td>
<td>15.7</td>
<td>0.04*</td>
</tr>
<tr>
<td>Running</td>
<td>60</td>
<td>50</td>
<td>0.3</td>
</tr>
<tr>
<td>Walking</td>
<td>14</td>
<td>11.3</td>
<td>0.9</td>
</tr>
</tbody>
</table>

*Level of significance, p < 0.05

4.14 Number of playing sessions per week and injury prevalence

Participants were requested to report the number of training sessions per week, gym sessions, as well as the number of match sessions and how long in minutes they train and play per match per week as illustrated in table 4.17. 7.4 % (n=25) of the
participants did 1-2 training sessions per week, 56.6% (n=190) did 3-4 sessions and 36.0% (n=121) did 5 sessions and above. The chi-square test shown a significant relationship between injury occurrence and the number of matches per week (P=0.00 <0.05). The chi-square test showed a significant relationship between injury prevalence and minutes of training and playing matches per week (P= 0.03 < 0.05). The results are presented in Table 4.17.

**Table 4.17 Frequency distribution of number of playing sessions per week and Injury prevalence (n=251)**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Injured (n &amp; %)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training sessions/week</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-2</td>
<td>19 7.4</td>
<td>0.06</td>
</tr>
<tr>
<td>3-4</td>
<td>142 56.6</td>
<td></td>
</tr>
<tr>
<td>5 and above</td>
<td>90 36.0</td>
<td></td>
</tr>
<tr>
<td>Gym sessions/week</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>24 9.5</td>
<td>0.04*</td>
</tr>
<tr>
<td>1-2</td>
<td>101 40.2</td>
<td></td>
</tr>
<tr>
<td>3-4</td>
<td>83 33.0</td>
<td></td>
</tr>
<tr>
<td>5 and above</td>
<td>43 17.3</td>
<td></td>
</tr>
<tr>
<td>Match sessions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>10 3.9</td>
<td>0.03*</td>
</tr>
<tr>
<td>1-2</td>
<td>145 59.8</td>
<td></td>
</tr>
<tr>
<td>3-4</td>
<td>59 23.5</td>
<td></td>
</tr>
<tr>
<td>5 and above</td>
<td>32 12.8</td>
<td></td>
</tr>
<tr>
<td>Training minutes/week</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-120</td>
<td>99 39.6</td>
<td>0.00*</td>
</tr>
<tr>
<td>121-211min</td>
<td>58 23.2</td>
<td></td>
</tr>
<tr>
<td>212-302min</td>
<td>28 11.0</td>
<td></td>
</tr>
<tr>
<td>303-393min</td>
<td>47 18.8</td>
<td></td>
</tr>
<tr>
<td>394-484min</td>
<td>12 4.8</td>
<td></td>
</tr>
<tr>
<td>485&gt;</td>
<td>7 2.7</td>
<td></td>
</tr>
<tr>
<td>Match minute per week</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-90min</td>
<td>27 10.9</td>
<td>0.04*</td>
</tr>
<tr>
<td>91-180min</td>
<td>43 17.1</td>
<td></td>
</tr>
<tr>
<td>181-270min</td>
<td>81 32.1</td>
<td></td>
</tr>
<tr>
<td>271-360min</td>
<td>100 39.9</td>
<td></td>
</tr>
</tbody>
</table>

*Level of significance, p < 0.05*
4.15 Recovery protocol

The participants were asked to report if they used the recovery protocol and which recovery protocol they were using. More than half 62.2% (n=209) used the recovery protocol as illustrated in Table 4.18.

Table 4.18 Frequency distribution of use of recovery protocol (N=336)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Frequencies (n)</th>
<th>Percentage%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of recovery</td>
<td>Yes</td>
<td>209</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>127</td>
</tr>
<tr>
<td>Ice Baths</td>
<td>Yes</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>252</td>
</tr>
<tr>
<td>Skins</td>
<td>Yes</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>323</td>
</tr>
<tr>
<td>Stretching</td>
<td>Yes</td>
<td>190</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>146</td>
</tr>
<tr>
<td>Glutamine</td>
<td>Yes</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>215</td>
</tr>
<tr>
<td>Massage</td>
<td>Yes</td>
<td>252</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>84</td>
</tr>
</tbody>
</table>

4.16 Risk factors for soccer injuries

Risk factors for soccer injuries are conditions that influence a player’s health status and are capable of causing illness or injury, including genetic or biological risk factors, lifestyle, or environmental conditions that can lead to injury among the players.
4.16.1 The intrinsic risk factors for soccer injuries

The study results indicated that the age-group of 16-20 years old (n=167, 49.7%) is associated with increased prevalence of soccer injuries, as indicated in table 4.3, and the weight-group with highest prevalence of soccer injuries is 57-67kgs (n=135, 40.2%) and the height-group which was more prone to soccer injuries was 1.59-1.69m (n=95, 28.8%).

Table 4.19 Intrinsic risk factors associated with injury occurrence (n=251)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Injured (n &amp; %)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age-group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11-15</td>
<td>71 (21.1)</td>
<td>0.5</td>
</tr>
<tr>
<td>16-20</td>
<td>167 (49.7)</td>
<td></td>
</tr>
<tr>
<td>21 and above</td>
<td>13 (3.9)</td>
<td></td>
</tr>
<tr>
<td><strong>Weight-group</strong></td>
<td></td>
<td>0.1</td>
</tr>
<tr>
<td>35-45</td>
<td>11 (3.3)</td>
<td></td>
</tr>
<tr>
<td>46-56</td>
<td>60 (17.9)</td>
<td></td>
</tr>
<tr>
<td>57-67</td>
<td>135 (40.2)</td>
<td></td>
</tr>
<tr>
<td>68-78</td>
<td>41 (12.2)</td>
<td></td>
</tr>
<tr>
<td>79 and above</td>
<td>4 (1.2)</td>
<td></td>
</tr>
<tr>
<td><strong>Height-group</strong></td>
<td></td>
<td>0.01*</td>
</tr>
<tr>
<td>1.37-1.47</td>
<td>8 (2.4)</td>
<td></td>
</tr>
<tr>
<td>1.48-1.58</td>
<td>49 (14.6)</td>
<td></td>
</tr>
<tr>
<td>1.59-1.69</td>
<td>95 (28.3)</td>
<td></td>
</tr>
<tr>
<td>1.70-1.80</td>
<td>86 (25.6)</td>
<td></td>
</tr>
<tr>
<td>1.81 and above</td>
<td>13 (3.8)</td>
<td></td>
</tr>
<tr>
<td><strong>Injury recurrence</strong></td>
<td>194 (77.5)</td>
<td>0.04*</td>
</tr>
</tbody>
</table>

*Level of significance, p < 0.05
4.16.2 The extrinsic risk factors for soccer injuries

The study results indicated that the player's position which is associated with increased prevalence of soccer injuries is defender n=76 (22.6%) and the playing surface with highest prevalence of soccer injuries is grass surface n=186 (55.5%). The results are presented in Table 4.20.

Table 4.20 Extrinsic risk factors associated with injury occurrence (n=251)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Injured (n &amp; %)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Player's position</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defender</td>
<td>76 (22.6)</td>
<td>0.1</td>
</tr>
<tr>
<td>Striker</td>
<td>64 (19.0)</td>
<td></td>
</tr>
<tr>
<td>Midfielder</td>
<td>46 (13.7)</td>
<td></td>
</tr>
<tr>
<td>Wingback</td>
<td>35 (10.4)</td>
<td></td>
</tr>
<tr>
<td>Goalkeeper</td>
<td>30 (8.9)</td>
<td></td>
</tr>
<tr>
<td>Playing Surface</td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>Artificial</td>
<td>62 (18.5)</td>
<td></td>
</tr>
<tr>
<td>Indoorgym</td>
<td>3 (0.9)</td>
<td></td>
</tr>
<tr>
<td>Grass</td>
<td>186 (55.4)</td>
<td></td>
</tr>
</tbody>
</table>

*Level of significance, p < 0.05
CHAPTER FIVE

DISCUSSION

5.1 INTRODUCTION
The aim of this study is to identify common soccer injuries and risk factors to soccer related injuries among Rwandan high school soccer teams. This chapter discusses the epidemiology aspects of the Rwandan high school soccer injuries, by looking at the prevalence and the risk factors which can lead to injury occurrence. The discussion is based on comparison with other studies. The findings are the results of the information gathered from Rwandan high school soccer players. The findings on demographic characteristics of the participants are also taken into consideration. The chapter ends by showing the limitations of this study.

5.2 CHARACTERISTICS OF PARTICIPANTS
The participants of this study were male soccer players at high school level and the respondent rate was 93.1% (336). The response rate differed with what found by Parry and Drust (2006) most probably due to the fact that data was collected during studying periods and the questionnaires were collected the same day after being completed. The participants’ mean age was 17 years old and the age to start practicing soccer ranged between 6-16 years old. The findings of this study concur with what found by Parry and Drust (2006) and Emmery and Meeuwisse (2006) that majority of the soccer players at high school level were aged between 14-20 years old. It is not surprising if you
consider the age by which children started the primary school and therefore the expected age by which they would have at completion of high school. Defenders followed by strikers and midfielders predominated the playing position in the current study similaraly to what found by Emmery and Meeuwisse (2006) but the reasons to playing postion choice remain unclear.

Interestingly, Mtshali, Mbambo-Kekana, Stewart and Musenge (2008) in their study reported that the starting age to practice soccer ranged from 4 years of age which could explain how much soccer is loved by young school people in Africa whose Rwanda is a member.

### 5.3 INJURY PREVALENCE AND CAUSES

#### 5.3.1 INJURY PREVALENCE

The variation of injury's definition in various epidemiology studies investigating about soccer injuries limit conclusively the comparability of the findings. However, this study reported a higher prevalence of soccer injuries in Kigali high school soccer players (74.7%) differing with what found by Naidoo (2007). The high school age correspond to soccer age where younger soccer players commit themselves to achieve more techniques and skills regarding soccer practices and performances at high levels. It is therefore not suprising that high school soccer players in Kigali suffered from various soccer related injuries if you consider a total absence of qualified medical practitioners in all teams and the inappropriately use of protective equipments. Emphasis should be
put on preventive measures including infrastructures, proper coaching, protective equipment use and availability of qualified team care provider.

The level of competition was found strong enough to predispose high school soccer players to soccer related injuries. In the current study, majority of the high school soccer players reported to have contracted their injuries during competitive matches (69.7%) and the association between the injury occurrence and the competition level was very strong (p = 0.000). The findings were supported by what reported by Mtshali et al. (2008) that soccer players are prone to injure during competitive matches than trainings.

This huge difference could be explained by the goals to achieve and the target sets which largely differ from competition than trainings. The desires to win the competition, get points, be promoted to the higher levels and win trophies govern the mind of players which increase self-determination leading to uncontrolled injuries compare to trainings where only new techniques and skills are applied and practiced. This fighting spirit exists also in high school soccer players which could explain why the highest prevalence of injury was reported to be found in matches in this study.

Age was also found to be associated with soccer injury occurrence in high school soccer players. The findings of the current study revealed that high school soccer players aged between 16-20 years suffered from soccer related injuries more than any other age group (49.6%). The findings are supported by what found by Junge et al.
(2000) that soccer players aged between 16-21 years old were more vulnerable to soccer related injuries compared with the other age groups.

The age range between 17-21 is considered as soccer age where players want to show themselves, to get the performance peak and secure permanent places in their teams respectively. Furthermore, at that age, players are exposed to participate in various competitions with the possibility of being selected in District, Provincial even in National teams. It is therefore not surprising with the findings of this study that players aged between 16-20 contacted more injuries than others.

As the type of injuries as concerned, this study did not reveal the types of injuries, because the participants did not consult medical professionals to diagnose their injuries and they were not able to diagnose the types of injury sustained themselves.

5.3.2 MECHANISM OF INJURY

In order to suggest preventive strategies specific to soccer injury, it is necessary to have detailed information on the injury mechanisms involved, since injuries are often the result of a combination of internal risk factors, external risk factors and injury mechanisms (Andersen, Larsen, Tenga, Engebretsen and Bahr, 2003). Based on characteristics and the way soccer is played as rough contact sport, contact to contact between players was believed to be the leading mechanism for injury occurrence in soccer players. In the similar way, the findings of the current study reported more than 60.2% of the total injuries to be resulted from contact to contact between players similarly to what demonstrated by Naidoo (2007). However, running, jumping, turning, landing, shooting, heading and falling were non-contact soccer gestures which
occasionate injury to occur. Strict respect and/or revision and adaptation of soccer play rules together with proper and well scheduled coaching programmes would weaken the influences and intensity of some injury mechanisms and therefore lower the rate of soccer related injury occurrence.

5.3.3 SEVERITY OF INJURY
The definition of injury severity adopted in this study was the same as the one used in other studies. According to the latest consensus discussions in FIFA (Federation of International Football Associations) and UEFA (Union of European Football Associations), injury severity is categorized in four categories, slight (1-3 days absence), minor (4-7 days absence), moderate (8-28 days absence) and major (>28 days absence) (Hagglund et al., 2005; Fuller et al., 2006). The results of the current study showed slight (53.9%) and moderate (26.1%) injuries to be more observed than minor (16.1%) and major injuries (3.3%). The findings of this study concur with those found by Powel and Barber-Foss (2000) and Le Gall et al. (2006) that slight injuries occupy the forefront line of injuries in high school soccer players. A total absence of team specialist medical practitioiner witnessed the posible poor and inadequate rehabilitation accompanied with the possible early return to sporting activities which may increase the injury reccurrent rate and worsen the severity of the sustained injury from slight to major of the same type and location (Woods et al., 2002). Therefore, emphasis should be put on improving the quality of rehabilitation injured players received and collaboration between the coaching and rehabilitating teams regarding the way and condition of returning previously injured players to be respected.
5.3.4 LOCATION OF INJURY

Soccer is played using mainly the feet but also other body parts could be used. This therefore explain the reason why soccer injuries were distributed all around the body of the soccer players. The body areas prone to soccer injuries did not differ from those found in various literatures. By summing up injury frequencies reported to ankle, knee and other remaining lower extremity parts, the study found a frequency of 78%. The findings of this study agreed with similar studies that have found lower extremity injuries representing 60%-87% of the total injuries incurred by soccer players (Hawkins et al., 2001; Lyon, 2001; Morgan & Oberlander, 2001; Rahnama et al., 2002, Faude et al., 2005, Naidoo, 2007). The most affected joint in this study was the ankle followed by the knee. The findings of this study are in agreement with the studies of Frantz, Amosun and Weitz (1999), Hawkins and Fuller (1999), Twizere and Frantz (2007) who found that the most affected joint was the ankle followed by the knee.

5.4 RISK FACTORS

The main findings in risk factors are discussed in this section. The most common risk factors identified in this study are level of play, playing surface (type/condition), player position, age, leg dominance and inadequate rehabilitation. The most significant risk factors identified in this study are previous injury, exposure time, use of protective equipment, warm-up and cool-down. A similar study reported similar results; stating that, most common risk factors are inadequate rehabilitation, age, player position, level of play and playing surfaces. In addition the findings of this study revealed that the most significant risk factors were warm-up and cool-down, use of equipment, exposure time
and previous injury (Malina, 2010). Some other studies do negate the findings of the present study. Arnason, Sigurdsson, Gudmundsson, Holme, Engebretsen and Bahr (2004), reported that the most common risk factors which lead to soccer injuries include abnormal joint kinetics and kinematics, joint laxity, mechanical or functional instability, muscular imbalances.

5.4.1 INTRINSIC RISK FACTORS

5.4.1.1 AGE

Age can play a major role in injury. Figure 4.3, in this study shows that younger athletes sustained a larger amount of injuries. From the age of 16 to 20, injuries were recorded, which is 49.7% of all injuries and the age group of 11-15 had 21.1% of all injuries. The same results have been found in previous studies by Emery and Meewisse (2006). After the age of 20 only 3.9% injuries were recorded. This may be because there were more younger soccer players and they did not use protective equipment as recommended, so the incidence was higher. In addition most of players did not get professional treatment (60.2%). The same result has been found by Emery and Meeuwisse (2006), Koutures and Andrew (2010) who studied youth football players and found the incidence of injury to double over the age of 14. Another reason for more injuries in this study is that younger players are generally less skilled and do not perform high risk tasks as much as their older colleagues. Therefore, their intensity of play is less, resulting in smaller joint reaction and collision forces (Keller, Noyes & Buncher, 1987). It is also thought that players of an older age have had greater exposure to injury as they have been in the game longer so may be more predisposed to injuries (Murphy et al. 2003). Age
therefore has an effect on injuries to soccer players. In this study younger soccer players suffered the most injuries. As Keller et al. (1987) said, younger players have less skill, so this may result in more unskilled and dangerous situations. Younger players do not have the same experience when it comes to tackling and challenging and reading situations so this may be why younger soccer players suffer more injuries in this study.

5.4.1.2 PREVIOUS INJURY

The injury reccurrent rate in this study accounted 77.3% of the total injuries. In the same way, Murphy et al. (2003) acknowledged that if the previous injury is not rehabilitated properly it result in further injury of the same type and location is likely to reoccur. It is evident that injury recurrence rate is high among rwandan high school soccer players if you consider a total absence of team qualified rehasbilitation specialist and inappropriate use of protective equipment.

The high school soccer team managers should therefore pull up their socks to put in place qualified medical practitioners, coaches and all need equipments to minimize the injury occurrence rate and increase the safety in high school soccer in rwanda.

5.4.1.3 LIMB DOMINANCE

The results of this study show that the majority of players were right footed (87.5%), and more injuries were found in these players. This may be because if a player is particularly one footed then the player would be more prone to injury as they would kick,
tackle, turn and jump on their favoured leg. This could therefore cause the player to put that limb under particular strain or fatigue. On the other hand, the weaker limb may also be more injured as it could be weaker because it is used less often so if it did ever have to perform a task such as tackling it may not be as strong as the dominant limb, thus resulting in injury. Similar findings have been found by Brophy, Silvers, Gonzales, Mandelbaaum (2010) who concluded that 74.1% of participants were injured on the dominant leg.

5.4.2 EXTRINSIC RISK FACTORS

5.4.2.1 USE OF PROTECTIVE EQUIPMENT
Protective equipment has been designed to shield various parts of the body against injury without interfering with the sporting activity. Protective equipment can also be used on return to activity after injury in situations where direct contact may aggravate the injury (Brukner and Khan, 2003b). However, the use of protective equipment by Rwandan high school soccer players was very critical. Despite the importance of shin guards in injury prevention and their compulsory wearing in both training and competitions as recommended by FIFA in 1990, the study revealed that only 19.4% of all players were regular users of shin guards and 18.6% of all players were using them only in matches and not in training. Those who used shin guards were very few compared to the situation reported in previous similar studies in Europe (Ekstrand, 1982; Hawkins & Fuller, 1998) in Rwanda, Africa (Twizere & Frantz, 2007; Nuhu, 2008). The link between the infrequent usage of shin-guards in training and matches and lower extremities injuries suffered by Rwandan high school soccer players might be
hypothesized since a lack of, or inadequate use of, shin guards was associated with 4% of lower leg injuries sustained in the senior amateur soccer players surveyed in the study of Ekstrand (1982). However, not wearing shin-guards has been shown to have a direct link with leg injuries (Dvorak and Junge, 2000). The limitation of this study was that there was no question addressing the reasons for non-usage of shin guards and if the injury contrasted while wearing shin guard or not within soccer players’ questionnaires. Further studies should find out whether the financial reasons and low emphasis on wearing the shin guards during training and match sessions are related to the current results.

Ankle taping and bracing also were found adequate to increase joint stability and therefore lower the injury rate especially the injury recurrence from a previous injury. However, the findings of the current study reported only 37.2% to be frequent users of ankle support devices. A number of studies indicated that prophylactic ankle bracing was more effective in reducing the frequency of ankle sprains in soccer players with previous ankle problems than in players without such a history (Surve, Schwellnus, Noakes & Lombard, 1994; Sharpe, Knapik & Jones, 1997). But currently, there is no and/or less studies demonstrating the efficiency of joint support on other than ankle joints.

Appropriate shoes in football should be of adequate depth in the upper part, have a rigid heel counter, have sufficient forefoot flexibility, have a wide sole, be slightly curved in shape and the cleats should be placed to allow adequate forefoot flexibility (Brukner and Khan, 2003). This study, however, revealed that few players (38.0%) were regular users
of appropriate shoes among the regular users of appropriate shoes 18.6% of players were using appropriate shoes only in matches. In the study conducted by Ekstrand and Gillquist (1983) on 180 male soccer division players, 13.3% of injuries resulted from the combination of playing surfaces and inferior footwear. Ekstrand (1982) specified that the traumatic injuries, such as knee sprains, were usually due to twisting of the knee when the foot wearing a shoe with screws in the cleats was fixed to the ground. Since this study did not qualitatively check the footwear, and only reported what the high school soccer players assumed to be “good”, there is a limited comparison with other studies. Financial constraints could be the reason for some players not having their own shin guards and appropriate soccer shoes to use during training and matches. Therefore, the advocacy need to be made to independent sponsors to sponsor the high school competitions, help to provide needed equipments and the players themselves to be equiped with sufficient knowledge about the goodness use of appropriate equipment in soccer related injury prevention.

5.4.2.2 PLAYING SURFACE

The type of playing surface can play a major role in soccer injuries. This study revealed that 51.8% of injuries was related to grass surface. Contrary to the result of this study Murphy et al. (2003) points out that there is an increased incidence of injury on artificial surfaces. The divergency of the findings could be relied on he fact that in rwanda, almost all games and trainings for high school soccer events took place on grass pitches only. Woods et al. (2002) found that 70% of the injuries recorded in pre-season play was when the ground was dry. Even during the in-season when grounds were still dry and
hard, 50% of all injuries were still recorded. Orchard and Seward (2002) found that ankle and knee injuries were more prevalent on surfaces like astro-turf. This is a very hard surface with increased traction and little or no shock absorption. However, the condition of playing surfaces, is the most causal factor to influence injury was not qualitatively evaluated, thus the high percentage of injuries found in this study may be related to the quality of playing surface. Appropriate monitoring of field conditions, specifically holes or other irregularities, can reduce lower extremity injuries. More specifically, uneven playing surfaces can result in excessive loading of ligaments and muscles and may contribute to improper landing after jumping.

However, the authors also believe additional information and research has to be done, to see why this is the case. One of the main problems has to be the strength of the surface and the frictional forces between footwear and the surface. Another factor could be the amount of sand that is sometimes put on these surfaces. From personal experience the sand can cause the foot to slip and give way at any time which can result in ankle and knee injuries. The closest to this surface is when the the ground was wet and the injury rate on these pitches was about 35% (Keller et al., 1987). In order to keep the results accurate and prevent any anomalies, all injuries should be recorded on a particular pitch type, whether it is Artificial, Grass, allweather, or gym, with respect to their condition. This would prevent ground type becoming an issue between the different injuries that occur.
5.4.2.3 PLAYER POSITION

The defenders (22.6%) and strikers (19.0%) were commonly injured in this study. This can be understood because soccer is more robust for strikers and strength is required to win the ball. The findings of the current study slightly differed from what found by Dvorak and Junge (2000) that defenders and midfielders were prone to sustain more injuries compared with the other player positions.

It is clear that defenders and strikers may suffer from soccer related injuries more than others due to the fact that the ball is played in around the post areas all along the play time. Furthermore, strikers and defenders use to much strength for strikers to score and defenders to defend the goals to be scored. In addition, defenders were reported to be highly involved in tackling actions in defending the ball. Rather, tackling and tackled players were all exposed to contrast injuries as demonstrated by Rahnama et al. (2002).

5.4.2.4 WARM-UP AND COOL-DOWN

The results of this study show that a large number of participants did not perform warm-up and cooling-down as it is recommended. Among all participants only 28.6% did warm-up. Of the 28.6% only 13.3% did them for more than fifteen minutes. The same results have been found in previous studies in Rwanda by Twizere and Frantz (2007) and Nuhu (2008) who concluded that Rwandan soccer players are more disposed to soccer injuries due to inadequate warm up and cool down. According to Brukner and Khan (2003b) it is recommended to practice before and after any sporting activity a warm-up and cool-down of at least 15 to 30 minutes. Cooling down after training or a game is thought to reduce muscle soreness and stiffness the next day (Brukner and
Khan 2001). Warming up is thought important to get the players warm and prepared for the game or training, to increase heart rate and get the body as near to what it would be in a game without over exerting the players. Furthermore the author acknowledged that warm-ups have been found beneficial along with flexibility work in reducing injury rates. Stamford (1995) mentioned that cooling down enhances the disposal of the waste products of muscle metabolism hence shortening the recovery time. Cool down could help soccer players to recover from fatigue after the game. Therefore, it could be assumed that the Rwandan high school soccer players are more predisposed to training and match injuries due to low warm-up and cool-down intensity. The lack of proper warm-up and cool-down during training and matches could be due to the lack of awareness of its importance and benefits in injury prevention. It could also be attributed to the fact that team members arrive late at the field on the day of the match. Therefore, players have less time to spend in warming-up and cooling-down. Finally, coaches who are in charge of planning and implementing the coaching programmes should consider and include warm up and cool down practices in their dairy coaching schedules to reduce the injury rate.

Among the activities performed during warm-up and cool-down include stretching and it is believed to be important in the prevention of sports injuries. Although many studies have shown no association with stretching and injury (Murphy et al. 2003), it is still thought that it may have a role in injury and performance. Nearly all soccer clubs perform warm-up drills and cool-down drills that involve stretching to increase the muscle and ligament flexibility. This would then allow the muscle to stretch further
without tearing or straining. Also in soccer the main muscle groups are stretched and some groups could be missed. The stretch may not be held for long enough and many find stretching a very monotonous regime which may not always be carried out after or before injury. Anderson (2005) pointed out that the purpose of stretching is to distend the scar tissue, while it is still plastic, but already strong enough to prevent functionally disabling retraction. This shows that stretching post injury may have some effect, however research is still controversial in this area. A stretching programme is recommended prior to and after any sporting activity. The results of this study revealed that only 34.40% did stretching prior and after training as well as match sessions. The test Chi-square revealed a strong relationship between injury occurrence and stretching (p=0.00). Therefore, injuries related to a lack of sufficient stretching could be linked to the onset of more match injury prevalence than training injury prevalence as revealed by the results of this study.

5.5 TREATMENT RECEIVED BY SOCCER PLAYERS

The results of this study revealed that most participants did not get professional management (66.3 %). The results of this study agreed with the results found by McKay, Goldie, Payne and Oakes (2001). Professional management was defined as any use of prescribed anti-inflammatory drugs, strapping, or application of ice. Normally, an injured soccer player must get professional treatment, if not it could be assumed that he did not get treatment, even if he received any other kind of treatment, since the player did not consult a professional practitioner. The non-professional
treatment must be discouraged and an awareness campaign on appropriate injury management is needed, especially for high school soccer players in Rwanda. Most professional treatments received was medication (27.7), Doctor Consultation (25.9) and Physiotherapy treatment (16.1). A similar study reported similar results; stating that, Medical treatment and physiotherapy treatment are the most professional sport treatment found in the treatment of sports injuries (Orchard & Seward, 2002). Hadara and Barrios (2009), Stankus (1993) stated that, effective treatment depends on an accurate diagnosis, an appreciation of the causes of injury, and the functional requirements for returning to the activity that caused the injury. Treatment must work to decrease pain, promote healing, and restore normal function. Treatment and rehabilitation can be organized in sequential stages with each stage composed of specific goals and tasks. The author further stated that, physiotherapists and medical doctors, with their expertise in body mechanics, anatomy, and physiology play a fundamental role in helping people develop appropriate and safe exercise programmes and injury prevention measures. Furthermore the authors mentioned that, medication such as non-steroid anti-inflammatory (NSAIDs) have analgesic, anti-pyretic and anti-inflammatory properties and thus have a role to play in the treatment of soft tissue injuries. The high percentages of non-professional treatment used by Rwandan high school soccer players could be attributed to the high cost of medical and physiotherapy treatments compared to the low economic status of Rwandan high school soccer players and soccer teams. In addition, there is no medical assistance plan for Rwandan high school soccer players at team level or at federation level because of budget constraints. The medical plan may help high school soccer players to be treated at low
cost and to receive the appropriate treatment. The inappropriate management of soccer injuries may be the reason for the high percentage (77.3%) of injury recurrence reported by soccer players. If injuries are not properly rehabilitated then there is a greater risk for the injury to reoccurring (Alison, Schiff, Rivala, 2009). This has an impact on team and specifically players’ performances (Finch, 1997).

5.6 LIMITATIONS

This study was not free from limitations which are identified as follows:

- Conducting a retrospective study in high school populations made it difficult to determine the type of injuries as players had to recall information. The participants did not consult medical professionals to diagnose the injuries and they did not know the type of injury sustained.
- Comparisons to similar studies are difficult due to the nature and adopted definitions of injury and injury prevalence.
- Sports injury prevention strategies and safety practices implemented were assessed but the detailed information about their quality was not gathered.
- The impact of a lack of sporting activity during injury occurrence would be well investigated with a control group study.
CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 INTRODUCTION

In this final chapter, a summary of the main findings of the study is provided. Thereafter, a concise conclusion is drawn. To counter the epidemiology of soccer injuries in Rwandan high schools, some suggested recommendations are made at the end of this chapter.

6.2 SUMMARY

The potential risk for injury among soccer players has become a topic of concern internationally and locally. Soccer has become the fastest growing sport in high school. Concurrently there will be an increase in the number of players injured while playing the game of soccer. This study fills a gap in providing important baseline data on the epidemiology of soccer injuries in Rwandan high schools. The results present a pattern of injury prevalence and risk factors that concur with other major international studies. The study further highlights the need for effective interventions on various levels.

The aim of this study was to identify common soccer injuries and risk factors related to soccer injuries among the high school soccer teams in Rwanda. To achieve this aim, the identification and description of injury prevalence has been made and possible causal factors have been investigated. Generally, the findings of this study revealed that, injury prevalence was high (74.7%) and that the most affected body parts were the ankle followed by the knee and shin. The injuries sustained during matches were more
severe than the ones sustained during training and most of the injuries were slight followed by moderate, minor and severe injuries.

This study also revealed that the mechanisms that seemed to play a big role in injury occurrence were collision, being tackled, tackling and overuse. Furthermore, despite their evident role in injury prevention, the soccer players were still misusing the protective equipment as well as not putting emphasis on warm up and cool down. The possibility of a soccer player sustaining an injury due to lack of wearing protective equipment and poor performance of sporting activities is high. Finally, this study revealed that, the majority of soccer players did not receive professional management and of those who received it, the majority of them were not cleared to return to play.

6.3 CONCLUSION

The common soccer injuries are so prevalent that they need to necessitate an urgent implementation of prevention programme. The type and severity of the common soccer injuries indicate their impact on the soccer sporting activity in Rwandan high schools. Although professional management is effective to counter these common soccer injuries, Rwandan high school soccer players still do not visit professional management services sufficiently for help. The similarity of injuries and risk factors to soccer injuries with other studies, their negative impact according to the findings of this study indicate the need for medical team intervention.
Finally, considering the sample characteristics and the sample size of this study, the results of this study can be generalized. Therefore, the epidemiology of, and risk factors to soccer related injuries among Rwandan high school soccer players need urgent implementation of prevention programmes.

6.4 RECOMMENDATIONS

6.4.1 SHORT TERM GOALS

- Inappropriate use of protective equipments was highlighted in this study. It was proved in previous studies that proper use of protective equipments lowers considerably the rate of injuries to soccer payers. It is in this regard that I strongly recommend the proper use of shin guards, tapes, braces gloves for goal keeps and appropriate shoes in both training and match sessions by all Rwandan high school soccer players. The schools, Rwandan School Sport Federation, together with the Ministry of Education should be approached and asked to intervene to provide the required protective equipment since high school players could not afford them on their own.

- Proper coaching also significantly helps to control soccer related injury occurrence. Being of the same opinion, the researcher insists that all coaching schedules in Rwandan high schools should include warm-up, stretching, cool-down, strengthening, plyomeric and skills training sessions to maximize their positive effects on soccer injury prevention. The coaches must be responsible for it to ensure its implementation. Thus education related to injury prevention for coaches is advised.
• Soccer is not an injury free sport. Each high school soccer team is required to have a permanent qualified medical practitioner to look after its injured players. This would not only increase the awareness of the players but would minimize the injury occurrence rate which most of the time is associated with improper rehabilitation or early return from a previous injury. It is thus recommended that awareness be created among the soccer fraternity involving all key stakeholders.

• Research monitoring injury surveillance needs to be ongoing and this study should serve as baseline data.

6.4.2 MEDIUM TERM GOALS

• High school soccer team coaches and educators need to be continuously trained to update their knowledge about a well organized coaching program schedule, injury prevention and protocol to return player to active duty from previous injury. This would assist in injury control.

• In Rwanda, school level soccer does not attract and interest as many people, as the senior soccer does. Consequently, less is known and less investment is made to high school soccer sides. It is in this regard that the research encourages all concerned parties to advocate for high school soccer to increase its safety.

6.4.3 LONG TERM GOALS

• Rwandan soccer in high school is played on uneven and poor playground surfaces. This because, schools cannot afford to properly manage the
playgrounds. It is for this reason that the researcher emphasized that adequate infrastructure should be made available by qualified institutions to ameliorate the injuries in soccer at high school level.

- Longitudinal research studies measuring the impact of intervention programmes for injury prevention needs to be conducted.
REFERENCES


Ekstrand, J., & Gillqvist, J. (1982). The frequency of muscle tightness and injuries in soccer players. The American Journal of Sports Medicine, 10 (2), 75-78.


flexibility as a risk factor for developing muscle injuries in male soccer players. The


Quinn, E. (2008). Common soccer injuries recognizing treating and preventing the most common soccer pain and injuries.


109
5 October 2010

To Whom It May Concern

I hereby certify that the Senate Research Committee of the University of the Western Cape has approved the methodology and the ethics of the following research project by:

Mr. JB Ndhumyimana (Physiotherapy)

Research Project: The epidemiology of, and risk factors to soccer related injuries among male high school students in Kigali City, Rwanda

Registration no: 16/12

Perry Syster
Manager: Research Development Office
University of the Western Cape
APPENDIX B

REPUBLIC OF RWANDA

Kigali, 27/12/2010

MINISTRY OF EDUCATION
B.P 622 KIGALI

PERMISSION TO RESEARCH IN RWANDA

NO: MINEDUC/S&T/.0012/2010

Permission is hereby granted to Mr Jean Bosco Nshimiyimana, a Masters Degree in Physiotherapy, in the University of Western Cape, South Africa, to carry out research on “The Epidemiology of and, Risk Factors to Soccer Related Injuries among Male High School Students Soccer Players in Kigali City, Rwanda”.

This research will entail use of questionnaires to Students who play Soccer.

The research is for a period of Two months, from starting from 10th January to the 10th March, 2011.

The reference number of this letter shall be cited in the final report as follows:


Please allow him any help and support to conduct this research in the City of Kigali.

Yours sincerely,

Dr. Marie-Christine Gasingirwa
Director General Science, technology and Research
Ministry of Education
January 2011

Nshimiyimana J. Bosco

Tel: 0788324067

To,

The Minister of Education

Kigali – Rwanda

Excellence,

Re: Permission to conduct a research study

I am a Rwandan postgraduate student enrolled in the Physiotherapy (Masters) program at the University of the Western Cape – South Africa. I am expected to conduct research as part of the requirements for a M.Sc. (Masters) Degree in Physiotherapy. The title of my study is “The epidemiology of and, risk factors to soccer related injuries among male high school students soccer players in Kigali city, Rwanda”.

Please find the attached letter of acceptance of my research proposal from the authorities of the University of the Western Cape. I hereby request permission to carry out the above mentioned study on male soccer teams in high schools.

It is hoped that the results of this study in Rwanda will contribute to information needed to design effective injury prevention programs for high school soccer teams.

I would be very grateful if you would allow me to carry out the study during studying period.

Participation in this study will be anonymous and voluntary. The information gathered will be treated with respect and confidentiality.

Hoping for your positive response

Yours sincerely,

J. Bosco Nshimiyimana
January 2011

Dear Player

RE: The epidemiology of, and risk factors to soccer related injuries among male high school soccer players in Kigali city, Rwanda.

A research project concerning the epidemiology of, and risk factors to soccer related injuries among male high school soccer players in Kigali city, Rwanda is currently being undertaken. The principal researcher is Mr. J. Bosco Nshimiyimana of the University of the Western Cape.

Permission from the Higher Degree Committee and Ministry of Education has already been obtained. The aim of the project is to determine the epidemiology of, and risk factors to soccer related injuries among male high school soccer players in Kigali city, Rwanda.

The information required is information pertinent to the player’s age and position, site of injury, mechanism of injury, management of injury and injury prevention measure undertaken prior to injury. Questionnaires will be administered by a trained physiotherapist.

I hereby wish to request your permission for participation in the above mentioned project. Strict confidentiality will be observed regarding all information that you give. You will also be treated with the utmost respect at all times. You have the voluntary right to consent or withdraw from the study at any time. Please complete the section below if you give permission.

I ……………………………………… (Student’s name) I accept to be included in the research project.

Signature : ……………………………

Yours sincerely

J. Bosco Nshimiyimana
Tel: 0788324067
APPENDIX E

January 2011

Dear Parent/Guardian

RE: The epidemiology of, and risk factors to soccer related injuries among male high school student soccer players in Kigali city, Rwanda.

A research project concerning the epidemiology of, and risk factors to soccer related injuries among male high school student soccer players in Kigali city, Rwanda is currently being undertaken.

The principal researcher is Mr. J. Bosco Nshimiyimana of the University of the Western Cape.

Permission from the Higher Degree Committee and Ministry of Education has already been obtained. The aim of the project is to determine the epidemiology of, and risk factors to soccer related injuries among male high school student soccer players in Kigali city, Rwanda. The information required is information pertinent to the player’s age and position, site of injury, mechanism of injury, management of injury and injury prevention measure undertaken prior to injury. Questionnaires will be administered by trained physiotherapists.

Your child is expected to participate in the above mentioned project. Strict confidentiality will be observed regarding all information that he gives. He will also be treated with the utmost respect at all times. Your child will have the voluntary right to consent or withdraw from the study at any time. Please complete the section below if you give permission.

I …………………………………….. (Parent/Guardian) hereby give permission for ………………………………………… (Child’s name) to be included in the research project.

……………………………………………………………………..

Signature Date

Yours sincerely

J. Bosco Nshimiyimana

Tel: 0788324067
PARENTAL/GUARDIAN INFORMATION SHEET

Project Title: The epidemiology of and, risk factors to soccer related injuries among male high school student soccer players in Kigali city, Rwanda.

This is a research project being conducted by J. Bosco NSHIMIYIMANA at the University of the Western Cape. We are inviting your child to participate in this research project as a person who plays soccer. The purpose of this research project is to determine the epidemiology of, and risk factors to soccer related injuries among male high school student soccer players in Kigali city, Rwanda. After you have heard more about the study, and if you agree, then the next thing we will do is ask your child for his agreement as well. Both of you have to agree independently before we can begin.

The child will be asked to complete a questionnaire which will take about 30 minutes. In addition, research assistant will be used for distribution and collection of questionnaires. To help protect his confidentiality, the questionnaire will not request his identity.

This research is not designed to help your child personally, but the results may help the investigator learn more about epidemiology and risk factors related to soccer injuries. We hope that, in the future, other people might benefit from this study through improved understanding of epidemiology and risk factors related to soccer injuries.

Participation in this research is completely voluntary. The participant may choose not to
take part at all, or if he decides to participate in this research, he may stop participating
at any time, and he will not be penalized or lose any benefits to which he otherwise
qualify.

Should you have any questions regarding this study and the rights of your child as a
research participant or if you wish to report any problems you have experienced related
to the study, please contact:

**In Rwanda:**

J. Bosco NSHIMIYIMANA

District Kicukiro, Kigali

Cell phone number: 0788324067, E-mail: njbeboy@gmail.com

Should you have any questions regarding this study and the rights of your child as a
research participant or if you wish to report any problems you have experienced related
to the study, please contact: Chairperson of the Rwanda National Ethics Committee: Dr
Wane Justin at 0788500499, Secretary of Rwanda National Ethics Committee: Dr.
Emmanuel Nkeramihigo at 0788557273

Ministry of Health

B P 84

Kigali, Rwanda

Telefoni: 55107884, E-mail: rnec@moh.gov.rw

**Or in South Africa:**

J. Bosco Nshimiyimana

University of the Western Cape

Private Bag X17, Bellville 7535
Cell phone number: 0788324067, E-mail: njbeboy@gmail.com

Should you have any questions regarding this study and the rights of your child as a research participant or if you wish to report any problems you have experienced related to the study, please contact:

Head of Department: Professor J. Philips
Dean of the Faculty of Community and Health Sciences: Professor R. Mpofu
University of the Western Cape
Private Bag X17, Bellville 7535

This research has been approved by the University of the Western Cape’s Senate Research Committee and Ethics Committee.

Researcher ........................................ Date ......................................
PARTICIPANT INFORMATION SHEET

Project Title: The epidemiology of and, risk factors to soccer related injuries among male high school students soccer players in Kigali city, Rwanda.

This is a research project being conducted by J. Bosco NSHIMIYIMANA at the University of the Western Cape. We are inviting you to participate in this research project as a student who plays soccer. The purpose of this research project is to identify the epidemiology of, and risk factors to soccer related injuries.

You will be asked to fill a questionnaire which will take about 30 minutes. To help protect your confidentiality, the questionnaire will not ask your identification.

This research is not designed to help you personally, but the results may help the investigator learn more about epidemiology and risk factors related to soccer injuries. We hope that, in the future, other people might benefit from this study through improved understanding epidemiology and risk factors of soccer injuries. Your participation in this research is completely voluntary.

You may choose not to take part at all, or if you decide to participate in this research, you may stop participating at any time, and you will not be penalized or lose any
benefits to which you otherwise qualify. This research is being conducted by J. Bosco NSHIMIYIMANA, a student in Physiotherapy Department at the University of the Western Cape. If you have any questions about the research study itself, please contact:

**In Rwanda:**

J. Bosco NSHIMIYIMANA

District Kicukiro, Kigali

Cell phone number: 0788324067, E-mail: njbeboy@gmail.com

Should you have any questions regarding this study and your rights as a research participant or if you wish to report any problems you have experienced related to the study, please contact: Chairperson of the Rwanda National Ethics Committee: Dr. Wane Justin at 0788500499, Secretary of Rwanda National Ethics Committee: Dr. Emmanuel Nkeramihigo at 0788557273

Ministry of Health

B P 84

Kigali, Rwanda

Telefoni: 55107884, E-mail: nec@moh.gov.rw

**Or in South Africa:**

J. Bosco NSHIMIYIMANA

University of the Western Cape

Private Bag X17, Bellville 7535

Cell phone number: 0788324067, E-mail: njbeboy@gmail.com
Should you have any questions regarding this study and your rights as a research participant or if you wish to report any problems you have experienced related to the study, please contact:

Head of Department: Prof. J. Philips

Dean of the Faculty of Community and Health Sciences: Professor R. Mpofu

University of the Western Cape

Private Bag X17, Bellville 7535

This research has been approved by the University of the Western Cape’s Senate Research Committee and Ethics Committee.

Researcher .................................. Date ..................................

UNIVERSITY of the WESTERN CAPE
APPENDIX H

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa

Tel: +27 21-959, Fax: 27 21-959

E-mail: mwarner@uwc.ac.za

IBISOBANURIRWA UHAGARARIYE UGIRA URUHARE MU BUSHAKASHATSI

Ubu bushakashatsi: Icyorezo cy’ ibikomere/ imvune n’impamvu zishobora gutera ibikomere/ imvune abanyeshuri babahungu bo mumashuri yisumbuye bakina umupira wamaguru mumugi wa Kigali, Rwanda.

Ubu bushakashatsi burimo gukorwa na J. Bosco NSHIMIYIMANA, umunyeshuli wiga ubugororangingo muri kaminuza ya Western Cape, muri Afurika y’epfo. Turasaba umwana muhagarariye kugira uruhare muri ubu bushakashatsi kubera ko yujuje ibisabwa nabwo, nk’umukinnyi ukina umupira wamaguru. Intego y’ubu bushakashatsi ni ukumenya icyorezo cy’ imvune n’ impamvu zishobora gutuma izo mvune zishobora kubaho mu bakinnyi bakina umupira wamaguru mumashuri yisumbuye mu Rwanda. Numara kumva ubu bushakashatsi ukemera ko umwana wawe yabugiramo uruhare, tuzakurikizaho gusaba umwana wawe ku giti cye kugira uruhare muri ubu bushakashatsi.

Umwana wawe arasabwa kuzuza impapuro zibibazo byateguwe n’ukora ubushakashatsi ku bijyanye n’ icyorezo cy’ imvune n’ impamvu zishobora gutuma izo mvune zishobora kubaho. Bizamutwara igihe kingana n’ iminota 30 tugereranyije. Ukora
ubushakashatsi azifashisha abantu babiri bazamufasha gutanga impapuro zibibazo no kuzishyira hamwe zimaze kuzuzwa. Tuzakora ibishoboka byose mu kugirira ibanga umwana wawe. Kugira ngo tubamare impungenge, ntazina rizashyirwa kurupapapuro rwibibazo.


Yemerewe kwivana muri ubu bushakashatsi igihe cyose abishatse nta nkurikizi, ntazabihanirwa cyangwa ngo atakaze inyungu iyo ariyo yose yakagombye kubona. Nta kibazo kirimo cyamuhungabanya.

Ubu bushakashatsi burimo gukorwa na J. Bosco NSHIMIYIMANA, umunyeshuli wiga ubugorangingo muri kaminuza ya Western Cape, muri Afurika y’epfo. Ufite ikibazo kijyanye n’ubu bushakashatsi, wakwiyambaza:

**Mu Rwanda:**

J. Bosco NSHIMIYIMANA

Akarere ka Kicukiro, Kigali

Telefoni mobile: 088324067, E-mail: njbeboy@gmail.com
Hagize ikibazo cyose mwagira cyangwa mushatse kumenyekanisha ibibazo mwahuye nabyo birebana n'ubu bushakashatsi, mwakwiyambaza:

Umuyobozi wa Komite y'yu Rwanda ishinze uburenganzira bw'abakorerwaho ubushakashatsi mu Rwanda:

Dr Wane Justin at 0788500499 cyangwa Umunyamabanga wa Komite y'yu Rwanda ishinze uburenganzira bw'abakorerwaho ubushakashatsi mu Rwanda: Dr. Emmanuel Nkeramihigo at 0788557273

Minisiteri y'Ubuzima

Agasanduku k'iposita 84

Kigali, Rwanda

Telefoni: 55107884, E-mail: rnec@moh.gov.rw

Muri Afurika y'epfo

J. Bosco NSHIMIYIMANA

University of the Western Cape

Private Bag X17, Bellville 7535

Telefoni mobile: 0788324067, E-mail: njbeboy@gmail.com

Hagize ikibazo cyose mwagira cyangwa mushatse kumenyekanisha ibibazo mwahuye nabyo birebana n'ubu bushakashatsi, mwakwiyambaza:

Uhagarariye ishami ry'ubugororangingo: Prof. J. Philips

Umuyobozi wa Faculty of Community and Health Sciences: Prof. Ratie Mpofu

University of the Western Cape

Private Bag X17, Bellville 7535
Ubu bushakashatsi bwemejwe na Sena ya Kaminuza ya Western Cape ishinzwe ubushakashatsi, ndetse na Komite y’iyo Kaminuza ishinzwe iyubahirizwa ry’ikiremwa muntu mu bushakashatsi.

**Ukora ubushakashatsi**………………………………………………………….*Italiti*……………….**
APPENDIX I

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa

Tel: +27 21-959, Fax: 27 21-959

E-mail: mwarner@uwc.ac.za

IBISOBANURIRWA UGIRA URUHARE MU BUSHAKASHATSI

Ubushakashatsi: Icyorezo cy’ ibikomere/ imvune n’impamvu zishobora gutera ibikomere/ imvune abanyeshuri babahungu bo mumashuri yisumbuye bakina umupira wamaguru mumugi wa Kigali, Rwanda.

Ubu bushakashatsi burimo gukorwa na J. Bosco NSHIMIYIMANA, umunyeshuli wiga ubugororangingo muri kaminuza ya Western Cape, muri Afurika y’epfo. Murasabwa kugira uruhare muri ubu bushakashatsi kubera ko mwuje ibisabwa nabwo, nk’abakinnyi b’ umupira w’ amaguru mumashuri y’ isumbuye. Ubu bushakashatsi bugamije kandi kumenya icyorezo cy’ imvune n’ impamvu zishobora gutuma izo mvune zibaho.

y’amafaranga uzabona muri ubu bushakashatsi, ahubwo ibizavamo bizafasha ukora ubushakashatsi kongera ubumenyi ku bakinnyi b’ umupira w’ amaguru.


Ubu bushakashatsi burimo gukorwa na J. Bosco NSHIMIYIMANA, umunyeshuli wiga ubugorangingo muri kaminuza ya Western Cape, muri Afurika y’epfo. Ufite ikibazo kijyanye n’ubu bushakashatsi, wakwiyambaza:

**Mu Rwanda:**

J. Bosco NSHIMIYIMANA

Akarere ka Kicukiro, umujyi wa Kigari

Telefoni mobile: 0788324067, E-mail: njbeboy@gmail.com

Hagize ikibazo cyose wagira cyangwa ushatse kumenyekanisha ibibazo wahuye nabyo birebana n’ubu bushakashatsi, wakwiyambaza:

Umuyobozi wa Komite y’u Rwanda ishinze uburenganzira bw’abakorerwaho ubushakashatsi mu Rwanda: Dr Wane Justin at 0788500499 cyangwa

Umunyamabanga wa Komite y’u Rwanda ishinze uburenganzira bw’abakorerwaho ubushakashatsi mu Rwanda: Dr. Emmanuel Nkeramihigo at 0788557273
Minisiteri y’Ubuzima
Agasanduku k’iposita 84
Kigali, Rwanda
Telefoni: 55107884, E-mail: rnc@moh.gov.rw

Muri Afurika y’epfo
J. Bosco NSHIMIYIMANA
University of the Western Cape
Private Bag X17, Bellville 7535
Telefoni mobile: 0788324067, E-mail: njbeboy@gmail.com

Hagize ikibazo cyose wagira cyangwa ushatse kumenyekanisha ibibazo wahuye nabyo
tirebana n’ubu bushakashatsi, wakwiyambaza:
Uhayarariye ishami ry’ubugororingo: Prof. J. Philips
Umuyobozi wa Faculty of Community and Health Sciences: Prof. Ratie Mpofu
University of the Western Cape
Private Bag X17, Bellville 7535
Ubu bushakashatsi bwemejwe na Sena ya Kaminuza ya Western Cape ishinzwe
ubushakashatsi, ndetse na Komite y’iyo Kaminuza ishinzwe iyubahirizwa
ry’ikiremwa muntu mu bushakashatsi.

Ukora ubushakashatsi..........................................................Italiti..............
APPENDIX J

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa

Tel: +27 21-959, Fax: 27 21-959

E-mail: mwarner@uwc.ac.za

PARENTAL/GUARDIAN CONSENT FORM

Title of Research Project: The epidemiology of and, risk factors to soccer related injuries among male high school students soccer players in Kigali city, Rwanda.

I have been asked to give consent for my child to participate in this research study which will involve him completing a questionnaire. I understand that he will also be asked to give permission and that his wishes will be respected. I have been informed that there are any risk from participating in this study. I am aware that there may be no benefit to either my child or me personally. I have been provided with the name of a researcher who can be easily contacted using the number I was given for that person.

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily for my child to participate as a participant in this study and understand that I have the right to withdraw him from the study at any time without in any way affecting him.

Name of Parent or Guardian .................................................................

Signature or Thumb print of Parent of Guardian...................................

Date (Day/month/year)...........................................................................
I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Name of witness………………………………………………………………………………
Signature of witness ………………………………………………………………………
Date (Day/month/year)……………………………………………………………………

I have accurately read or witnessed the accurate reading of the consent form to the parent/guardian of the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Name of researcher…………………………………………………………………………
Signature of researcher……………………………………………………………………
Date (Day/month/year)……………………………………………………………………

A copy of this Informed Consent Form has been provided to the parent or guardian of the participant. An Informed Assent Form will be completed.
APPENDIX K

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa

Tel: +27 21-959, Fax: 27 21-959

E-mail: mwarner@uwc.ac.za

PARTICIPANT CONSENT FORM

Title of Research Project: The epidemiology of and, risk factors to soccer related injuries among male high school students soccer players in Kigali city, Rwanda.

The study has been described to me in a language that I understand and I freely and voluntarily agree to participate. I agree to complete the questionnaire during my participation in this study. My questions about the study have been answered. I understand that my identity will not be disclosed and that I may withdraw from the study without giving a reason at any time and this will not negatively affect me in any way.

Name of participant……………………..................……………………

Signature/Thumb print of participant..............................………………………..

Date (Day/month/year)....………......................................................

I have witnessed the accurate reading of the assent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given assent freely.

Name of witness ……………………………………………………………………
Signature of witness .................................................................

Date (Day/month/year) .................................................................

I have accurately read or witnessed the accurate reading of the assent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given assent freely.

Name of researcher..................................................................................................

Signature of researcher..........................................................................................

Date (Day/month/year) ...................................................................................

A copy of this Assent Form has been provided to the participant. Parent/Guardian has signed an informed consent.
ICYEMEZO CYO KWEMERA KUGIRA URUHARE MU BUSHAKASHATS'I
ICY'O HAGARARIYE UGIRA URUHARE MU BUSHAKASHATS'I

Ubushakashatsi: Icyorezo cy’ ibikomere/ imvune n’impamvu zishobora gutera ibikomere/ imvune abanyeshuri babahungu bo mumashuri yisumbuye bakina umupira wamaguru mumugi wa Kigali, Rwanda.

Amazina y’uhagarariye ugira uruhare mu bushakashatsi.............................................
Umukono/Igikumwe cy’uhagarariye ugira uruhare mu bushakashatsi......................
Italiki (umunsi/ukwezi/umwaka)...................................................................................

Ntanze ubuhamya ko nasomye neza ibisobanurirwa uhagarariye umwana ugira uruhare
muri ubu bushakashatsi, kandi ko yahawe umwanya wo kubaza ibibazo afite. Nemeje
ko yemeye ku giti cye ko umwana we/ahagarariye agira uruhare muri ubu
bushakashatsi.
Amazina
y’umuhamya..................................................................................................................
Umukono
w’umuhamya..................................................................................................................
Italiki
(umunsi/ukwezi/umwaka)..............................................................................................
Nemeje ko nasomye neza cyangwa ko hasomwe neza ibisobanurirwa uhagarariye
umwana ugira uruhare muri ubu bushakashatsi, kandi ko yahawe umwanya wo kubaza
ibibazo afite. Nemeje ko yemeye ku giti cye ko umwana ahagarariye agira uruhare muri
ubu bushakashatsi.
Amazina y’ukora ubushakashatsi......................................................................................
Umukono w’ ukora ubushakashatsi..................................................................................
Italiki (umunsi/ukwezi/umwaka)......................................................................................
Kopi y’urupapuro rw’ibisobanurirwa uhagarariye umwana yahawe uhagarariye umwana
ugira uruhare muri ubu bushakashatsi. Umwana ugira uruhare muri ubu bushakashatsi
nawe arasabwa ku giti cye kwemera kugira uruhare muri ubu bushakashatsi.
KWEMERA KUGIRA URUHARE

Ubushakashatsi: Icyorezo cy’ ibikomere/ imvune n’impamvu zishobora gutera ibikomere/ imvune abanyeshuri babahungu bo mumashuri yisumbuye bakina umupira wamaguru mumugi wa Kigali, Rwanda.

Nyuma yo gusobanurirwa iby’ubu bushakashatsi n’ibijyanye nabwo mu rurimi numva, kandi ko bazangirira ibanga ku byo nzabamenyesha, no kuba nemerewe kwivana muri ubu bushakashatsi igihe cyose mbishatse kandi ko nta nkurikizi byangiraho, nemeye ku bushake bwanjye kugira uruhare muri ubu bushakashatsi.

Amazina y’ugira uruhare mu bushakashatsi...........................................................................................................

Umukono/Igikumwe cy’ ugira uruhare mu bushakashatsi..................................................................................

Italiki (umunsi/ukwezi/umwaka)......................................................................................................................

Ntanze ubuhamya ko nasomye neza ibisobanurirwa ugira uruhare muri ubu bushakashatsi, kandi ko yahawe umwanya wo kubaza ibibazo afite. Nemeje ko yemeye ku giti cye kugira uruhare muri ubu bushakashatsi.

Amazina y’umuhamya...........................................................................................................................................
Umukono w’umuhamyana..............................................................

Italiki (umunsi/ukwezi/umwaka).................................................................

Nemeje ko nasomye neza cyangwa ko nasomewe neza ibisobanurirwa ugira uruhare muri ubu bushakashatsi, kandi ko nahawe umwanya wo kubaza ibibazo mfite. Nemeje ko nemeye ku giti cyanjye kugira uruhare muri ubu bushakashatsi.

Amazina y’ukora ubushakashatsi.................................................................

Umukono w’ukora ubushakashatsi.................................................................

Italiki (umunsi/ukwezi/umwaka).................................................................

Kopi y’urupapuro rw’ibisobanurirwa ugira uruhare mu bushakashatsi yahawe ugira uruhare muri ubu bushakashatsi. Uhagarariye ugira uruhare muri ubu bushakashatsi yemeye ko uwo ahagarariye agira uruhare muri ubu bushakashatsi.
APPENDIX N

Research Questionnaire

Section A: Personal information

Player researcher number:
Age: ______________________
Weight: ____________________
height: ______________________

(a) Leg dominance
Right Footed:               (b) Starting Age of playing soccer:
                            Current age:          (c) Highest Current Playing Level:
Left Footed:                Club: □

Section B: Frequency of play

Please record the number of:

(a) Playing/Training sessions per week:
(b) Number of gym session per week:
(c) Number of match days per week (including training matches):

How long in minutes do you?:
Train per week:              Play matches per week:
Section C: Playing Position

Circle your number one playing position as 1 and your alternative position as 2

(a) Defender: 1 2  (c) Wing Back: 1 2  (e) Goal Keeper: 1 2
(b) Midfielder: 1 2  (d) Striker: 1 2

Section D: Injury prevention programmes

1. Protective Clothing

(a) Do you wear protective gear?
Yes: □
No: □

(b) If yes state, how often you wear:
1. Always (100%);  2. Very often (75%) 3. Often (50%); 4. Sometimes (25%)

<table>
<thead>
<tr>
<th>Protective clothing</th>
<th>Matches</th>
<th>Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shin guards</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ankle protection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appropriate footwear</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Warm up and Cool down

(a) Do you warm up and cool down before and after
training sessions matche sessions
Yes: □  Yes: □

xxix
(b) Is your warm up and cool down any of the following:

<table>
<thead>
<tr>
<th>Less than 15 min: □</th>
<th>About 15 min: □</th>
<th>More than 15 min: □</th>
</tr>
</thead>
</table>

(c) Which of the following activities do you include in your warm up, you may choose more than one option:

<table>
<thead>
<tr>
<th>Jogging: □</th>
<th>Dynamic stretching: □</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking: □</td>
<td>Static Stretching: □</td>
</tr>
<tr>
<td>Running: □</td>
<td>Soccer Specific drills: □</td>
</tr>
</tbody>
</table>

3. Recovery

(a) Do you make use of a recovery protocol?
Yes: □
No: □

(b) Do you make use of one or more of the following routinely as part of your daily recovery routine?

<table>
<thead>
<tr>
<th>(a) Ice Baths: □</th>
<th>(c) Active: □</th>
<th>(e) Massage: □</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stretching: □</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(b) Skins: □</th>
<th>(d) Glutamine: □</th>
<th>(f) Other:</th>
</tr>
</thead>
</table>
Section E: Surface

1. Mark the surface that you most train on as 1, sometimes train on as 2, rarely train on as 3.

<table>
<thead>
<tr>
<th>Artificial:</th>
<th>Track:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3</td>
<td>1 2 3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hard:</th>
<th>Grass:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3</td>
<td>1 2 3</td>
</tr>
</tbody>
</table>

2. Surface condition at the time of injury

Dry: □
Wet: □

Section F: Injury history

1. Injury history

a) Have you ever been injured whilst playing soccer over the last year?

Yes: □
No: □

b) Was your injury occurred in training?

Yes: □
No: □

c) Was your injury occurred in match?

Yes: □
No: □

d) Was your injury recurrent?
2. General Injuries sustained

Tick which, if any, body part areas have been injured over the last year. You may tick more than one box

| Chest: ☐ | Shoulder: ☐ | Elbow: ☐ | Back: ☐ | Ankle: ☐ |
|———|———|———|———|———|
| Neck: ☐ | Lower leg: ☐ | Calf: ☐ | Hand: ☐ | Knees: ☐ |
|———|———|———|———|———|
| Head: ☐ | Thigh: ☐ | Arm: ☐ | Wrist: ☐ | Other: ____________________ |

3. Injury Mechanism

(a) Did you injure yourself by:

| (a) Bumping into a player: ☐ | (c) Tripping: ☐ | (e) Overuse: ☐ |
|———|———|———|
| (b) Landing: ☐ | (d) Falling: ☐ | (f) Other: ____________________ |

4. Injury Characteristics

When you got injured, did you see, hear or experience any of the following: If yes use the following symbols:

 ✓ : Yes , × : No

| (a) Swelling: ☐ | (c) Unable to bear weight through the injured site: ☐ | (e) Crackling/popping sounds: ☐ | (g) Visible internal bruising: ☐ |
5. Injury Severity

After the injury you:

   a). Were able to continue with the game: □

   b). The injury required first aid before you could continue with the game: □

   c). The injury resulted in you requiring a medical consultation immediately after the injury and not returning to the game: □

   d). Injury resulted in you loosing practice and game time for a while after that match/practice: □

If yes, how many practice games have missed as a result of your injury?

1-3: □  4-7: □  8-28: □  28 and above: □

6. Injury Management

(a) Did you receive professional management of your injury?

   Yes: □

   No: □

(b) If yes, tick the appropriate box below, you may tick more than one box.

<table>
<thead>
<tr>
<th>Physiotherapy: □</th>
<th>Post op rehab: □</th>
<th>Medication: □</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctor Consultation: □</td>
<td>Operation: □</td>
<td>Bracing: □</td>
</tr>
</tbody>
</table>

(c) Were you medically cleared to return to play?

   Yes: □

   No: □

Thank you for your assistance in completing this questionnaire.
APPENDIX O

Urutonde rw’ibibazo by’ ubushakashatsi
Igice cya mbere: Umwirondoro

Inomero y’ubushakashatsi y’umukinnyi:
Imyaka: ______________________
Ibiro: ________________________ Uburebure: ______________________

<table>
<thead>
<tr>
<th>(a)</th>
<th>(b)</th>
<th>(c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ukuguru ukinisha</td>
<td>Imyaka watangiriyeho gukina umupira</td>
<td>Ikiciro cyo hejuru ukinamo ubu:</td>
</tr>
<tr>
<td>Indyo:</td>
<td>Imyaka ufite ubu:</td>
<td>Mwikipe y’ishuri:</td>
</tr>
<tr>
<td>Imoso:</td>
<td>Kurwego rw’intara:</td>
<td>Kurwego rw’igihugu:</td>
</tr>
</tbody>
</table>

Igice cya kabiri: Inshuro zikinwa

Andika incuro:

<table>
<thead>
<tr>
<th>(a)</th>
<th>(b)</th>
<th>(c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ukina cg witoza mucyumweru:</td>
<td>Incuro ukora imyitozo ngororamubiri mucyumweru:</td>
<td>Incuro ziminsi ukina mace mucyumweru harimo na match ukina witoza (mwikipe yawe mwakozemo amakipe abiri 11/11):</td>
</tr>
</tbody>
</table>

Nigihe kingana iki muminota?

| Witoza mucyumweru: | Ukina mace mucyumweru: |

Igice cya gatatu: Umwanya ukinaho

Shyira akaziga kuri 1 kumwanya bwite uhora ukinaho no kuri 2 nkumwanya ukinaho rimwe na rimwe no kuri 3 kumwanya ukinaho gake cyane

xxxiv
Igice cya kane: Uburyo bukoreshwa mukwirinda imvune

1. Imyambaro yo kwirinda

(a) Ujya wambara imyambaro yo kwirinda?

Yego: □

Oya: □

(b) Niba ari yego andika incuro uyambara:

1. Igihe cyose (100%); 2. kenshi cyane (75%); 3. kenshi (50%); 4. Rimwe na rimwe (25%).

<table>
<thead>
<tr>
<th>Imyambaro yo kwirinda</th>
<th>Igihe dukina nindi kipe</th>
<th>Igihe dukora imyitozo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ibikoresho birinda ruseke</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ibikoresho birinda akabumbankore</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inkweto zabugenewe ka ndi zimeze neza</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Kwishyushya no gukora imyitozo nyoroshya mubiri

(a) Ujya wishyushya mbere ndetse ugakora nimiyoitozo nyoroshya mubiri nyuma

Yego: □

Oya: □

(b) Kwishyushya kwawe ndetse no gukora imyitozo nyoroshya mubiri byaba bimara iminota ikurikira:
(c) Mugihe wishyushya mubikorwa bikurikira nibihe ukora, ushobora guhitamo igikorwa kirenze kimwe:

<table>
<thead>
<tr>
<th>Kugenda wihuta: □</th>
<th>Kwinanura wowe ubwawe imikaya y’umubiri: □</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kugenda urugendo rurerure: □</td>
<td>Kunanurwa imikaya y’umubiri wawe nundi muntu utari wowe: □</td>
</tr>
<tr>
<td>Kwiruka: □</td>
<td>Imyitozo yihariye yo kwimenyereza gukina neza: □</td>
</tr>
</tbody>
</table>

3. Kwivuza

(a) Iyo ugize imvune urivuza?

Yego: □
Oya: □

(b) Waba ukoresha bumwe cg bwinshi mu buryo bukurikira nkuburyo bugufasha kwivura buri gihe

<table>
<thead>
<tr>
<th>(a) Ubukonje: □</th>
<th>(c) Kwinanura imikaya y’umubi: □</th>
<th>(e) Masaje: □</th>
</tr>
</thead>
<tbody>
<tr>
<td>(b) Kunanuriwira imikaya y’umubiri nundi muntu: □</td>
<td>(d) Imiti ivura imvune cg ifasha imvune gukira vuba: □</td>
<td>(f) Ibindi: ____________________</td>
</tr>
</tbody>
</table>

Igice cya gatanu: Ikibuga

1. Ubwoko bw’ ikibuga

Shyira akaziga kuri 1 niba aricyo kibuga witorezaho cyane, kuri 2 niba ariho witoreza rimwe na rimwe, kuri 3 niba uhitoreza gake cyane.

<table>
<thead>
<tr>
<th>Tapi:</th>
<th>Ikibuga cyagenewe imyitozo ngorora mubiri:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3</td>
<td>1 2 3</td>
</tr>
</tbody>
</table>
2. Imitere y'ikibuga mugihe kimvune

Cyari cyumutse: □

Cyari gitose: □

Igice cya gatandatu: Ibijyanye n’imvune/ igikomere

1. Amateka y’imvune

Waba warigeye z’umwaka/uvunika ubwo wakinaga umupira umwaka ushize?

Yego: □ Oya: □

b) Wba waravunitse uri mu myitozo?

Yego: □

Oya: □

c) Wba waravunikiye muri mace?

Yego: □

Oya: □

d) Iyo mvune yawe yarigarutse birenze rimwe?

Yego: □

Oya: □

2. Ibikomere/Imvune zose zabonetse

Shyira ikimenyetso mukazu, niba hari, igice cyumubiri wawe cyagize imvune umwaka ushize. Ushobora guhitamo hensi

<table>
<thead>
<tr>
<th>Agatuza: □</th>
<th>Urutugu: □</th>
<th>Inkokora: □</th>
<th>Umugongo: □</th>
<th>Akabumbankore: □</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ijosi: □</td>
<td>Umurundi: □</td>
<td>Impfundiko: □</td>
<td>Ikiganza: □</td>
<td>Amavi: □</td>
</tr>
<tr>
<td>Umutwe: □</td>
<td>Ikibero: □</td>
<td>Ukuboko: □</td>
<td>Mubujana: □</td>
<td>Ahandi_________</td>
</tr>
</tbody>
</table>

3. Uburyo wakomeretsemo/ wavunitsemo
(a) Waba warakomeretse muri ubu buryo bukurikira:

<table>
<thead>
<tr>
<th>(a) Ugonganye nundi mukinnyi:</th>
<th>(c) uteje cg ujyanye igice cyumubiri wawe vuba vuba:</th>
<th>(e) Ukinishije igice cyumubiri cyari:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>(b) Ugaruka hasi nyuma yo gusimbuka:</th>
<th>(d) Wituye hasi:</th>
<th>(f) ikindi:</th>
</tr>
</thead>
</table>

4. Ubwoko bwigikore/Imvune

Igihe wakomerekaga/wavunikaga, waba warumvise cg se ukabona ibi bikurikira

<table>
<thead>
<tr>
<th>(a) ububyimbe:</th>
<th>(c) kudashobora kugenda ntacyo wifashije cg ufashijwe na mugenzi wawe:</th>
<th>(e) Kumva ibintu bikocoka murugingo:</th>
<th>(g) Kumva wavunikiye imbere ariko ntagikomere ufite:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>(b) ububare:</th>
<th>(d) Kudashobora kunyeganyeza igice cyumubiri cyakomerertse/cyavunitse:</th>
<th>(f) Kwifunga kwivi:</th>
<th>(h) Ikindi:</th>
</tr>
</thead>
</table>

5. Ubukanana bwigikomere/imvune

Nyuma yo gukomereka

a). Washoboye gukomeza gukina: □
b). Byasabye ko imvune/igikomere bikorerwa ubuvuzi bwibanze mbere yuko ukomeza gukina: □
c). Igikomere/imvune byasabye ko uhita ujya kwisuzumisha kwa muganga ntiwakomeza gukina: □
d). Igikomere/imvune byatumye uhagarika imyitozo cg umukino igihe runaka nyuma yuwo mukino wakomerekeyemo?: □

Niba ari yego, wasibye imikino ingahe kubera igikomere/imvune?

1-3: □ 4-7: □ 8-28: □ 28 kuzamura: □

6. Ubuvuzi bwigikomere/imvune

(a) Waba waravuwe igikomere/imvune wagize nabaganga babyigiye?
Yego: □
Oya: □

(b) Niba ari yego, Shyira ikimenyetso mukazu kari imbere yubuvuzi wakorewe ushobora guhitamo aharenze hamwe.

<table>
<thead>
<tr>
<th>Ubuvuzi ngororangingo: □</th>
<th>Guhabwa ubuvuzi bugusubiza mubuzima busanzwe nyuma yo kubagwa: □</th>
<th>Guhabwa imiti: □</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gusuzumwa na Dogiteri: □</td>
<td>Kubagwa: □</td>
<td>Gushyirwaho sima cg bande ifasha imvune gukira: □</td>
</tr>
</tbody>
</table>

(c) Waba warasubiye gukina ubyemerewe na muganga?

Yego: □
Oya: □

Tugushimiye kwemera gusubiza uru rutonde rwibibazo.