MEDICAL CONDITIONS AND ILLNESS IN ELITE FOOTBALL PLAYERS DURING INTERNATIONAL COMPETITION

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Declaration

I, Nicolas Charle Theron, hereby declare that the work on which this dissertation is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university.

Signature: _____ Date: _____

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List of abbreviations

AFC	Asian Football Confederations
CAF	Confederations of African Football
CNS	Central nervous system
cm	Centimetre
CONCACAF	Confederation of North America, Central America and Caribbean Association Football
°C	Degrees Celsius
ECG	Electrocardiogram
ECHO	Echocardiogram
EIA	Exercise induced asthma
EURO	European
FIFA	Fédération Internationale de Football Association
FINA	Fédération Internationale de Natation
F-MARC	FIFA Medical Assessment and Research Centre
GIT	Gastrointestinal tract
HIV	Human immunodeficiency virus
IAAF	International Association of Athletics Federation
ICD	International Classification of Disease

IOC	International Olympic Committee
Kg	kilogram
NICD	National Institute of Communicable Diseases
NSAID’s	Non-steroidal anti-inflammatory drugs
OFC	Oceania Football Confederation
UEFA	European Football Association
URTI	Upper Respiratory Tract Infection
USA	United States of America
Yrs	years

Abstract

Background: Previous clinical research of football players participating in international tournaments has mainly focussed on documentation of injuries and risk factors for injury. However, despite anecdotal evidence that medical symptomatology, illness and medical complaints are common during travel to international competitions, the epidemiology of medical conditions before, during or after elite level football tournaments, has not been well documented.

Objective: The aims of the research presented in this dissertation were: 1) to determine the prevalence of medical conditions in elite football players 2) to determine the incidence and nature of medical conditions and illness in the elite football players participating in an international tournament (2009 FIFA Confederations Cup tournament) and 3) to provide data for the medical planning and management of elite football players during future events.

Methods: The first component of this dissertation consisted of a comprehensive review of the current literature describing the prevalence and incidence of medical conditions and illness in athletes. The original research component of this dissertation consisted of two parts, and both studies were conducted during the FIFA Confederations Cup tournament, which was held in South Africa in June 2009. All the players in the 8 participating teams (23 players per team – a total of 184 players) were approached by the FIFA Medical Assessment and Research Centre (F-MARC) through their team physicians and invited to participate as research subjects in the studies. Part 1 (descriptive cross-sectional study): Prior to the tournament, all the players completed a previously validated medical history and illness questionnaire. Furthermore, the questionnaire contained sections on player demographics, training history, medication and supplement use, life-style history, family history of atopy, current and past history of medical conditions and detailed

sections pertaining to upper respiratory tract infections (URTI), allergies, asthma, exercise associated muscle cramping (EAMC) and history of previous surgery. Part 2 (prospective cohort study): During the 15 days of the tournament each team physician was requested to complete a daily injury, medical illness and treatment log for each player. Finally, data on the environmental conditions at each venue were collected, as recorded by the South African Weather Service.

Results: The main findings in part 1 of this study were: 1) exercise associated muscle cramping (EAMC) was the most prevalent medical condition reported, with 64 (46%) of the players reporting a history of EAMC, 2) the prevalence of allergy was 27 (20%) and asthma 6 (4%), 3) the prevalence of dermatological conditions was 16 (12%), 4) the prevalence of gastro-intestinal conditions was 10 (7%) and central nervous system conditions was 6 (4%), 5) URTI one week before the tournament was reported by 7 (5%) of the players, 6) 68 (49%) of the players reported a history of previous surgery and 7) 72 (52%) of the players reported the use of supplements or vitamins and 11 (8%) the use of medication. Knee surgery was the most common anatomical area operated with 33 (24%) of the players reporting previous knee surgery. This was followed by a much lower prevalence of ankle surgery, 8 (6%).

In part 2 of the study, a total of 56 injuries and 35 illnesses were recorded during the tournament. The main findings in this study were: 1) an overall injury rate of 64.4 injuries per 1000 match hours or 2.1 injuries per match, 2) an overall rate of 2.7 injuries and 1.7 illnesses per 100 player days, 3) that 0.88 days were lost per injury and 0.46 days were lost per illness, 4) the lower limb was the most commonly injured body part, 5) 11 (20%) of the injuries reported were to the thigh, 6) 15 (44%) of the injuries reported were due to a contusion, 6) 13 (37%) of the illnesses reported were due to ENT conditions, and 7) 7 (20%) were due to respiratory tract symptoms.

Summary and conclusion: Illness and injury are common during an international football tournament. The pattern of injury was similar to that previously reported. However, the novel finding of this dissertation was that illness is a significant component to the medical care to a travelling team and needs to be considered by team physicians managing the medical needs of elite football teams.

Keywords: football, illness, medical conditions, international sporting tournaments, elite athletes.

Chapter 1

Introduction and scope of the dissertation

The 8th FIFA Confederations Cup football tournament, in which 8 international football teams competed, was held from the 14th to the 28th of June 2009 in South Africa. This tournament is played every 4 years, 1 year before the FIFA World Cup football tournament. The tournament, also known as the "festival of champions", is considered a prestigious warm-up tournament for the next FIFA World Cup. Furthermore, this tournament was also used to evaluate the medical facilities and environmental conditions in South Africa, the host country for the 2010 FIFA World Cup tournament.

The 2009 FIFA Confederations Cup football tournament was played between the winners of each of the FIFA confederations regional tournaments, the previous FIFA World Cup winners (Italy) and the next FIFA World Cup tournament host countries national team (South Africa). This tournament was comprised of 8 international teams each consisting of 23 players, a total of 184 players, and included the teams from Brazil, Egypt, Iraq, Italy, New Zealand, South Africa, Spain and the United States of America. These teams and their regional representations are listed in Appendix 1. The 4 host city venues for the tournament in South Africa were Johannesburg, Mangaung (Bloemfontein), Rustenburg and Tshwane (Pretoria).

This was the first time that this tournament was held in Africa and meant that participating players from all over the world had to travel to South Africa. The tournament also took place in the winter season, a novelty for a FIFA Confederations Cup or World Cup tournament. The participating players were thus potentially exposed to the specific environmental conditions and possibly new infective agents in South Africa at the time of the tournament. During the tournament itself, the players were also exposed to demanding physical challenges (for example; climatic extremes, pollution in large cities and alteration to sleep cycles) that may have negatively affected their general health.

It is well recognised that team physicians attending to athletes medical needs will encounter non-trauma related medical problems. Such medical conditions and illnesses associated with exercise in elite professional footballers participating in a tournament can affect many of the body organ systems including; the respiratory, gastrointestinal, dermatological, cardiovascular, musculoskeletal, neurological, metabolic, endocrine or urogenital systems. It is not currently known what patterns of medical complaints occur during large international football tournaments or how many of these complaints are due to pre-existing medical conditions. The prevalence of medical complaints in the participants prior to a tournament and the incidence of medical conditions and illness during elite athletic tournaments have not been well studied. In this dissertation, the focus will be on the prevalence and incidence of medical conditions and illness experienced before and during an international football tournament.

To date, the majority of research studies that have examined medical conditions during competitive football and other sporting events have focussed on the incidence and nature of injuries only. Injury surveillance systems for football and multi-sports tournaments such as the Olympic Games have been well described and the standardization of injury definitions and surveillance methodology has been accepted by experienced team physicians[1,2]. Yet, illness surveillance has not been well researched and thus an approach to standardize methodologies of illness surveillance does not currently exist. However, the injury surveillance system in the future Olympic Games will include disease conditions as well as injury data[3]. A number of studies have reported medical complaints in specific systems and the main focus of these studies has been on respiratory tract symptoms after competitions[4,5]. The outbreak of infective medical conditions during sports participation has also received some attention and a review of such outbreaks has been published[6]. A limited number of studies have documented medical conditions and illness in athletes and the results of these studies suggest that the incidence and nature of medical conditions experienced by elite athletes while participating in large sporting events is similar across various sporting codes and events. However, further research is needed to accurately document the patterns and significance of disease in the various sporting codes and in particular in football. In football players, the incidence and prevalence of medical conditions and illness, including respiratory tract symptoms in relation to training, competition and travel to international competitions (tournaments), has not been documented.

In chapter 2 of this dissertation the current literature pertaining to the occurrence of medical conditions and illness in athletes and the reporting thereof before, during and after elite international sporting events will be reviewed. In particular the following will be discussed: 1) medical conditions and symptomatology reported by athletes prior to events, 2) medical conditions recorded during sports participation and 3) medical conditions related to travelling to and participation in elite international sporting events.

Chapters 3 and 4 focus on, the original research component of this dissertation and on the following 2 studies: 1) the prevalence of pre-competition medical conditions in elite football players and 2) the incidence of medical complaints and illness during an elite international football event. Furthermore, the effects of pre-tournament medical complaints, medical history, environmental conditions and training load on the incidence of medical conditions and illness experienced during competition will be explored. As this was the first study of this nature, the present study served as a reference for research that was conducted during the subsequent 2010 FIFA World Cup tournament. Therefore, this study also served as an initiative to further develop and standardize the research methodology that can be used during subsequent elite sporting events for the collection of illness data. Finally, the results of this research provide practical guidelines for those tasked with the medical care of athletes.

In chapter 5 of this dissertation, the main findings will be summarized and clinical guidelines for sports physicians and event organisers regarding the prevention and management of medical conditions and illness during elite international sporting events will be presented.

Chapter 2

Medical conditions and illness in elite athletes: A review of the reported prevalence and incidence of medical conditions and illness in elite athletes

2.1. Introduction

Sport, whether practiced for recreational or health purposes or as a profession is practiced by millions of individuals all over the world. It is well established that regular physical exercise is beneficial in the primary and secondary prevention of chronic diseases of lifestyle, including coronary heart disease, hypertension, cancer, obesity and diabetes mellitus. The health benefits of regular physical activity were emphasized in a recent publication naming physical inactivity as arguably the most important public health threat of the 21st centruy[7]. There is thus a perception that athletes, due to their participation in regular exercise and subsequent physical fitness, are generally healthy and that their participation in exercise training protects them against the risk of acquiring medical conditions and illnesses. The reporting of medical problems encountered by athletes has traditionally focussed on injuries, yet the medical conditions including systemic conditions such as respiratory tract complaints, central nervous system conditions, exercise associated muscle cramping and infections, have largely been neglected. Indeed, when infection is considered, epidemiological evidence suggests that increased exercise training load (volume and intensity), particularly in endurance athletes, can be associated with an

increased risk of developing illnesses or infections[8,9]. A popular working theory regarding exercise and infection is the J-curve proposed by Nieman[10]. According to this theory, regular moderate exercise decreases the risk of infection to below that of sedentary individuals, whereas strenuous, intense exercise increases risk of infection above that of sedentary individuals. The J-curve theory is supported by a recent study which confirmed an association between the volume and intensity of exercise and the incidence of upper respiratory illness (URI)[11]. However, more evidence is needed before the J-curve can be accepted as subject numbers in the existing studies are small and rely on patient recall or self reporting of the diagnosis of illness. The exact frequency, duration, type and intensity of exercise required to optimally lower ones risk of infection or to adversely increase the risk of infection remains to be determined. Also, pathogen exposure, stress, sleep, nutrition and the environment affect the immune system and play a confounding role in the occurrence of illness in athletes. These factors have also not been investigated fully[12-14]. Furthermore, elite athletes participating at higher than recreational levels of sporting performance will compete at a high intensity and spend many hours daily, training for their events. This physical stress is often compounded by the psychological demands of international sport as well as the travel related stress of getting to and being in the environment of the event destination. These additional factors may further predispose elite athletes to a higher risk of medical conditions and illness[12]. Therefore, international sporting tournaments require significant preparation by the host countries medical team and physical and emotional preparation by both the players and the accompanying officials to ensure successful participation.

The environment in which athletes compete, train and reside, both domestically and internationally provide varied opportunities for the transmission of infectious organisms via airborne, person to person or common-source exposures[6]. Furthermore, 59 infectious disease outbreaks reported in competitive sports from 1922 till 2005 were identified and reviewed recently[6]. Another review of infections in athletes suggested that athletes do indeed have an increased risk of developing illnesses but concluded that more research was needed to determine the mechanism of transmission[15]. The precise aetiology and pathogenesis of illness, in particular respiratory tract symptoms in athletes during training and competition, is not clear. However, a popular hypothesis is that alterations in the immune system allow post-exercise infections to develop[9,16-20]. This hypothesis has however recently been challenged due to the findings that evidence of actual infection has not been consistently documented either clinically, serologically or through the culture of organisms[21,22]. In a study investigating the association of exercise and URI, pathogens were identified in less than 30% of the affected athletes[11]. Further investigations are needed to determine the cause of illness in the symptomatic URI athletes where a causative agent could not be identified. Furthermore, despite numerous attempts to describe an association between post-exercise immunity and upper respiratory tract infections, no clear relationship between altered immune parameters and upper respiratory tract symptoms has been documented[21-23]. Therefore, the hypothesis that infection is responsible for respiratory tract symptoms in athletes, particularly after endurance events requires further study, or alternative hypotheses need to be considered. There is a growing interest in the prevalence and incidence of medical conditions and illness in athletes before, during and after sporting events.

The majority of the previous studies investigating elite sporting tournaments have focused on injury reporting and only limited studies have reported on the incidence of illness. In football, injury research methodology has been well described by an injury consensus group established under the auspices of F-MARC, who defined topics such as the definition of injury, recurrent injuries, injury severity, training and match exposure, as well as criteria for classifying injuries according to location, type, diagnosis and cause[24]. However, no such research methodology has been described for medical conditions and illness reporting. The focus of this review is on illness, where applicable references and comparisons of injury data and illness data will be discussed. Football injuries will not be reviewed in this chapter as they have been well reported and reviewed elsewhere[25,26].

This review will therefore focus on the epidemiology (prevalence and incidence) of medical conditions and illness experienced by elite international athletes and the following definitions of the terminology used throughout this thesis are therefore of importance[27]:

> The point or current prevalence of a condition is defined as the relative frequency (number of cases) of the condition present in a cohort population at a particular moment in time.
>
> The life-time prevalence of a condition is defined as the relative frequency (number of cases) of the condition having previously been present in a cohort population at any stage in their life-time (over a period of time).
>
> The incidence of a condition is defined as the relative frequency (number of new cases) of the condition occurring over a pre-determined period of time.

The relationship between pre-existing medical conditions reported by athletes before a competition (prevalence) and the medical conditions recorded during a completion (incidence) has not been examined. Of particular interest in this review are the medical conditions experienced by elite football players prior to, during and after international tournaments.

The review is divided into the following sections. In section 2.2., the prevalence of medical conditions and illnesses in athletes will be reviewed and in section 2.3., the incidence of medical conditions and illness during sporting participation will be reviewed. Finally in section 2.4., general medical conditions and travel related medical problems in elite athletes participating in international events will be reviewed.

2.2. The prevalence of medical conditions and illnesses in elite athletes with specific reference to footballers

2.2.1. Introduction

The prevalence of medical conditions affecting athletes prior to participation in elite international sporting events have been reported previously, but have not been well studied. Indeed, only limited data exist in few selected sports. These include a review of common illnesses and injuries limiting competitive swimming[28], a descriptive review of infectious diseases in rugby players[29], a 12 year profile of the injury and illness data for the Twin Cities marathon[30] and a study investigating

medical conditions in participants, prior to and during the 1980 Melbourne marathon[31]. Medical conditions were reported in 33% of the 459 participants prior to the 1980 Melbourne Marathon. In these athletes, 51% reported unspecified musculo-skeletal conditions and 23% respiratory tract illness (RTI) or viral infections and 10% reported gastrointestinal conditions[31]. A review of the current literature failed to identify studies outlining the prevalence of pre-competition general medical conditions in elite football players. The findings of a pre-participation physical examination focussing on unknown or undiagnosed heart conditions including congenital cardiomyopathy in the participants of the final rounds of the 2006 FIFA World Cup have been published[25]. However, to date, the general medical history and examination data of the other body systems collected in these footballers has not been published.

In elite football players, the overall prevalence of medical conditions and illness, including upper respiratory tract symptoms (URTS) in relation to training and competition has not been documented. This review will focus on all medical conditions and illnesses as reported during elite sporting events. The review will emphasise URTS as this is one of the most commonly reported medical problems in athletes. The studies that have reported the prevalence of specific medical conditions in elite athletes will be discussed in context of the various body organ systems.

2.2.2. Cardiovascular system

The true prevalence of heart disease in athletes is difficult to determine as the majority of athletes with underlying heart disease or those who suffer a sudden cardiac death do not experience any warning symptoms[32]. However, a periodic health examination (PHE) has been suggested as a means to detect underlying cardiac disease in athletes[3]. Exercise or sports-related sudden cardiac death is a rare event. However, when it does occur, the most common causes in athletes have been reported as hypertrophic cardiomyopathy (24-36%), coronary artery abnormalities (18-24%), Marfan syndrome (4%) and mitral valve prolapsed (4%)[32-36]. The prevalence of hypertrophic cardiomyopathy in young Italian footballers is lower than other population groups (2%) and arrythmogenic right ventricular dysplasia / cardiomyopathy was reported to account for the most (22%) sudden cardiac deaths in young Italian athletes[37,38]. Periodic health examinations with specific emphasis on electrocardiogram (ECG) and cardiac echocardiogram (ECHO) are currently not routinely conducted. In the majority of sporting codes these examinations have only recently been included as part of the PHE as a result of the consensus statement of the IOC[3]. However, a pre-participation medical examination focussing on unknown cardiac disease and the prevention of sudden cardiac death was required for all the players participating in the FIFA 2006 World Cup in Germany. This information was collected by F-MARC prior to the tournament[25]. This study found that about 1% of the players required further cardiac assessment from the information gathered during the pre-participation medical examination[39].

2.2.3. Respiratory system

2.2.3.1. Terminology and definitions

Athletes can present with respiratory tract symptoms ranging from a blocked or "runny" nose to coughing and chest pain. These symptoms may be accompanied by additional systemic symptoms such as fever, headache, muscle pain and general fatigue. It has been suggested that if an athlete has a common cold ("runny" nose and sore throat without a fever or general body pain) then exercise training may be resumed a few days after the resolution of the symptoms. However, if the athlete complains of fever, fatigue, muscle aches and lymph gland swelling, 2 to 4 weeks should be allowed before intensive training can be resumed[13]. To describe these clinical presentations more accurately it has been proposed that the terms Upper Respiratory Tract Symptoms (URTS) (blocked or "stuffy" nose, "runny" nose, sore throat), Lower Respiratory Tract Symptoms (LRTS) (cough, wheeze, chest pain) and systemic symptoms (fever, muscle aches, joint pain, general fatigue) be used[40].

2.2.3.2. Respiratory system

Respiratory symptoms suggestive of asthma are common in athletes[41]. The prevalence of asthma in athletes appear to be higher than that of the normal population and varies from 3-30% in summer sports[42] and 12-60% in winter sports[43] depending on the environment in which it is measured, the highest prevalence reported in cross-country skiers[44,45].

2.2.3.3. Ear, nose and throat and atopic illness

The prevalence of atopic illness in the general population is not known but allergies are common worldwide and the prevalence of allergic disease in industrialized countries is estimated to be 10-25%[45]. In a study investigating allergic rhinitis in elite athletes, it has been reported that 30% of the control subjects experienced physician diagnosed disturbing allergic symptoms[46]. It has also been documented that respiratory tract allergy, in particular allergic rhinoconjunctivitis is common in athletes, especially in elite athletes[46-51]. Atopic illness was identified in 62% of the 81 (63% of Olympic squad) athletes tested who represented South Africa during the Sydney Olympic Games, and of these athletes tested (11%) were found to be asthmatic[49]. The prevalence of atopy (62%) in the South African Olympic squad is thus significantly higher than that in the general population but it is similar to the prevalence reported in Australian athletes. Indeed, 56% of 214 elite Australian athletes tested for allergy before the Sydney Olympic Games gave a symptom history consistent with allergic rhinoconjunctivitis, 59% had a positive skin prick test to tested allergens and 21% stated that they had experienced asthma[50]. A later study examining the patterns of allergic reactivity and disease in Olympic athletes reported a positive skin prick test in 56% of the athletes and 37% of the athletes reported having had allergic rhinoconjunctivitis[48]. In a recent study, the prevalence of allergic disease in juvenile football players was documented as 34.5%[52]. However, this study was unfortunately of limited value due to its small sample size. As the symptoms of allergic respiratory tract conditions and the symptoms of URT infections overlap, the possibility that RTS in athletes are related to allergies needs to be considered. Finally other physical factors, such as mechanical trauma of the airways due to high air flow rate during exercise, as a cause for RTS in athletes must be considered as possible mechanisms.

2.2.4. Dermatological conditions

The epidemiology and prevalence of various skin diseases in athletes have been reported[53,54]. Furthermore, infective skin disorders pose a risk of disease transmission amongst athletes. Studies reporting the prevalence of Tinia Corporis in wrestling teams have found 24 to 77% of wrestlers to be infected[53]. Herpes simplex in athletic populations has also been widely studied and the reported prevalence varies between 2.6% to 40.5% with a mean prevalence of 20%[55]. The prevalence of impetigo is currently unknown. Methicillin-resistant Staphylococcus aureus has however been cultured from 22% of wrestlers' furuncles[53].

2.2.5. Central Nervous System

Exercise and sport-related headaches are often induced by exertion. The prevalence of sport-related headaches has been reported to be 35% in active university students[56] and various headache syndromes have been described in athletes[57-60]. The prevalence of the sport-related headache types in affected athletes have been reported as follows: effort / exertion headache (60%), post-traumatic headache (22%), effort migraine (9%), trauma induced migraine (6%) and miscellaneous (3%)[56,61]. The prevalence of benign exertional headache (defined as a bilateral, throbbing pain lasting 5 minutes to 24 hours, specifically provoked by physical exercise and not associated with any systemic or intracranial disorder) has been reported in (1%) of the general population[62]. In division 1 National Collegiate Athletic Association men's and women's basketball players the prevalence of

migraine headaches has been reported to be 2.9%[63]. In football no epidemiological studies have been published, describing the prevalence of headache syndromes.

2.2.6. Gastrointestinal system

It is well recognized that gastrointestinal complaints are common amongst athletes, especially endurance athletes. Gastrointestinal symptoms in athletes[64] and distance runners[65,66] have been reviewed previously. Upper gastrointestinal symptoms such as heartburn, epigastric pain, nausea, and vomiting are reported by 20-50% of endurance athletes[67] and up to 50% of athletes during high-intensity exercise[68]. The lifetime prevalence of GIT symptoms associated with running range from 20-83%[65]. No epidemiological studies have been published, describing the prevalence of GIT symptoms in football players.

2.2.7. Conclusion

From the limited research describing the prevalence of medical conditions and illness in athletes, it can be concluded that medical conditions are common in this population. The prevalence of reported conditions depends on the condition and the population described. The majority of the current studies describe the prevalence of individual conditions in athletes and do not discuss the prevalence of “all” medical conditions in a cohort population. The most common conditions reported in athletes are gastrointestinal complaints (83%), skin infections (77%), allergic conditions (60%), asthma (60%), headaches (35%) and upper respiratory tract infections

(23%). Thus, only limited data are available regarding the prevalence of common medical conditions that may affect elite athletes. More specifically, there are no data on elite footballers. As pre-existing medical conditions may affect an athlete's performance and unknown conditions may expose an athlete to a risk of complications, the documentation of medical conditions present in athletes will assist team physicians to identify risk patterns and to help develop pre-participation examinations (PPE) or periodic health evaluations (PHE) to improve medical care delivered to athletes.

2.3. Incidence of medical conditions and illness in elite athletes during competition with specific reference to footballers

2.3.1. Introduction

The incidence of medical conditions affecting athletes during elite international sporting events has been reported previously, but has not been well studied. In particular, the incidence of general medical conditions and illness has not been reported in elite football players during international tournaments. Major sporting bodies including FIFA, the IOC, FINA and the IAAF have published only limited data for medical conditions or illness during their major events. These organizations have only recently added illness surveillance to their medical data collection during events. Serious medical illnesses during elite sporting events such as the World Cup and Olympic Games are uncommon and such, mass participation sporting events have not been associated with an increased number of disease outbreaks[69]. However, the recent emergence of diseases such as Avian influenza and H1N1

pandemic influenza have highlighted the need for good surveillance strategies during international sporting events.

2.3.2. Incidence if injuries reported by elite athletes and footballers

As previously mentioned, the majority of the current literature addressing the health of elite athletes has focussed on the incidence of injuries only and has neglected the incidence of medical conditions. Football injuries have also been well reported on during previous international FIFA tournaments, including the FIFA 2006 World Cup in Germany[25]. The FIFA Medical Assessment and Research Centre (F-MARC) began the study of injuries during the final rounds of the 1998 FIFA World Cup in France. All subsequent tournaments organised by FIFA as well as the football tournaments during the Olympic Games in Sydney and Athens have been monitored[26]. The incidence and nature of injuries in football is not the primary aim of this dissertation. Furthermore, F-MARC injury research methodology has been well reported elsewhere[1,2,25,26], therefore football injuries will not be reviewed in this literature review. However, injury epidemiology will be briefly discussed in chapter 4 of this dissertation with reference to illness data that were collected. The injury data will only be used to compare and highlight the relative importance of the medical conditions reported by elite footballers.

2.3.3. The incidence of medical conditions and illness in elite athletes

It is well established that various medical conditions and illnesses, especially respiratory tract symptoms, affect elite athletes while travelling to and competing in international competitions[70-73]. These medical conditions most commonly affect the ear nose and throat, respiratory tract, dermatological system, central nervous system and gastrointestinal system[70-74] but any of the body organ systems may be affected. Elite athletes are not immune to any of the disease processes that may affect the general population. A descriptive epidemiological study of college athletes found that 27% of the consultations were for medical problems, with respiratory tract (21% of the medical consultations) and dermatological (13% of the medical consultations) conditions being the most common problems encountered over a 2 year period[75]. Furthermore, there is some evidence suggesting that the risk of contracting certain medical conditions such as URT infections may be increased due to regular strenuous activity. The most common systems involved will be reviewed individually in more detail.

2.3.3.1. Cardiovascular system

Sudden cardiac death (SCD) (defined as, a witnessed or unwitnessed natural death resulting from sudden cardiac arrest occurring unexpectedly within 6 hours of a previously normal state of health[76]) is the most significant cardiovascular event which may occur while participating in sporting activities. The annual incidence of sudden death among high school and collegiate athletes ranges between 1 in 100 000 and 1 in 300 000 athletes per year[34,35]. Furthermore, the incidence of SCD

death is reported to have reduced by 89% in screened athletes from 3.6 / 100 000 person years (1979 – 1980) to 0.4 / 100 000 person years (2003 – 2004) with the rate of SCD in unscreened nonathletic population remaining unchanged[77]. However, in the 10 years from 2000 to 2010 there have been 40 reports of sudden death in professional footballers, one of which, a player (aged 26) who collapsed suddenly and died due to hypertrophic cardiomyopathy during the 2003 Confederations Cup in France (www.in.reuters.com, www.wikipedia.org). To date, no studies reporting the incidence of cardiovascular disease or sudden cardiac death in footballers have been published.

2.3.3.2. Respiratory system

There is evidence from previous studies that endurance athletes are prone to develop upper respiratory tract symptoms just prior to and in the 2 weeks after strenuous events[4.5,8,40,78-80]. It is also known that athletes have a high prevalence of allergy and that travelling athletes are exposed to a variety of allergens at the venues at which they participate. This may aggravate both acute and chronic allergies and reduce athletic performance in these athletes[47]. Respiratory tract symptoms in elite athletes participating in events lasting a few weeks, such as the Olympic Games, are very common and account for a large portion of the medical complaints attended to by the team physicians responsible for the athletes health[70,71]. Respiratory tract symptoms accounted for 36% of all the illnesses reported in a retrospective study of international footballers[81] and 47% of the illnesses managed at the Nordic venue for the 2002 winter Olympic Games[82].

2.3.3.2.1. Influenza

2.3.3.2.1.1. Seasonal influenza

Seasonal influenza occurs worldwide, and constitutes a highly contagious respiratory illness. Influenza will typically reach its peak in mid winter. In South Africa, mid winter is in June and this was the period of the present study and also the 2010 FIFA World Cup. It is well recognised that, due to air travel and high training loads, travelling athletes are prone to common viral infections including influenza. Crowded living conditions, including those at mass sporting events such as the Olympic Games and World Cup football tournament, also potentially favour the spread of contagious diseases, such as influenza. Influenza vaccination is currently recommended for any person wishing to protect themselves from the risk of contracting this infection, especially in industrial settings, where large-scale absenteeism could cause significant economical losses[83]. It can therefore be recommended that athletes receive an annual influenza vaccination.

2.3.3.2.1.2. Novel or Pandemic H1N1 "Swine" influenza

The WHO declared the outbreak of novel H1N1 "swine" influenza a global pandemic on the 11th of June 2009, exactly one year before the opening match for the 2010 FIFA World Cup tournament. Fortunately, this disease did not prove to be highly virulent and no travel restrictions were imposed. During the 2009 winter influenza season, 12 331 laboratory confirmed cases of pandemic H1N1 "swine" influenza

were reported by the National Institute of Communicable Disease (NICD) in South Africa, with 91 laboratory confirmed H1N1 related deaths[84]. The NICD reported 2 peaks in the weekly number of influenza specimens tested (the first peak in week 24 of 2009 and a second atypical peak in week 32 of 2009). This second atypical peak was due to the novel H1N1 influenza outbreak[85]. The northern hemisphere 2009-2010 seasonal influenza vaccine did not incorporate the A/California/7/2009(H1N1) virus strain of the novel H1N1 virus. However, the influenza vaccine for South Africa for 2010 did include this strain. It was thus recommended that travellers to South Africa including the elite footballers receive a separate monovalent pandemic H1N1 vaccine before travelling or consider influenza vaccination with the recommended southern hemisphere vaccine once in South Africa.

2.3.3.3. Dermatological system

Participation in sporting activities can result in various dermatological conditions the most common being skin infections. These skin infections can be minor such as superficial fungal infections or more significant conditions such as Herpes simplex eruptions, which have been well documented[55]. Furthermore, outbreaks of community-acquired methicillin-resistant Staphylococcus aureus skin infections, previously only recognized in hospital based patients, have also been reported in several sporting disciplines, including football, rugby, wrestling and fencing[86,87]. Such an outbreak was reported in 2003, where 5 of 58 (9%) of the St Louis Rams professional football team were affected[88]. In 2004, a case report of a single football player with a methicillin-resistant Staphylococcus aureus abscess on his wrist, after a graze wound was sustained on the pitch was reported[89]. Following these outbreaks, participants of contact sports have subsequently also been recognised

as being at a high risk for developing methicillin-resistant Staphylococcus aureus skin infections by the Centres for Disease Control and Prevention[89]. Other dermatological problems include inflammatory conditions such as allergic dermatitis and neoplastic disorders including skin malignancies from over-exposure to the sun. Dermatological conditions in athletes have been reviewed extensively elsewhere[53,90].

2.3.3.4. Central nervous system

The incidence of concussion has been well studied and reported in football[91]. However, no epidemiological studies have been published reporting on the incidence of other non-traumatic central nervous system conditions. Jet lag following travel across multiple time zones has been associated with neurological complaints in athletes. A high number of medical consultations were reported during the first week of travel to the Sydney 2000 Olympic Games, by the South African team, due to vague neurological symptoms, (headache, malaise and insomnia), and these were ascribed to possible jet lag[70]. Jet lag is the result of a lack of synchrony of the normal body rhythms due to travelling over time zones, the main symptoms of which are tiredness, sleeping difficulties, mood changes and loss of concentration. Although jet lag is not an illness and is of limited medical importance, the effects of jet lag may result in interpersonal conflict and poor sporting performance until the individuals have adapted to the new time zone. Furthermore, in a 1-year retrospective study of 852 German athletes, the risk of URTI was highest in endurance athletes reporting significant stress and sleep deprivation related to travel[14]. Generally, those travelling in an easterly direction will be affected more than those travelling in a westerly direction due to the shortening

of the day. A case report of an elite rugby player travelling over numerous time zones and managing to play with distinction ascribes the good performance to appropriate travel advice and the selective use of medication such as melatonin and short acting sedatives[92]. However, the World Health Organisation (WHO) does not recommend the use of melatonin but rather recommends the use of short-acting sedatives. The routine use of such short-acting sedatives has been described by members of teams competing in the Super 14 international rugby competition[93].

2.3.3.5. Gastro-intestinal system

Gastrointestinal complaints have been reported to account for up to 7% of the medical conditions reported by the participants of sporting events[81,94]. However, gastroenteritis disease outbreaks may result in a significantly higher frequency of gastrointestinal complaints. During the 2006 FIFA World Cup in Germany, 8 members of the Croatian team reported symptoms of a suspected viral gastro-enteritis on the 1st day of the tournament[69]. Travellers' diarrhoea was also reported in 20% of the 122 (81 athletes and 41 officials) team members travelling to the Youth Commonwealth Games in India[95]. The GIT symptoms with the highest incidence (occurrence / 1000 participant hours) in endurance sports have been reported as follows: urge to defecate (74), abdominal cramping (48) and heartburn (32)[96]. It has also been reported that running and the running leg of triathlon are characterized by a particularly high risk of developing lower GIT symptoms[96]. To date, the incidence of GIT symptoms in football players has not been investigated.

2.3.3.6. Other infections: Glandular fever

Infectious mononucleosis is common and by the age of 30, 90% of the general population has been exposed to the Epstein-Barr virus[97]. An outbreak of infectious mononucleosis has been reported in athletes and includes a report of 10 cases, confirmed by Epstein-Barr virus serology, in a squad of 24 swimmers in a single season[28]. A concern for athletes diagnosed with infectious mononucleosis is the association of spontaneous or traumatic rupture of the spleen and this has been reported to occur in as high as 0.5% of all cases[98].

2.3.4. Conclusion

From the limited research describing the incidence of medical conditions and illness it can be concluded that 27-69% of consultations in athletes seen by a team physician during sports events are due to medical conditions. The most common conditions reported in athletes are upper respiratory tract infections (47%), gastrointestinal symptoms (20%) and skin infections (13%). Only limited data discussing the incidence of common medical conditions that may affect elite athletes exists and it appears that there is only one study describing medical conditions amongst elite footballers. The incidence of illness may be at least as common as the incidence of injury and thus may be an important contribution to the burden of disease. Many of these conditions may have a profound effect on an athlete's performance and to assist team physicians and event organisers with optimal planning of medical care further research in this field is needed.

2.4. Medical conditions in athletes participating in international events

2.4.1. Introduction

Elite football players travel to different locations throughout the world to participate in events lasting from a few days to weeks. These events are characterized by regular strenuous games and training sessions between games. Many matches are also scheduled at night causing sleep disturbances. Players may be exposed to differing environmental conditions such as extremes of temperature, humidity, adverse atmospheric pollution, aeroallergen exposure and dietary changes. Furthermore, athletes breathe a higher volume of air than non-athletes and are thus exposed to a greater volume of respiratory irritants which may amplify an inflammatory response in their airways[45]. It has been suggested that exposure to these different environmental conditions may also increase the risk of medical conditions such as GIT illness, RTS, URTS and other illnesses during sports participation[50]. Finally, players travelling between the northern and southern hemispheres are exposed to different pathogenic organisms including seasonal viral influenza strains which may increase the risk of developing an illness.

2.4.2. Medical conditions associated with travel to international sports events

Whilst there are numerous studies describing general travel health and medical conditions at large sporting events such as the Olympic and Commonwealth Games[72,93,99-101], to date no studies have been published which have investigated the travel related health issues pertaining to elite footballers or FIFA World Cup tournaments. However, a recent paper has discussed communicable disease risks and advice for visitors to the South Africa 2010 FIFA World Cup[102].

It is well established that various medical conditions and illnesses, including respiratory tract symptoms, affect elite athletes while travelling to and participating in international competitions[70,71]. During the Cricket World Cup held in South Africa in 2003, 47% of the 90 patient presentations managed by the medical committee were due to illnesses, the other 53% were due to injuries[94]. The incidence of consultations in this Cricket World Cup was reported as 1.6 consultations per match, with upper respiratory tract infections being the most common medical problem reported. 29% of the illness presentations were reported to be due to assumed infection as these diagnoses were based on clinical evaluation only and not confirmed by laboratory investigations.

Of the 1804 athletes managed by the multipurpose medical facility at the 1996 Olympic Games, 868 (48%) were managed for non-injury related illness[103]. During the Sydney Olympic Games, 69% of all the consultation reported by the South African medical team were for non-traumatic complaints[70]. The reported conditions

most commonly affected the ENT, respiratory tract and gastro-intestinal system[70]. The New Zealand medical team, supporting their athletes at the 2000 Sydney Olympic Games also reported a high incidence of respiratory tract infections 101 (17%) of the 606 consultations, whilst in total, 308 (47%) of the consultations were reported as medical and 345 (53%) due to injuries[104].

The results of 4 studies describing the injury and illness data from elite sporting competitions are summarized in table 2.1.

Table 2.1.: The frequency (n = number of consultations) and percentage (%) of all formal medical consultations in elite athletes participating in tournaments / competitions [2000 Olympic Games (South African and New Zealand teams), 2004 Olympic Games (South African team), the 2003 Cricket World Cup (All teams) and the 2007 CONCACAF Gold Cup (Trinidad and Tobago team)]

	Sydney 2000 Olympic Games Team New Zealand[104]	Sydney 2000 Olympic Games Team South Africa[70]	Athens 2004 Olympic Games Team South Africa[71]	SA 2003 Cricket world Cup[94]	Trinidad and Tobago football[81]	Trinidad and Tobago football Players only[81]
Injuries	(345) 53%	(108) 31%	(72) 40%	(48) 53%	(117) 67%	(102) 73%
Illnesses	(308) 47%	(240) 69%	(108) 60%	(42) 47%	(57) 33%	(38) 27%
Ear nose & throat	3%	18%	13%	0	4.5%	4%
Respiratory	18%	16%	8%	14.5%	9%	9%
Neurological	1%	16%	4%	3%	2%	2%
Gastrointestinal	4%	6%	6%	7%	7%	2%
Dermatological	7%	2.5%	16%	8%	3.5%	3%
Urological	0.5%	2.5%	0.5%	3%	0	0
Psychological	0	2%	3%	0	3.5%	3.5%
Cardiology	0.5%	1%	3%	0	0	0
Ophthalmology	2%	0.5%	0.5%	3%	0	0
Other	11%	4.5%	6%	8.5%	3.5%	3.5%

Derman[70,71], Robinson[104], Kilian[94], Babwa[81]

When evaluating the data listed in table 2.1., the following comments need consideration.

Firstly, the data for the Olympic Games, Cricket World Cup and Trinidad and Tobago football teams all reflect the number of consultations for both players and officials. Data for the medical consultations of the Trinidad and Tobago team players only is also listed separately in the table. It may be assumed that team officials will have a lower incidence of injuries as they are not participating in the sporting competition and thus a higher proportion of illnesses than injuries will be recorded if the data from officials is included. Furthermore a significantly higher frequency of GIT consultations was recorded in the officials of the Trinidad and Tobago football team, when compared to the players.

Secondly, follow-up consultations should not be recorded when determining the incidence of an illness or injury. No mention is made in these studies of whether some of the illness consultations were follow-up visits or whether only new illnesses were recorded. If follow-up consultations have been recorded, the data are difficult to interpret. The New Zealand Olympic medical team reported 345 injuries and 308 illnesses but only 606 consultations as some consultations involved more than one presenting problem. The other studies did not discuss how they reported more than one complaint in a consultation.

Finally, with the exception of the New Zealand team, the ratio of injuries to illnesses is 60:40 for the Olympic Games (a multi-sports event), 50:50 for the cricket World Cup and 30:70 for the football study respectively. As football is a contact sport the

incidence of injuries is expected to be higher than that found in multi-sports events such as the Olympic Games. A similar finding has previously been reported in a study evaluating injuries in all the team sports during the 2004 Olympic Games where the overall incidence of injuries was reported as 0.8 injuries per match (multi-sport) and the incidence of injuries in football only was 2.4 injuries per match[1].

From the current studies it is difficult to compare the data directly as the reporting of illnesses differ. The New Zealand Olympic team reported (11%) of the consultations as “other” (gynaecological, dietary, other infections, allergy, insomnia, fatigue and notifications). Many of these consultations could have been diagnosed more accurately and classified in an appropriate coding system such as the ICD coding system. In the Cricket World Cup study no ENT conditions were recorded and 14.5% respiratory conditions. As 14.5% may be considered higher than expected it may be assumed that a number of the consultations recorded as respiratory may in actual fact have been of ENT origin. The definition and classification of respiratory tract and ENT illness needs clarification and needs to be addressed more accurately in future studies. This will assist physicians to accurately classify URT symptoms as either ENT or respiratory conditions and thus provide essential data to help plan better medical care for teams. Combining the respiratory and ENT frequencies for the various studies gives comparable results with the exception of the South African report from the Sydney Olympic Games. The author of the Sydney Olympic Games study suggested a higher frequency of ENT and respiratory consultations due the high prevalence of atopic illness in the athletes and a high incidence of seasonal allergic illness associated with high aero-allergen counts during this spring-time Olympic Games in Australia.

During the Sydney Olympic Games the South African team reported a high frequency of neurological complaints (16%)[70]. The authors of this paper ascribe the high frequency of vague neurological complaints to jet lag as the majority of the athletes reported these symptoms in the first week after travelling to Sydney.

A higher frequency (16%) of dermatological problems was recorded during the Athens Olympic Games[71]. The authors of that study attributed the high frequency of dermatological conditions to 1) a high frequency of fungal infections in the hot and humid weather conditions experienced in Athens during the Olympic Games, and 2) to a high frequency of ant or other insect bites to athletes in and around the Athens Olympic village.

From the above data it is evident that the medical (non-trauma related) conditions reported by the participants during various elite international sporting events account for a significant volume of the consultations that the team physician will need to tend to. Furthermore, the pattern of conditions reported is consistent through various sporting codes. It is also evident that specific travel related factors such as jet lag and environmental conditions such as aero-allergens can influence the pattern of diseases encountered. It is thus essential that team physicians familiarize themselves with the teams travel plans and competition venues environment when planning medical care.

2.4.3 Other diseases and vaccinations

Travel related diseases that can be highlighted as potential threats include polio, hepatitis A, hepatitis B, meningitis, measles, typhoid and cholera. As there is currently a resurgence of measles in developed countries, including South Africa, such vaccine preventable diseases cannot be ignored. Measles was recently highlighted, and this vaccine was the only vaccine recommended for the UEFA EURO 2008 football championships tournament that was held in Austria and Switzerland[105]. Attention to routine travel related vaccinations, including Hepatitis B, specifically for contact sport participants, including footballers has also been recommended[72,93].

The prevention of illness is important to help limit both morbidity and mortality. In elite athletes, disease can also have a significant impact on an athlete's ability to participate resulting in financial losses. Vaccination is one mechanism to help prevent the spread of disease and this has been recommended for athletes in previous studies[28]. Recommended adult immunisation schedules are updated and published regularly[106]. Recommended immunisations against diseases that may affect elite athletes include hepatitis, influenza and meningitis. To date, no studies have included a history of vaccinations in elite athletes. The prevalence of previous exposure and immunity to diseases such as Hepatitis A and B are unknown in the elite athletic populations and footballers. Furthermore, the incidence of travel related medical conditions in elite athletes or elite football players has not been documented.

Athletes who may be prone to respiratory tract infection due to the stress of training, participation and travel associated with sporting competition should ensure appropriate influenza vaccination. As Influenza is a debilitating disease with a rapid onset, athletes cannot afford to ignore this vaccine preventable condition. It is thus recommended that all participants, officials and supporters attending large international sporting events be vaccinated with the current seasonal influenza vaccination. Such recommendations have previously been advised by the World Health Organization for large sporting events such as the 2000 Olympic Games in Sydney, Australia[104]. As many athletes travel from one hemisphere to the other, consideration must be given to having a second Influenza vaccination with the current appropriate vaccine for the hemisphere to be visited.

2.4.3.1. Malaria

Malaria is the most common life threatening travel related disease that is associated with travel to the tropical regions of the world[107]. This is a protozoal parasitic infection caused by 1 of 5 Plasmodium species, P. falciparum (common to Africa), P. ovale, P. malaria, P. vivax or P. knowlesi. The parasite is transmitted to humans through the bite of the female Anopheles mosquito. The greater South Africa is Malaria free and there was no risk of contracting Malaria while staying in the host cities or attending matches during the 2009 Confederations Cup. Athletes visiting other areas as tourists, or for the purpose of training camps, may be exposed to malaria. Specific travel recommendations may be considered for each separate travel destination. The north-eastern regions of South Africa are Malaria endemic and preventative measure must be utilised when visiting those areas. Chemoprophylaxis is only recommended during the rainy season from September to

May but personal protective measures must always be taken by those who plan to visit these areas.

2.4.3.2. Bilharzia

Schistosomiasis (Bilharzia) is a trematode infection caused by the S. mansoni, S. heamatobium or S. intercalatum species and occurs over much of the eastern half of South Africa. The risk of this tropical infection to travellers and athletes has been highlighted in several published articles, and documented particularly in Zimbabwean triathletes[107,108]. All travellers should be advised to avoid swimming or wading in fresh water lakes and streams in high risk areas.

2.4.3.3. Tick-bite fever

African tick bite fever is a tick-borne Rickettsial infection which is endemic throughout South Africa. It occurs more commonly in the summer but can occur throughout the year. Published GeoSentinal data has reported the spotted fever group (rickettsiosis) as the most predominant cause of systemic febrile illness reported in South African travellers. Furthermore, these travellers were likely to present with rickettsiosis if they were male, travelling as a tourist and visited the country between June and September[109]. The incubation period of the disease is 5-7 days and thus a player may present with non-specific symptoms of fever, headache, joint pain and a rash after returning home. Possible exposure to ticks needs to be considered should players become ill after international travel. An

outbreak of African tick-bite fever in 13 (4%) of 331 French participants (athletes and officials) returning home after an Eco-challenge in South Africa has previously been reported[110].

2.4.3.4. Viral hepatitis

There is a risk of hepatitis virus transmission during sports participation. Outbreaks of both Hepatitis A and Hepatitis B have been documented in athletic populations. An outbreak of Hepatitis A affected 90 members of the College of Holy Cross football team due to an infected water supply[111] and an outbreak of Hepatitis B has been reported among a group of high school sumo wrestlers in Japan due to an asymptomatic carrier[112]. Furthermore, the prevalence of Hepatitis B in the team members of the Okayama University American football team in Japan reported over 19 months was (20.4%), significantly higher than that of other students at the university (1.8%). One of the team members was reported to be an asymptomatic carrier[113]. Athletes involved in team sports have a prolonged close contact exposure to team mates and share food, eating utensils or sporting equipment. Therefore they are at greater risk than individual sport athletes[114]. The current prevalence of hepatitis in athletic populations is not known and thus the risk of transmission cannot be estimated[115]. It is though a general recommendation that vaccination against both Hepatitis A and Hepatitis B be considered for all non-immune “at risk” individuals. Hepatitis B transmission is by blood products and sexual contact and athletes are considered a high risk population.

2.4.3.5. Human immunodeficiency virus (HIV)

The risk of Human Immunodeficiency Virus (HIV) infection during sporting participation has in theory been calculated to be extremely low[116]. However, HIV and other sexually transmitted diseases are health risks that need to be considered in elite athletes as "off the field" exposure to these diseases needs to be limited. It has been reported that 2.4% of travellers to South Africa report morbidity due to sexually transmitted diseases[109]. Athletes participating in South Africa must be made aware of the risks of contracting HIV and other sexually transmitted diseases (South Africa has one of the highest HIV seroprevalence figures in the world, 18% in the adult population and 29.3% of pregnant woman[109]) and they need to avoid risky behaviour.

2.4.3.6. Meningitis

Meningococcal disease is not common in South Africa, but localised sporadic outbreaks do occur usually between May and October. Of concern for large football events is the possible exposure of footballers from Africa to the "meningitis belt" which runs across central Africa from Senegal to Ethiopia. These players may pose a risk as there may be asymptomatic carriers of meningitis and thus exposing other players to the disease. Vaccination with the quadrivalent polysaccharide vaccine is not legally required for entrance to any country other than Saudi Arabia during the Hajj pilgrimage. This vaccination though can be considered and motivated when considering elite football tournaments as they can be viewed as mass gathering events with potential exposure from endemic areas.

2.4.3.7. Cholera

The 2008/2009 Cholera epidemic in neighbouring Zimbabwe did not spread to South Africa other than the direct bordering areas and no travel restrictions were necessary. Routine cholera vaccination is not an international requirement by the WHO or South African officials. Due to the low effectiveness of the current oral cholera vaccine, vaccination is not recommended or required for routine travel.

2.5. Post-event-illness in the returning athlete

Team physicians need to consider tropical infections, especially malaria when players present with a febrile or any "flu-like" illness after having travelled to the tropical and or malaria endemic areas of the world. Effective detection of a post-event Leptospirosis disease outbreak amongst participants of the Eco-Challenge-Sabah 2000 multisport endurance race held in Malaysian Borneo has been reported. These athletes presented with febrile illness, chills, headache and myalgia[117]. Travellers are exposed to various pathogens (viral, bacterial, fungal and parasitic) and they can return within the incubation periods of many diseases. There may be diagnostic difficulties in confirming the aetiology of a disease in a symptomatic patient with a history of travel. The possible unfamiliarity of a physician to disease that is not endemic to the area in which they practice, requires a stepwise approach to the management of fever in the returning traveller[118]. An early diagnosis and appropriate prompt treatment are essential in the successful management of malaria. The most common tropical illnesses in South Africa that could affect athletes are Malaria, Schistosomiasis and African tick bite fever. These

have already been reviewed[107]. It is essential to inform health care workers about previous travel should an illness occur once at home.

2.6. Summary and conclusion

There is a growing interest in medical conditions and illness in elite athletes. The current body of knowledge expands with every study published.

The most important findings from this review are that, 1) medical conditions and illness in elite athletes, and in particular in elite footballers have not been studied extensively, 2) there is a need for further studies to investigate medical conditions and illness in elite athletes and these aspect of elite footballers' health, 3) the natural immunity and vaccination status of elite athletes has not been studied and 4) travel and environmental factors have an effect on the medical conditions reported in elite athletes.

Furthermore, the reporting of medical conditions and illness and studies investigating the pattern of medical illnesses in athletes should be standardized. Particularly, the definition of illness, respiratory tract symptoms and ENT symptoms need to be clarified. Future studies investigating medical conditions and illness in athletes, particularly those reporting data from competitions need to report data collected for officials and players managed separately. This will allow for the distinction to be made between the incidence of medical conditions and illness in the players. The total work load on the medical team can then be more easily and more

accurately determined. To calculate the incidence of a condition, the first consultation needs to be documented and recorded as such. Follow-up consultations must also be recorded separately to determine the burden of disease on the medical staff. Team physicians responsible for the care of sporting teams are also responsible for the medical care of the team officials. For research purposes it is not only useful to determine the incidence of medical conditions in participating, athletes but also to determine the total work load of the medical team relating to care of officials and follow-up consultations which are often as time consuming as first consultations. Furthermore, how the researcher managed the reporting of multiple medical problems in one patient also needs to be discussed. In the recent paper reporting injuries and illnesses during the 2010 Winter Olympic Games, only the most severe injury / illness was recorded if multiple body parts were injured during the same incident or if different body parts were affected by illness[119]. This method has previously been described in a football injury data collection consensus statement[120].

Finally, the reporting of medical condition and illnesses experienced in athletes will contribute to the planning of events and the medical management of both footballers and athletes in general.

Chapter 3

The prevalence of medical conditions and illness in elite football players:

A cross sectional study

3.1. Introduction

It has been documented that the most common medical conditions in athletes affect the upper respiratory tract, gastrointestinal systems and the skin[103,121]. However, the prevalence of medical conditions and illness has not been investigated in elite professional football players. Furthermore, an elite international football tournament such as the Confederations Cup potentially exposes the players involved to competition in a foreign environment and this may increase the risk of developing medical conditions and illness whilst participating in such tournaments.

The aim of this study was to document the prevalence of medical conditions and illness in elite football players participating in the FIFA Confederations Cup held in South Africa in 2009.

3.2. Methods

3.2.1. Type of study

The study was a descriptive cross-sectional study.

3.2.2. Subjects

The UCT/MRC (University of Cape Town / Medical Research Centre) Research Unit for Exercise Science and Sports Medicine, together with F-MARC (FIFA Medical Assessment and Research Centre) (Switzerland), conducted this study to determine the prevalence of medical conditions and illness in the elite football players who participated in the 2009 Confederations Cup tournament. The research protocol was approved by the University of Cape Town Health Sciences Research and Ethics Committee (REC REF: 159/2009) (Appendix 2) and the Institutional Review Board of F-MARC.

All 184 elite male football players participating in the 2009 FIFA Confederations Cup football tournament were considered as potential subjects for this study. Prior to the start of the tournament, information regarding all the components of the planned research study was made available through F-MARC to the eight team physicians that were to accompany each countries players participating in the tournament. The team physicians were then asked to provide this detailed information about the

nature of the research study to each player in their respective teams. These details, as well as all the potential risks and benefits of the study, were explained to the players through a detailed subject information sheet (Appendix 3). Once informed, the potential subjects were invited to participate in the study and those that completed an informed consent form (Appendix 4) were included in the study.

3.2.3. Pre-competition medical history questionnaire

Once written informed consent was obtained, all the participating players were asked, together with their team physicians, to complete a detailed medical history and training questionnaire (Appendix 5). The main components of this questionnaire have been previously validated during similar studies on Ironman tri-athletes and ultra distance runners (2000, 2001, 2006 and 2007 Ironman research studies REC005/2000, 099/2001, 425/2005 and 007/2007)[40,49,122]. These components of this questionnaire were appropriately modified for use in elite football players.

In order for all the collected data to remain anonymous, a system of coding for each player and team was used and the personal details of each individual player were not included on the questionnaire. Each team was allocated a random number from 1 to 8 and each player a random number from 1 to 23. Only the team and player code numbers were listed on the questionnaires.

The main focus of the medical questionnaire was on current and past history of medical conditions. The medical questionnaire consisted of various sections and included details of each of the participant's medical, training and surgical history including respiratory tract illnesses, atopy and exercise associated muscle cramping.

The following sections were included in this study:

Section A, Basic player demographic details (including age, height, weight)

Section B, Training history

Section C, Medication, supplement and life-style history

Section D, Family history of asthma and allergies

Section E, Personal medical history including;

history of flu symptoms,

history of allergy symptoms,

history of asthma,

history of exercise associated muscle cramping,

history of gastro-intestinal symptoms,

history of nervous system symptoms,

dermatological history,

surgical history

3.2.4. Statistical analysis of the data

All data from the questionnaires were entered into Excel spreadsheet format (Microsoft Office 2007). The data were analysed using standard statistical methods. All numerical data are represented by the mean ± standard deviation (SD), with the number of subjects (n), in parenthesis. Categorical data are expressed as percentages or ratios. The statistical methods applied were frequencies, cross-tabulations and descriptive statistics.

3.3 Results

3.3.1. Response rate

One of the teams declined to participate in this research project. Therefore, only 7 of the 8 teams (87.5% of the teams representing 161 potential subjects from the 7 teams) participated in this research study. Of the 161 potential subjects for the study, 138 (85.7%) completed the medical questionnaires. The response rate for the return of the medical history questionnaires from each individual team is presented in table 3.1.

Table 3.1.: Medical history questionnaire response rates for the teams participating in the 2009 Confederations Cup, (number of players and percentage per team)

Team number [a]	Player response, (number of players)	Player response per team (%) [b]
1	22	96%
2	21	91%
3	23	100%
4	13	56%
5	17	74%
6	23	100%
8	19	83%
Average response	17.25	85.7%

[a] : Team number 7 declined to participate

[b] : Calculated as % players per team (23 players in each team)

3.3.2. Player characteristics

The mean age, height, body weight and dominance (upper and lower limb) of the 138 players who participated in the study is depicted in table 3.2. The majority of the players were right dominant (123 of the players reported right hand dominance and 109 right foot dominance).

Table 3.2.: Player demographics and dominance (upper and lower limb)

Age (yrs)	26.3 ± 3.5
Height (cm)	181.9 ± 6.2
Weight (kg)	77.4 ± 7.3
Upper limb dominance (% players) (right/left/both)	90%, 9%, 1%
Lower limb dominance (% players) (right/left/both)	79%, 13%, 8%

Data are expressed as mean and standard deviations (SD) of frequency (% players)

The number of players, in each of the various field positions, was reported by the players as follows: Goal keepers 17 (12.3%), defenders 42 (30.4%), midfielders 42 (30.4%), strikers 27 (19.6%) and those in unspecified position were 10 (7.3%).

3.3.3. Pre-competition training history

3.3.3.1. Pre-competition training history (15 weeks before tournament)

During the 15 week pre-competition period the players reported training 4.8 ± 2.2 days per week (mean ± SD) with a total of 11.5 ± 6.9 hours of training per week (mean ± SD). Ninety six (70%) of the players correctly reported their pre-tournament training history, completing both the volume and percentage of time spend performing various training types as was requested. Twenty two (16%) of the players, all from the same team, did not report any pre-tournament training. Twenty (14%) of the players reported training but did not report the percentage of their

training time spent performing the various training activity types. It was reported by the players that 0.5% of their training time was spent performing other activities.

3.3.3.2. Pre-competition training history (2 weeks before tournament)

The pre-tournament training section of the medical questionnaire, investigating the training load in the period 2 weeks prior to the 2009 Confederations Cup was completed by 128 (93%) of the players. The pre-tournament training history data was incomplete in 10 (7%) of the players and 20 (14%) of the players neglected to report the percentage of their training time spent performing the various types of training activities.

The average number of reported days per week on which the players trained during the 2 week period before the tournament was 6.1 ± 1.7 training days per week, with an average of 13.6 ± 5.4 hours of training per week reported. This constitutes an increase of 1.3 days per week compared to the 15 week pre-competition period where 4.8 ± 2.2 days per week of training were reported. Accordingly, the average number of hours of training per week, 2 weeks prior to the tournament increased by 2.1 hours per week from 11.5 ± 6.9 hours per week to 13.6 ± 5.4 hours per week. The majority (68%) of the reported training time was spent performing football training, the percentage of time spent on football training also increased from 63% to 68% in the 2 week period prior to the tournament. Of note, time spent on flexibility also increased marginally (0.9%) in the 2 week period prior to the tournament but strength and endurance training reduced. It was reported that 0.8% of the training time was spent performing other types of training activities. The nature of these

other training activities was not specified. The reported percentage training time spend by the players performing different types of training activities during the 15 and 2 week pre-competition time periods, is depicted in figure 3.1.

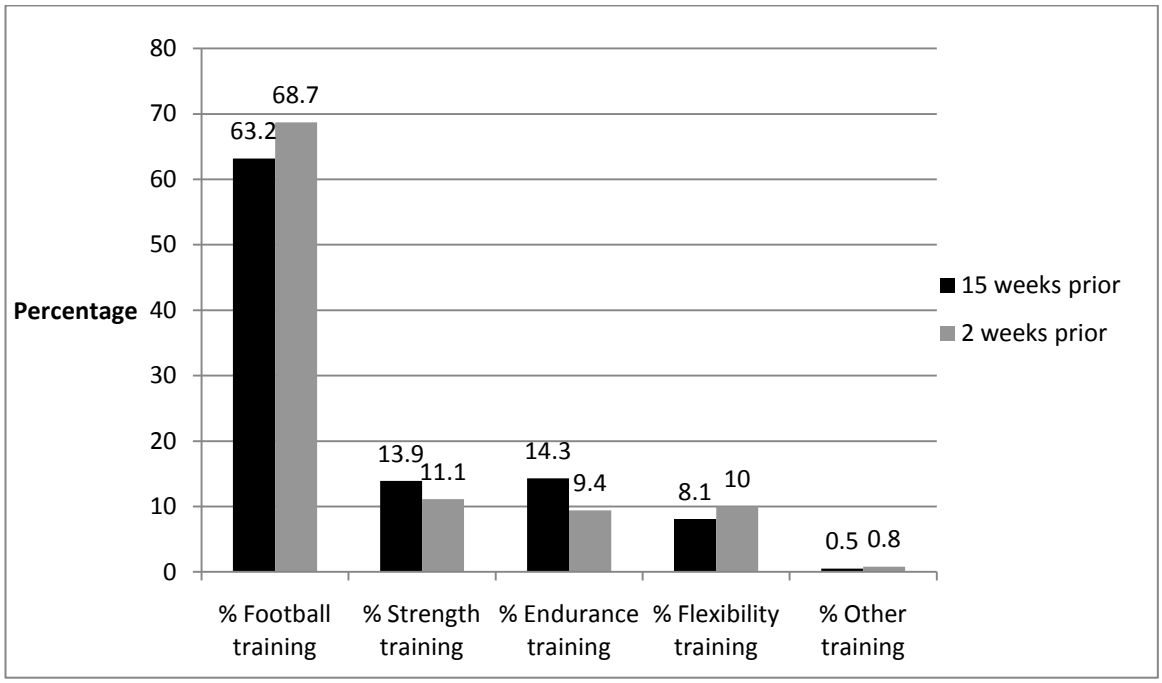

Figure 3.1.: Reported percentage of training time spent by the participating players on different training activity types in the 15 weeks pre-competition and 2 weeks directly prior to the 2009 Confederations Cup

The players reported that their football training affected their social life as follows:

no effect in 55 (39.9%),

fair or moderate effect in 50 (36.2%),

and significant effect in 32 (23.2%).

There were missing data in 1 player (0.7%).

3.3.4. Medication, supplements and life-style history

In this study 4 (3%) of the 138 players were current smokers (having smoked for an average of 8.5 years). These players reported smoking an average of 7 cigarettes per day. Three players (2%) were ex-smokers, having stopped for an average of 3 years and 131 players (95%) never smoked. Fifty eight players (42%) reported alcohol use with an average reported use of 2.6 glasses of beer per week, 1.3 glasses of wine per week and 0.2 units of spirits per week.

In this study, only 11 players (8% of the 138 players) reported the use of medication. The most frequently reported type of medication used was for asthma and allergies, followed by the use of anti-inflammatory medication. In contrast, 72 (52%) of the 138 subjects reported the use of either supplements and or vitamins. The reported use of the various classes of supplements and vitamins by the players in this study population is depicted in table 3.3.

Table 3.3.: Reported use (expressed as number and % players) of vitamin and supplement use in the players participating in the 2009 Confederations Cup

Supplements	Number (n) of players	% players
Multivitamin supplements	59	43
Carbohydrate supplements	32	23
Anti-oxidant supplements	28	20
Protein supplements	28	20
Creatine supplements	6	4
Caffeine supplements	2	1.4
Fat cutter supplements	1	0.7
Immune boosters	1	0.7
Other supplements	9	7

Of the 9 (7%) players reporting supplements used, listed as other supplements, the joint supplements (glucosamine and chondroitrin) were the most commonly used products (4 players) followed by Omega 3 oils.

3.3.5. Family history of asthma and allergies

A family history of atopy (either asthma or general allergies) was reported by 20 (14%) of the 138 players. Fourteen players (10%) reported a family history of asthma and 12 players (9%) reported a family history of allergy. Six players (4%) reported a family history of both asthma and allergies.

A family history of a father or a brother with atopy was reported by 35% of the players reporting a positive family history of allergies. A family history of a mother or sister with atopy was reported by 25% and 20% of the players reporting a positive family history of allergies respectively. A family history of a grandfather or grandmother with atopy was reported by 10% each of the players reporting a positive family history of allergies and 5% of the players reporting a positive family history of allergies, reported atopy in their children.

3.3.6. Pre-competition respiratory tract symptoms (RTS)

A total of 12 players (8.7%) reported RTS in the 6 week period before the tournament and 7 players (5.1%) reported RTS in the 1 week prior to the tournament. The nature of the RTS experienced by the players participating in the 2009 Confederation Cup tournament, prior to the tournament is depicted in figure 3.2.

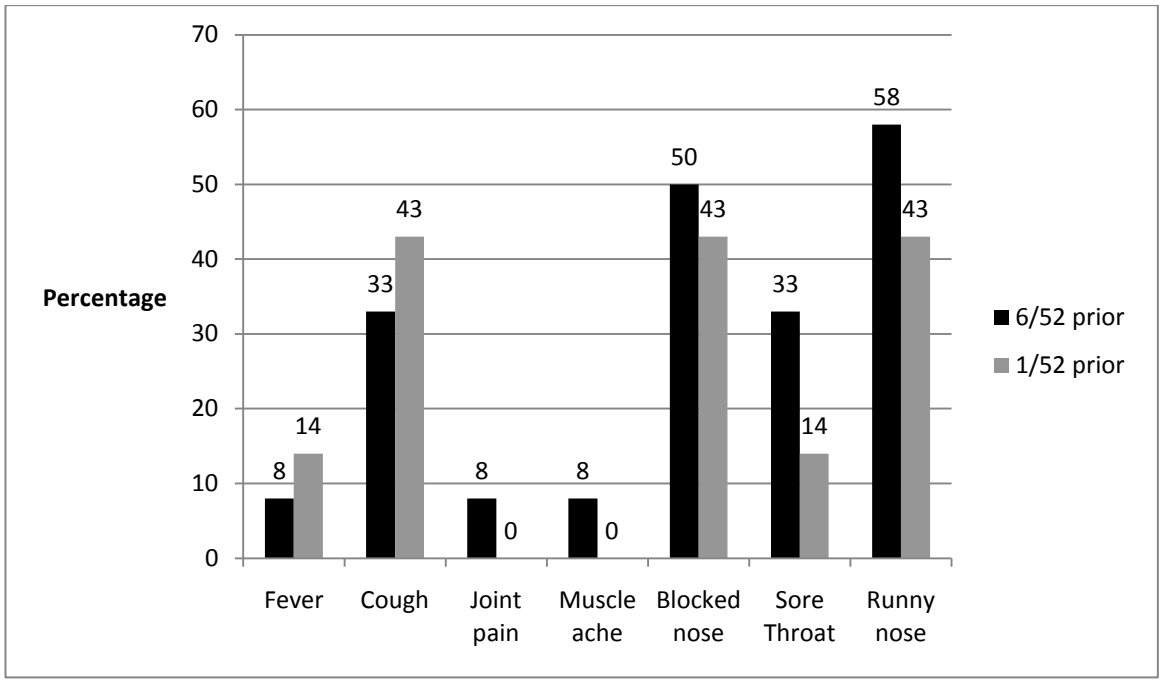

Figure 3.2.: The frequency of different RTS (expressed as % players with symptoms reported by the players 6 weeks and 1 week prior to the tournament) reported by the players participating in the 2009 Confederations Cup

3.3.7. Allergy symptom history

A total of 27 (19.6%) of the players reported having suffered at some time from allergic symptoms (including allergic rhinitis (hay fever), allergic sinusitis, allergic asthma, skin allergies, allergic conjunctivitis, a past history of allergy to medication or plant material or animal material). The average number of years of suffering from allergic symptoms was reported as 5.7 ± 4.0 years. A total of 21 (15.2%) of the players reported a history of respiratory tract allergy. The type of allergy reported and the medication use for these allergies is reported in table 3.4.

Table 3.4.: The prevalence (number of players with % in brackets) of self reported allergy, current and previous symptoms and medication requirements in the players participating in the 2009 Confederations Cup

Manifestation of allergic symptoms	Current symptoms	Previous symptoms	Currently requiring medication
Allergic rhinitis	9 (6.5%)	4 (2.9%)	4 (2.9%)
Allergic sinusitis	8 (5.8%)	0	3 (2.2%)
Asthma	4 (2.9%)	5 (3.6%)	3 (2.2%)
Skin allergy	4 (2.9%)	2 (1.4%)	1 (0.7%)
Allergic conjunctivitis	4 (2.9%)	2 (1.4%)	1 (0.7%)
Allergy to plant material (exposure)	10 (7.2%)	1 (0.7%)	5 (3.6%)
Allergy to animal material (exposure)	8 (5.8%)	2 (1.4%)	2 (1.4%)
Allergy to food (consumption)	3 (2.2%)	3 (2.2%)	1 (0.7%)
Allergy to medication	2 (1.4%)	0	1 (0.7%)

The reported current allergy medication use by the subjects (% of all subjects) was anti-histamine tables (2.9%), corticosteroid cream (1.4%), inhaled (nasal spray) corticosteroids (0.7%) and other inhalers or tablets (0.7%).

The prevalence (% players) with current allergy symptoms is depicted in figure 3.3. None of the players reported headache, fatigue or poor sleep as symptoms associated with their allergies.

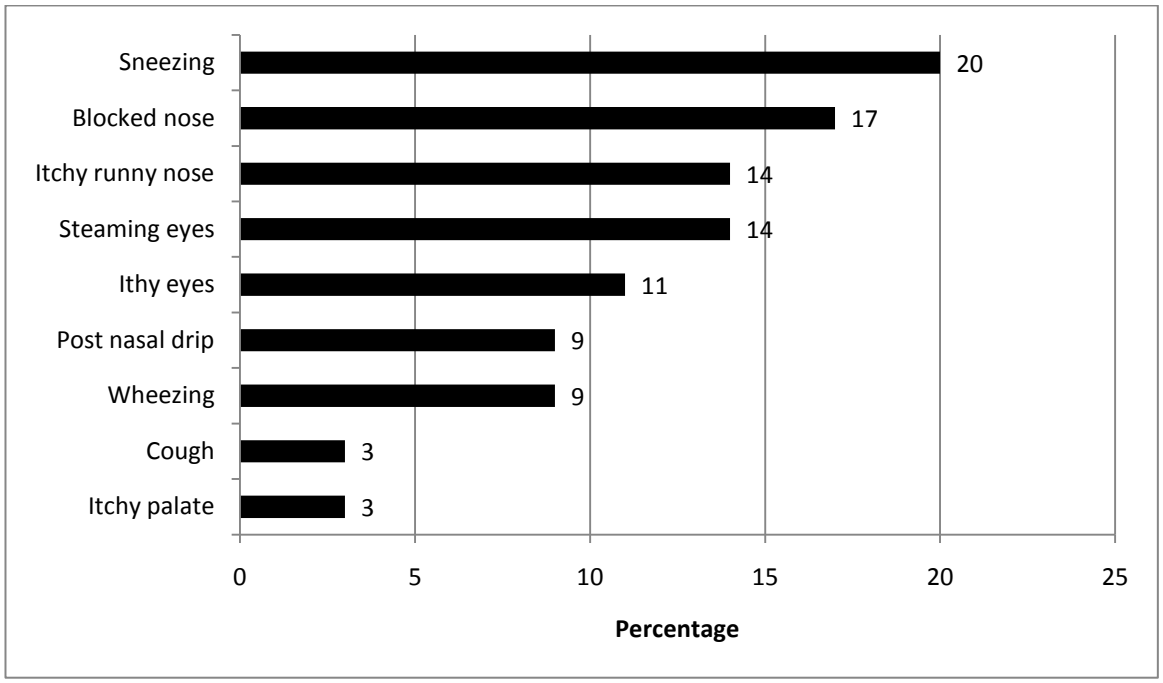

Figure 3.3.: Frequency of allergy symptoms (expressed as % players experiencing symptoms) reported by the players participating in the 2009 Confederations Cup

3.3.8. Asthma history

The prevalence of asthma was reported as 4.3% (6/138 subjects) and the mean number of years of having suffered from asthma symptoms was 12.5 ± 3.6 years. Two players (1.4%) reported that they experience exercise induced asthma symptoms only, 4 players (2.9%) reported asthma symptoms at any time, including

during exercise and 1 player (0.7%) reported that he experiences asthma symptoms at any time but not during exercise. The diagnosis of asthma was made by a doctor taking a medical history and performing an examination alone in 3 players (2.2%), while 4 players (2.9%) reported having had standard lung functions performed to confirm the diagnosis. Two players (1.4%) performed an exercise challenge lung function testing to confirm the diagnosis, 1 player (0.7%) performed a metacholine challenge test and 1 player (0.7%) performed an eucapnic hyperventilation test to confirm the diagnosis of asthma. No players reported other methods of asthmatic diagnostic testing performed.

The frequency of day time and night time asthma symptoms experienced by the 4 players reporting asthma symptoms was as follows: 3 players experienced asthma symptoms less than twice a week and 1 player experienced asthma symptoms 2 to 4 times per week both during the day and at night respectively. No players reported experiencing asthma symptoms more than 4 times per week and no players experienced continuous symptoms. Four players (2.9%) reported less than 1 episode of exercise related symptoms per 10 exercise sessions and 2 players (1.4%) reported 2 to 3 episodes of exercise related symptoms per 10 exercise sessions. No players reported a higher frequency of exercise related symptoms. None of the player's who reported that they suffer from asthmatic symptoms, reported that they had required hospital admission for the management of their asthma in the preceding 12 months. The most common asthma symptoms reported by the players were wheezing (2.9%), a tight chest (2.1%), dyspneoa (2.1%) and a dry cough (0.7%). None of the players reported chest pain or reported other complaints as symptoms of their asthma.

The use of asthma medication was reported as follows (% players): salbutamol (bronchodilator) inhaler (2.9%), cortisone inhaler (1.4%), salmeterol (bronchodilator) inhaler (0.7%), terbutaline (bronchodilator) inhaler (0.7%) and a corticosteroid and bronchodilator combination inhaler (0.7%). No players reported the use of fenoterol, formoterol, ipratropium, tiotropium or other inhalers. Furthermore, no players reported the use of corticosteroid, bronchodilator or leukotrine antagonist tablets, or other medication. Two players reported daily use and 2 players reported use of medication only before exercise while 1 player reported use as needed. The average time that the players reported using medication before exercise was 12.5 minutes. It is of interest to note, of the 6 players reporting current asthma and the use of asthmatic medication, 2 reported not having a therapeutic use exemption from their National Anti-doping organisations or sporting federation.

3.3.9. Exercise associated muscle cramping history

The lifetime prevalence of Exercise Associated Muscle Cramping (EAMC – defined as suffering from painful involuntary muscle contractions during or immediately or within 6 hour after exercise[123]), was reported by 46.4% (64) of the players. The average number of years of suffering from EAMC was 3.5 ± 3.6 years. The retrospective annual incidence (% players who suffered from muscle cramping in the previous year) of EAMC was 39.9% (55 players).

Forty episodes of EAMC were reported in the last 10 matches played by 27 of the players (an average of 1.5 ± 1.0 episodes of EAMC player per 10 matches). Therefore, episodes of EAMC were reported in 15% of the matches played. Sixteen

players reported 26 episodes of EAMC during their last 10 training sessions (an average of 1.6 ± 1.0 episodes of EAMC per affected player per 10 training sessions. Therefore, episodes of EAMC were reported in 16% of training sessions.

The prevalence (% players reporting EAMC) of training that was associated with EAMC was reported as follows: football training (81%), running in (25%) and weight training (4%). No players reported muscle cramping during other forms of exercise.

The self-reported most successful treatment for EAMC is depicted in figure 3.5. The majority (87.5%) of the players reported stretching as a successful method to relieve muscle cramping and this was followed by drinking fluid (78%), massage (55%) and rest (28%). The use of salt, magnesium and ice were reported as successful methods for the treatment of muscle cramps in (16%), (9%) and (6%) of the players respectively.

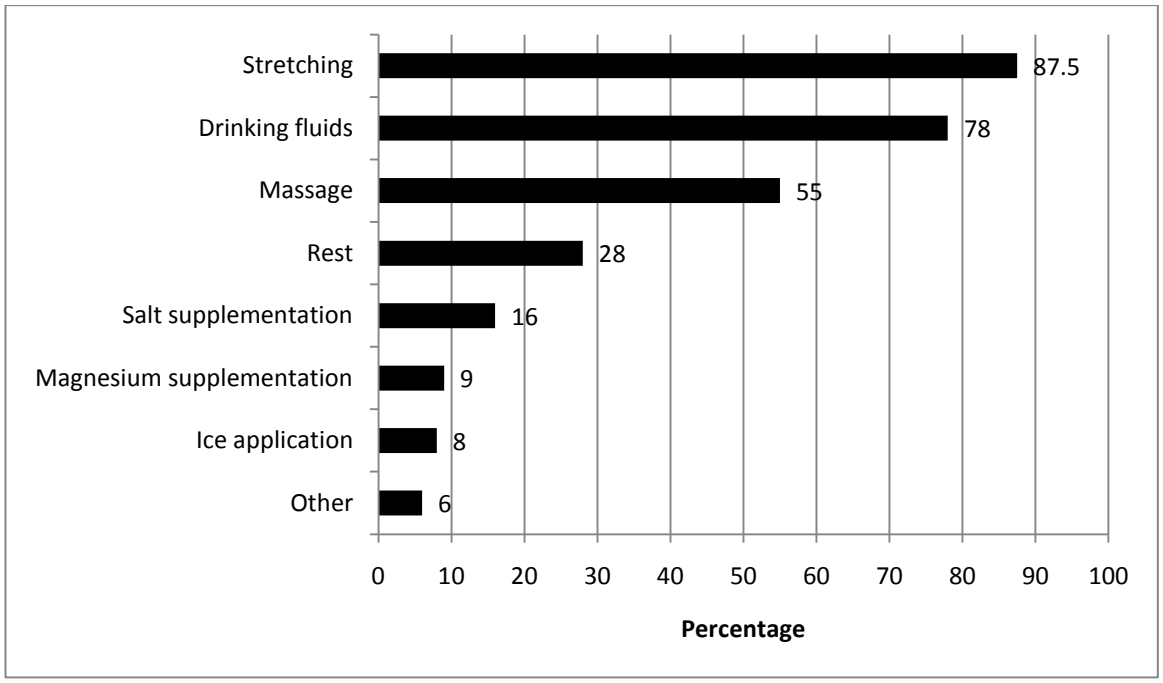

Figure 3.5.: Self-reported treatment modalities (as % players with EAMC) which relieve EAMC

Of the 64 players reporting EAMC 5 players did not complete the onset of EAMC section of the questionnaire. The majority (76%) of the players reporting EAMC, reported that they usually first experience muscle cramping during the 4th quarter of training or matches. This was followed by the EAMC after sessions (18%). No players reported an onset in the 1st quarter and (2%) reported the onset of EAMC in the 2nd or 3rd quarters each. No pattern of EAMC was reported in (2%) of the affected players.

A total of 48 (75%) of the players reporting EAMC reported calf muscle cramping. This was followed by EAMC of the hamstrings (28%), quadriceps (8%) and foot muscles (2%). No players reported muscle cramping in other muscle groups or areas such as the upper limb.

In general, players reported the severity of EAMC as minor (lasting on average 2.4 ± 1.6 minutes). The majority, of the players 84% reported their EAMC as mild (lasting less than 5 minutes before being able to continue exercising) while 6% reported that their EAMC was moderate (lasting 5-15 minutes before exercise could be resumed). Six of the 64 players who reported EAMC did not indicate the severity of their muscle cramping. None of the players reported whole body cramping, having been admitted to hospital as result of muscle cramping or dark urine in the 3 days after a cramping episode. Only 1 player report an episode of EAMC that was associated with confusion.

3.3.10. History of gastrointestinal symptoms

The prevalence (%) of GIT symptoms during participation in football activities was 7.2% (10 players). Of the 10 players reporting gastrointestinal symptoms some reported having experienced more than one symptom. The nature of GIT symptoms (expressed as % of players with reported GIT symptoms) were diarrhoea (50%), abdominal pain (40%), the urge to defecate (30%), heartburn (20%), nausea (10%) and vomiting (10%). No player reported a history of blood in the stools and none of the players reported a history of having had a gastroscopy, GIT ulcers, suffering from irritable bowel syndrome, being allergic to milk products or having a past history of other GIT disease.

The retrospective annual incidence (% players who suffered from GIT symptoms in the previous year) of GIT symptoms was 7.2% (10 players). These players reported

21 episodes of GIT symptoms in the preceding year while participating in football activities. Twenty eight episodes of GIT symptoms were reported in the last 10 matches played by the affected players (an average of 2.8 episodes of GIT symptoms per player per 10 matches).

The majority of the players (50%) reported the episodes of GIT symptoms that they experienced as minor, having no affect on training or matches and that they could continue with activity. The episodes of GIT symptoms affected (20%) of the players performance with these players reporting that they needed to slow down. The episodes of GIT symptoms prevented (30%) of the affected players from training or playing football.

3.3.11. Central nervous system symptoms history

The retrospective annual incidence (% players who suffered from CNS symptoms in the previous year) of CNS symptoms was 4.3% (6 players) these players reported 16 episodes of CNS symptoms in the preceding year while participating in football activities. Fifteen episodes of CNS symptoms were reported in the last 10 matches played by the affected players (an average of 3.0 episodes of CNS symptoms per player per 10 matches). All of the players (100%) reported the episodes of CNS symptoms as minor with no affect on training or matches. Anxiety was the most common symptom reported (2 players) followed by headache, depression and a loss of sensation in the feet reported by 1 player each. One player did not report the nature of the CNS symptoms which were experienced. No players reported any symptoms of tingling in the feet or hands or a loss of sensation in the hands.

3.3.12. Dermatological history

The prevalence of previous or current skin conditions was 11.6% (16/138 players). The most common dermatological symptoms reported in the affected players were skin allergy (44%) and sun burn (44%), followed by skin infection (23%) and other skin damage (23%). No players reported a current or previous diagnosis of skin cancer.

3.3.14. Surgical history

The prevalence of previous surgery was 49% (68/138 players) in the players. These players reported surgical procedures in 96 anatomical areas as some players reported surgery in more than one anatomical area. In 59 players (87%) the surgery was of an orthopaedic nature and in 9 players (13%) it was of a general (non-traumatic) nature. The most common orthopaedic surgical procedures (expressed as a % of all players) were knee (23.9%) followed by ankle (5.8%), lower leg (5.1%), foot (4.3%), shoulder (2.9%), facial (2.9%), nasal (2.9%), wrist (2.2%), finger (2.2%), hernia/groin (2.2%), dental (2.2%), head (1.4%), forearm (1.4%), hip (1.4%), lower back (0.7%), Achilles (0.7%) and hand (0.7%). The reported general surgical procedures (expressed as a % of all players) were abdominal (1.4%), rectal (1.4%), tonsillectomy (1.4%), small bowel (0.7%), testis (0.7%) and ear (0.7%). No players reported a previous surgical history of gastric, oesophageal, colon, gall bladder, pancreas, liver, neck, chest, thigh, upper arm or elbow surgery.

3.4. Discussion

The main finding of this cross-sectional study was that in the players participating in the 2009 Confederation Cup football tournament, exercise associated muscle cramping (EAMC) was the most prevalent self-reported medical condition reported in elite football players (46% of players). The prevalence of other common medical conditions in this group of football players were allergies (20%), dermatological conditions (12%), gastro-intestinal conditions (7%), symptoms of URTI one week before the tournament (5%), asthma (4%) and central nervous system conditions (4%). Additional findings were that (52%) of players reported the use of supplements or vitamins and (8%) the use of medication. Finally, 49% of the players reported a history of previous surgery with knee surgery being the most common anatomical area (24% of the players reporting previous knee surgery).

This study is the first reporting the prevalence of medical conditions in elite football players. Therefore, there are no data in elite football players that could be used for comparison to these findings. These results can however be compared to reported data in other athletes, mainly endurance athletes.

Our observed high lifetime prevalence of EAMC in football players (46%) is similar to that which has been reported in marathon runners and triathletes (30-50% and 67% respectively)[124,125]. Studies reporting on EAMC in marathon runners have associated EAMC with high intensity activity, increased duration of activity and subjective muscle fatigue[124]. In triathletes, a past history of EAMC and high intensity

of activity were associated with EAMC. Serum electrolyte changes and dehydration were not associated with EAMC and other mechanisms such as neuromuscular fatigue have been proposed as a cause of EAMC[126]. The nature of football cannot be compared to marathon running or triathlon directly. However, football is an endurance activity that is performed with numerous short explosive bursts of running. Muscle fatigue due to high intensity running is common in football. Therefore, our findings of a similar prevalence of EAMC to marathon running and triathlon are consistent with the current model of muscle fatigue as possible cause of EAMC. Furthermore, the high prevalence (76%) of football players reporting the onset of muscle cramping in the fourth quarter of training or matches is also consistent with the current fatigue model of EAMC. The calf muscle was the most commonly affect muscle (75%) by EAMC in our study and (80%) in marathon runners[124]. The preferred treatment of EAMC reported by the football players in this study was by stretching the affected muscle. These findings are consistent with current literature and hypotheses related to the pathophysiology of EAMC in athletes[123,127]. The precise incidence of EAMC in footballers has not been well documented and thus further studies are needed in this area.

A personal history of allergy at some time was reported by (19.6%) of the players. This prevalence of allergies in football players is lower than that reported in elite athletes where the prevalence of allergy has been reported as high as 48%[128,129].

The prevalence of dermatological symptoms in the footballers was 11.6%. It is well recognised that dermatological conditions are common among athletes and that such conditions may result in time-loss due to the infective nature of such conditions[130]. It has previously been reported that dermatological problems are

amongst the most common medical problems managed by team physicians, tending to athletes while participating in sporting events. As dermatological conditions were not the main focus of this study and as skin conditions in athletes have been reviewed comprehensively elsewhere[54,130], dermatological conditions will not be discussed further. However, the results from our study do indicate that team physicians to football players require a good working knowledge of dermatology.

The prevalence of gastro-intestinal symptoms reported in the elite footballers of 7% (0.3 episodes of symptoms per match in affected players) is lower than that of previous studies, where the lifetime prevalence of GIT symptoms associated with running range from 20-83%[65]. Diarrhoea was the most frequently reported GIT symptom followed by abdominal pain. Upper gastrointestinal symptoms such as heartburn, epigastric pain, nausea, and vomiting are reported by 20-50% of endurance athletes[67] and up to 50% of athletes during high-intensity exercise[68]. As there are no other studies describing football players, further research is needed to investigate this difference.

The reported familial history of asthma and allergies of 14% is similar to that which is reported in the general population[45] but lower than other studies reporting on elite athletes, it has been reported that 42% of Australian Olympic athletes had a positive family history of allergy[48]. The reported familial history of asthma in 10% of the football players is also as would be expected in the general population, but lower than that reported in other studies involving athletes. Previous studies investigating asthma in elite athletes, report the prevalence of a positive family history of asthma to vary from 11% to 19%[128]. The reported prevalence of asthma was 4.3% and this is significantly lower than the general population and also lower than that reported in

other sporting activities. Data obtained from the 1984 United States Olympic team found that 67 (11%) of 597 athletes had a history of asthma or experienced EIA[131] and a previous study investigating asthma in elite athletes reported a prevalence of 14% of the athletes investigated[48]. Furthermore, 23% of Australian Olympic athletes reported that they experience asthma[48]. The low prevalence of asthma in elite footballers is not known. It is also interesting to note that the most common current allergic condition reported in (7.2%) of the players, was that of a plant allergy. These findings require further research.

The prevalence of central nervous system symptoms was (4%) with anxiety being the most common symptom reported. There are not data in other groups of athletes where the prevalence of CNS symptoms was measured and these data could therefore not be compared with other sports.

Medication use in athletes has been well documented[132]. In this study, only 11 (8%) of the players reported the use of medication. Compared to previous reports of medication use in Olympic athletes, this prevalence is low and reflects either an under reporting of medication used or a particularly healthy group of players. 61% and 54% of Canadian athletes reported the use of medication during the Atlanta and Sydney Olympic Games respectively[133]. The low use of medication in footballers in this study when compared to the 1996 and 2000 Canadian Olympic athletes may be due to a positive response of the players to the large educational campaign to discourage the use of medications and supplements in elite sport, given the potential risk of contamination with prohibited substances. Furthermore, the 1996 and 2000 data reflect medication use in elite Canadian athletes, and thus may reflect a different athletic population entirely. It is also possible that footballers have

culturally never been large medication users. As in previous studies, asthma, allergy and anti-inflammatory medication were the most commonly used type of treatment. Medication use during international football tournaments has previously been reported as an average intake of 0.63 substances per player per match, with the use of non-steroidal anti-inflammatory medications being the most commonly used medication[134]. Data from 6 FIFA tournaments for female and youth players found that 37.9% of all players reported the consumption of at least one form of medication within 72 hours before matches[134]. Non-steroidal anti-inflammatory drugs were the most frequently prescribed group of substances and 17.3% of under-17 players, 21.4% of under-20 players and 30.7% of female players reported the use of NSAID's[134]. Furthermore, the use of NSAID's during the 2002 and 2006 FIFA World Cup tournaments was reported as 54% of all the players taking NSAID's during the tournament and 10% of the players taking an NSAID before every match[135]. B_2-agonists were prescribed to 2.1% of all players and general asthma medication to 3.5% of the players[134]. 859 of 6577 (13.1%) of prescription medication was for respiratory tract conditions. The recommendations for the diagnosis and management of asthma in elite athletes are continually being reviewed due to the potential abuse of asthmatic medication[41].

The use of nutritional supplements by the elite football players participating in this study are comparable with data reported elsewhere. This study found that 72 (52%) of the 138 players reported the use of either supplements or vitamins and 59 (43%) of the players reported the use of vitamins only. A meta-analysis of 51 studies, reporting non-anabolic nutritional supplement use in athletes, found an over overall prevalence of supplement use of 46% in 10 247 athletes at all levels, participating in 15 sports[136]. Of the Canadian athletes participating in the Atlanta and Sydney Olympic Games, 69% and 74% respectively reported the use of some form of

dietary supplement[133]. This also correlates with the reported supplement use of 48.8% and vitamin use of 43.2% as observed in athletes participating in the Athens 2004 Olympic Games[137].

A history of previous orthopaedic surgery was reported by 43% of the players. The data collected reflects previous surgery and not previous injuries. The data only reflects the number of surgical procedures performed on specific anatomical areas as players were not requested to specify how many times any specific body area was operated on previously i.e. the players were not required to report if an area was operated on more than once. It remains of interest to document previous and current injuries, especially injuries just prior to a tournament as injuries are an important cause of time-loss in athletes. The result from this study (43% prevalence of a history of previous surgery) is consistent with the data from a study assessing the orthopaedic component of a standardized pre-competition medical assessment. Of 553 players participating in the 2006 FIFA World Cup, 223 (41.1%) reported at least 1 surgical procedure due to a sports injury and 278 (51%) reported to have sustained at least 1 significant injury during their career[138]. Previous knee injuries were the most commonly reported injury in 121 (22.2%) of the players followed by ankle injuries in 95 (17.4%) of the players in the World Cup study. In both this study and the 2006 FIFA study knee surgery was reported in 24% of the payers and ankle surgery in 8 (6%) and 40 (7.4%) of the players for this study and the World Cup study respectively. The high frequency of injuries and surgery reported reflect the high demand of elite football on the participants bodies, particularly their knee and ankle joints.

In our study, the players' body compositions and physical fitness characteristics (such as strength, speed, agility and endurance) were not examined. However, this is the first time that hand and leg dominance has been documented in elite football players. As being able to play the ball with both feet is an essential skill for football and young football players are coached to kick with both feet, it is not surprising to note that 8% of the players reported being able to use both legs but only 1% of the players reported using both hands. As the demographic data of players may also be relevant when examining the incidence and nature of injuries this may form part of future studies.

Four (3%) of the players reported that they were smokers and 58 (42%) that they consumed alcohol, generally at a low weekly consumption. Even though other studies have reported a 0% prevalence of smoking in elite athletes[128], it may be considered that these results are not a true reflection of the actual prevalence of smoking and alcohol consumption in elite football players. This was likely due to under reporting due to fear of possible exposure.

3.4.1. Strengths and limitations of this study

The main strengths of this study are that 1) it is the first study to document the prevalence of medical conditions in elite football players' and, 2) it utilized previously validated medical history questionnaires. In addition, the methodology utilized in this study can now be adapted and utilized in future research setting.

The main limitation to this study is that the individual response rate for this study was only 75% and the team response rate was 87.5% (due to 1 team not participating in the study). However, these response rates compare favourably with those reported by FIFA during international football tournaments where an average response rate of 84% for football studies has been reported (ranging from 47% to 100%)[26]. No specific reason as to the unwillingness of one team to participate was given. As the study documentation and questionnaires were only available in English, language difficulty and translation problems may have contributed to non-compliance. Only 3 of the teams used English as an official home language. For future studies of this nature, it may be important to address this concern and present the questionnaires in more languages.

A further limitation of this study was that all the data were self reported and was based on recall over a period of a few weeks. The limitations of self-reported data need to be considered when evaluating these results. The quality of the data collected also varied both in team and individual context, some sections were not completed accurately or neglected totally. This problem has previously been observed in a study reporting on the implementation of a pre-competition medical assessment in elite footballers, where the completion of forms returned varied from 34% to 94% among the teams[139]. This highlights a need for improved research methodology and the implementation of a standardized, "user-friendly" reporting form is suggested. Furthermore, no special investigations were performed to confirm the presence of medical condition and no official medical reports were collected or included in the study to validate any player's medical condition. Thus, these data need to be interpreted with these limitations in mind.

3.4.2. Summary and conclusions

In summary, the present study was the first study that investigated the prevalence of general medical conditions in elite footballers. The assessment of injury and illness data allows for future planning of medical care provided to elite athletes. The data show that elite footballers are affected by a wide spectrum of medical conditions that are related to both athletic activity and general medical conditions. The prevalence of such a wide spectrum of medical conditions highlights the need for appropriate medical support for elite football players. Team physicians taking care of elite football players need to be well trained and need to have the necessary skills and experience to manage both injuries and a wide spectrum of medical conditions. Further studies are required to investigate the relationship between the various medical conditions and aspects such as training history, environmental factors and the effect of psychological stressors on illness patterns in elite football players.

Chapter 4

The incidence of injuries and illness reported during an elite international football tournament

4.1. Introduction

The incidence and nature of injuries sustained by elite athletes, while participating in sporting events of various sporting codes, have been well documented[140,141]. In particular, the incidence and pattern of football injuries during previous international FIFA tournaments, including the 2006 FIFA World Cup in Germany have been well studied[25]. The FIFA Medical Assessment and Research Centre (F-MARC) began the study of injuries during the final rounds of the 1998 FIFA World Cup in France. Injuries in all subsequent competitions organised by FIFA as well as the football tournaments during the Olympic Games in Sydney and Athens have been monitored[25]. In contrast, the incidence and nature of general medical conditions and illness prior to, during or after international competitions have, to our knowledge, not been studied in elite football players.

The aim of this study was to determine the incidence and nature of such medical conditions and illness in elite football players, and follows on the research that was discussed in chapter 3.

4.2. Methods

4.2.1. Type of study

The study was a prospective cohort study.

4.2.2. Subjects

The UCT/MRC (University of Cape Town / Medical Research Centre) Research Unit for Exercise Science and Sports Medicine, together with F-MARC (FIFA Medical Assessment and Research Centre) (Switzerland), conducted this study to determine the incidence of medical conditions and illness in the elite football players who participated in the 2009 Confederations Cup football tournament. The research protocol was approved by the University of Cape Town Health Sciences Research and Ethics Committee (REC REF: 159/2009) (Appendix 2) and the Institutional Review Board of F-MARC.

All 184 of the elite male football players participating in the 2009 FIFA Confederations Cup football tournament were included as potential subjects for this study. Prior to the start of the tournament, information regarding all the components of the planned research study was made available to the eight team physicians that were to accompany the players participating in the tournament. The team physicians were then asked to provide this detailed information about the nature of

the research study to each player in their respective teams. These details as well as all the potential risks and benefits of the study were explained to the players through a detailed subject information sheet (Appendix 3). Potential subjects were approached by the FIFA Medical Assessment and Research Centre, through their team physicians, and invited to participate in the study. Detailed information and an informed consent form (Appendix 4) for completion, was given to each player.

4.2.3. Daily injury and illness log

The team physicians from each of the participating teams were requested to complete a daily injury and illness log for the players in their respective teams each day during the 15-day competition (Appendix 6). The necessary documentation forms were distributed and collected by the F-MARC medical officers who were appointed to each venue during the tournament. To ensure that consistent and comparable data were collected, the injury definitions, research methodology and implementation as proposed by the 2006 FIFA Injury Consensus Group and used by F-MARC in previous FIFA tournaments was used[24].

4.2.3.1. Injury recording

An injury was defined as any physical complaint sustained by a player that resulted from either a football match or during football training, irrespective of the need for medical attention or time-loss from football activities. An injury that resulted in a player receiving medical attention is referred to as a “medical-attention” injury and

an injury that resulted in a player being unable take a full part in future football training or match play as a “time-loss” injury. Furthermore, injuries were classified, whether they occurred during match or training sessions and also whether they were the result of contact with another player or other object. Any potential injuries that were unrelated to football competition or training were not recorded as football injuries.

Match exposure was defined as play between teams from different countries and training exposure was defined as team-based and individual physical activities under the control or guidance of the team’s coaching or fitness staff that were aimed at maintaining or improving players’ football skills or physical conditioning. Pre-match warm-up and post match cool-down sessions were recorded as training exposure. The time during a match at which an injury occurred was recorded. Injuries were also classified according to location (body site), type, mechanism of injury (traumatic or over-use) and diagnosis. Recurrent injuries were also recorded and the severity of an injury and illness was reported as the expected absence in days from football activities[24,25]. In each case the injury was diagnosed by the team physician, who is an experienced and qualified medical practitioner.

The comprehensive injury report data collection form as used in similar surveys at international football competitions and at the Olympic Games was used and modified to include illness data. The injury and illness report form was comprised of one page to complete. The form was largely in a tick-only format and data was coded as far as possible so as to improve the quality of data collected. The location and type of injury was recorded using the coded categories listed in Appendix 6.

The incidence of injury was expressed as 1) number of injuries per match, 2) number of injuries per 1000 match hours and 3) number of injuries per 100 player days. The total number of match hours played was calculated as follows, (22 players x 90 minutes x 16 matches) / 60 minutes = 528 match hours. Extra time and a reduced numbers of players on the field due to injury or being sent off (red carded) were not taken into account as only a few matches went into extra time and the exclusion of players was a rare exception. This same methodology has been used by FIFA in previous studies reporting on football injuries. Using the same methodology ensures that the results can be compared directly to previous FIFA studies.

4.2.3.2. Illness recording

Medical conditions and illnesses were defined as any non-trauma related symptoms or signs presenting in a player that needed medical attention from the team physician. All the non-traumatic complaints such as illness and psychological complaints were recorded in a separate section of the daily injury and illness log form (Appendix 6).

Illness data collected included the affected system, a final diagnosis, symptoms and signs, cause of illness, treatment and absence from play (in days). The information that was included was the same as that which the team physician would have obtained during normal clinical care of the players in his team. The clinical information was reported by use of a sport-specific injury coding system, as previously described[142].

Illness data has, to our knowledge, not been recorded in previous studies. Therefore, a method of illness recording was first developed based on a system codes. This coding system was based on the International Classification of Diseases (ICD) 10 coding system. Furthermore, the incidence of illness was not expressed according to playing hours as injuries are, but rather as illness per team days and illness per 100 player days. In each case, the injury was diagnosed by the team physician, who is an experienced and qualified medical practitioner.

The number of team days was calculated as follows:

8 teams participated for the first 7 days of the tournament, this constitutes 56 (8 teams x 7 days) team days. 6 teams participated on the 8th day, this constitutes 6 (6 teams x 1 day) team days. This was followed by 7 days during which the semi-finals and quarter finals were played. Only 4 teams participated during this period, this constitutes 28 (4 teams x 7 days) team days, therefore a total of 90 team days for the duration of the tournament.

The number of player days was calculated as follows:

The duration of the tournament was 15 days. All of the 8 teams of 23 players each participated in the first round knockout stage of the tournament, for the first 7 days, this amounted to 1288 (8 teams x 23 players x 7 days) player days. On day 8, 6 teams remained in the tournament as 2 teams were knocked out on the previous day, this amounts to 138 (6 teams x 23 players x 1 day) player days. This was followed by the remaining 7 days which consisted of the semi-finals and final matches during which only 4 teams participated this amounted to 644 (4 teams x 23

players x 7 days) player days. The total number of player days for the tournament was thus 2070 [(184 x 7) + 138 + (92 x 7)] player days. The tournament fixtures and related player days for the duration of the tournament are listed in Appendix 7.

4.2.4. Environmental conditions during the tournament

Daily data on the weather conditions at each venue for the duration of the 2009 Confederations Cup were obtained directly from the South African Weather Service (www.saweather.co.za).

4.2.5. Statistical analysis of the data

All the data from the questionnaires was entered on to Excel spreadsheets (Microsoft Office 2007). The data was analysed using standard statistical methods. All numerical data is represented by the mean ± standard deviation (SD), with the number of subjects in parenthesis. Categorical data are expressed as percentages or ratios. The statistical methods applied were frequencies, cross-tabulations and descriptive statistics.

4.3. Results

4.3.1. Response rate

Of the possible 90 injury and illness incident report forms for the 8 teams, 63 (70%) were returned. Twenty seven (30%) of the possible 90 reports were not collected. It is not known whether the reports were not returned due to non-compliance or if there were no injuries or illnesses to report on these days. There were 16 (17.7%) team days where no injuries or illnesses were reported.

4.3.2. Injuries and illnesses

4.3.2.1. Injuries

During the tournament 56 injuries were reported. Of the 56 injuries reported, 22 (39%) were reported during training and 34 (61%) injuries reported during the 16 matches played. This corresponds to an overall injury rate of 64.4 injuries per 1000 match hours or 2.1 injuries per match. Twenty three (68%) of the 34 reported match injuries occurred in the second half of play, 10 (29%) occurred in the first half of play and the time of injury was not reported for 1 injury. The average elapsed time during matches at which point injuries occurred was at the 60th minute of match play.

The frequency of the reported location of injuries (injured body parts), are depicted in figure 4.1. The thigh was the most commonly injured body part (19.6% of all injuries), followed by the knee, ankle, foot and lower leg injuries. The majority of injuries occurred in the lower limbs.

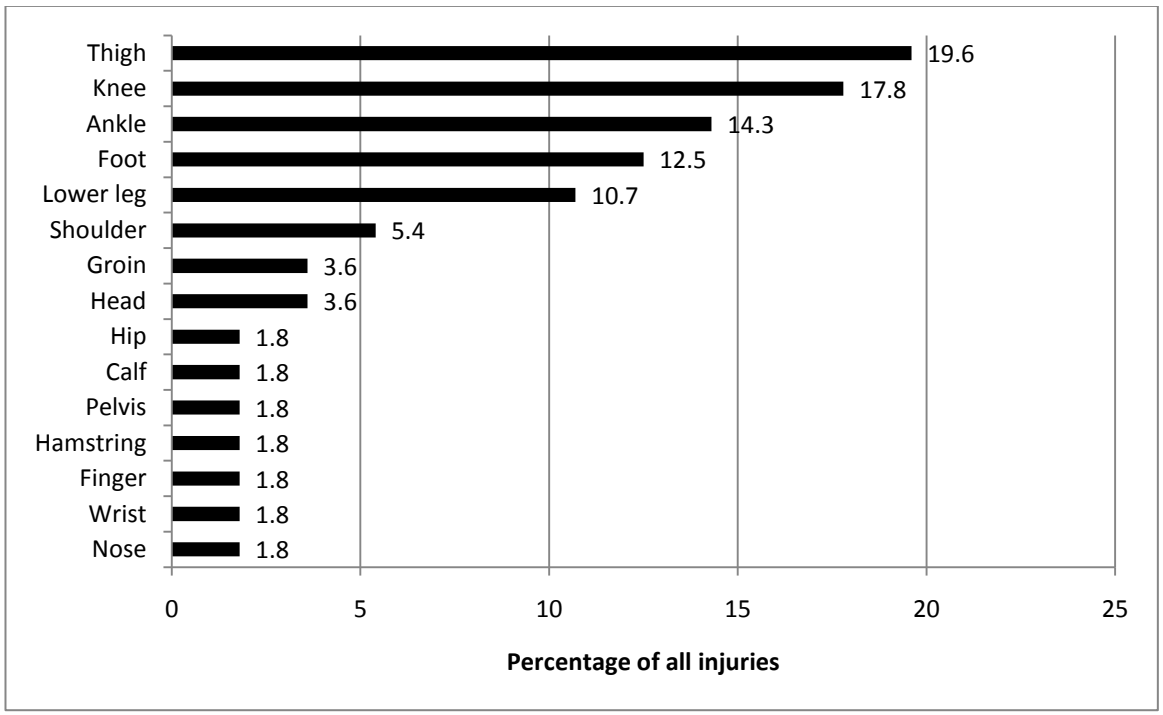

Figure 4.1.: The frequency of the location of injuries sustained by the players participating in the 2009 Confederations Cup (expressed as % of all injuries)

The frequency of the types of injuries reported during the tournament, are depicted in figure 4.2. The most common type of acute injury was a contusion (39.3% of the injuries reported) followed by ligament sprains (17.8%), muscle strains (10.7%) and muscular cramps (10.7%). There were only 3 lacerations recorded during this tournament.

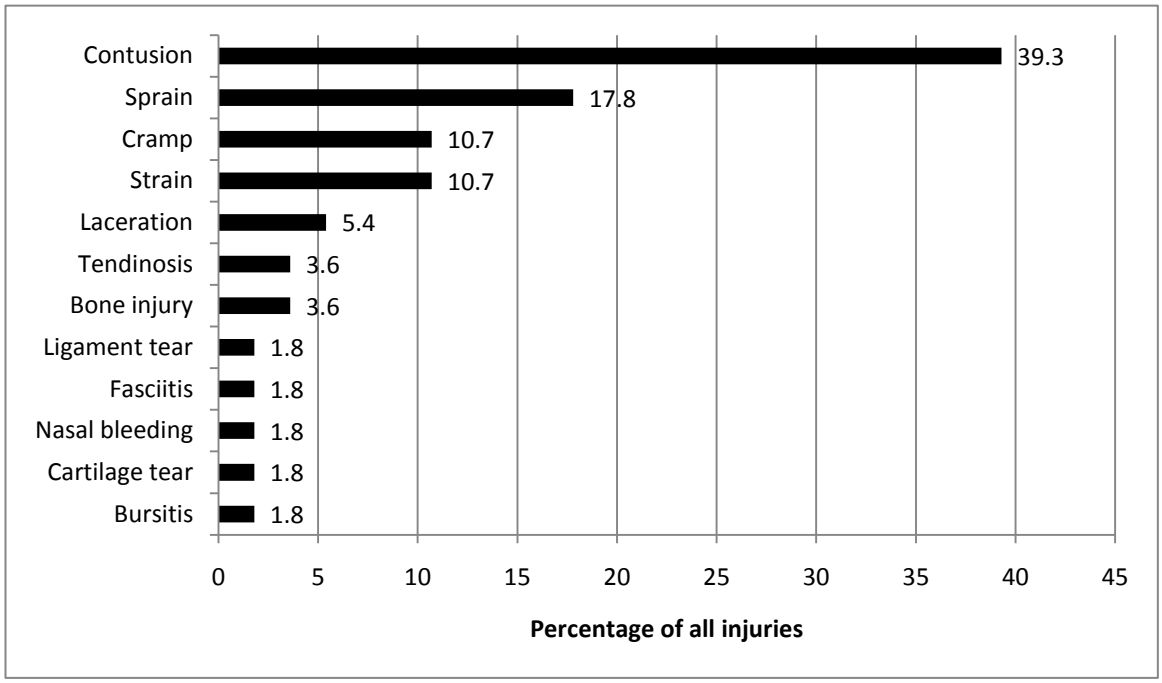

Figure 4.2.: Frequency of the type of injuries sustained in the players participating in the 2009 Confederations Cup (expressed as % of all injuries)

The frequency of the mechanisms or causes of the injuries sustained during the 2009 Confederations Cup are depicted in figure 4.3. Player contact was reported to be the cause of injury in the majority (55.4%) of the injuries, followed by overuse (25%) of the injuries.

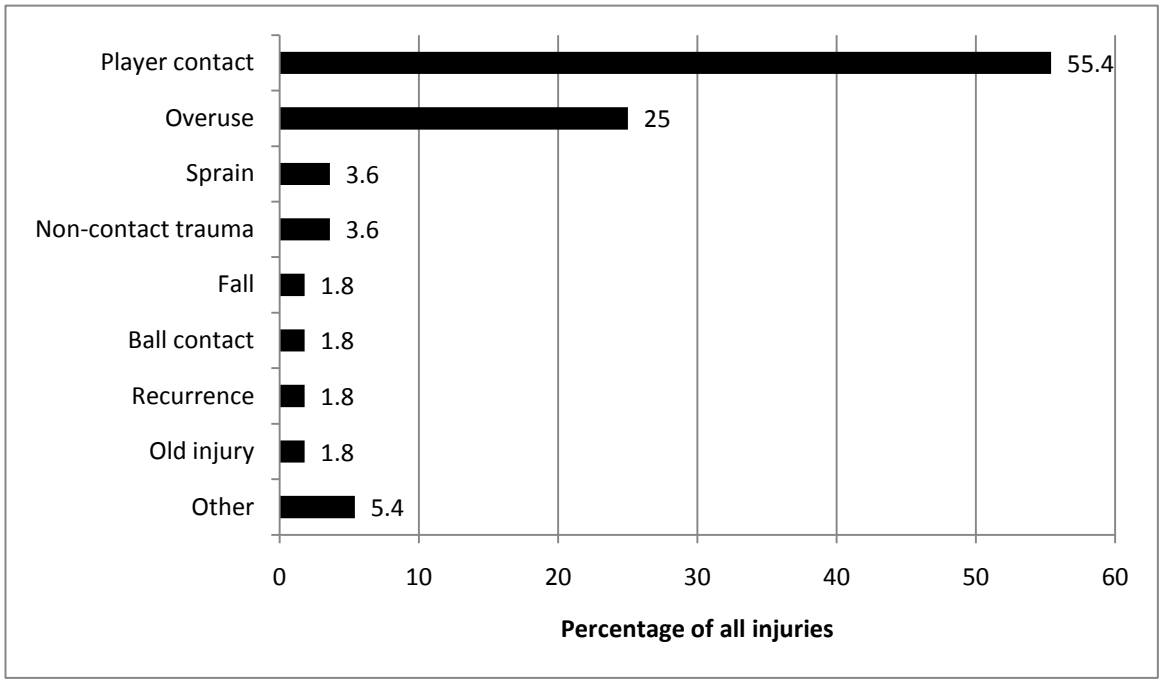

Figure 4.3.: The frequency of the mechanisms of the injuries reported in the players participating in the 2009 Confederations Cup (expressed as % of all injuries)

For the 56 injuries reported, there were 49 days of time lost due to the injuries. An average of 0.88 days was therefore lost per injury for the tournament. In 37 (66%) of the injuries, no time was lost and the players could resume normal football activities directly after the injury. 1 day of time was lost in 7 of the injuries, 2 days in 6 of the injuries, 3 days in 3 of the injuries and 7 days in another 3 injuries. During these days, the injured players were not able to train or play matches. 1 player reporting a 7 day time loss injury had to withdraw from the tournament due to his injury.

4.3.2.2. Illness

During the 2009 Confederations Cup tournament, 35 illnesses were reported. The frequency of the systems that were affected by illness during the 2009 Confederations Cup is depicted in figure 4.4. The majority (57.1%) of the reported illnesses affected the respiratory system, 13 (37%) due to ENT conditions and 7 (20%) due to respiratory tract symptoms. This was followed by the dermatological system (17.1%) and the digestive system (14.3%).

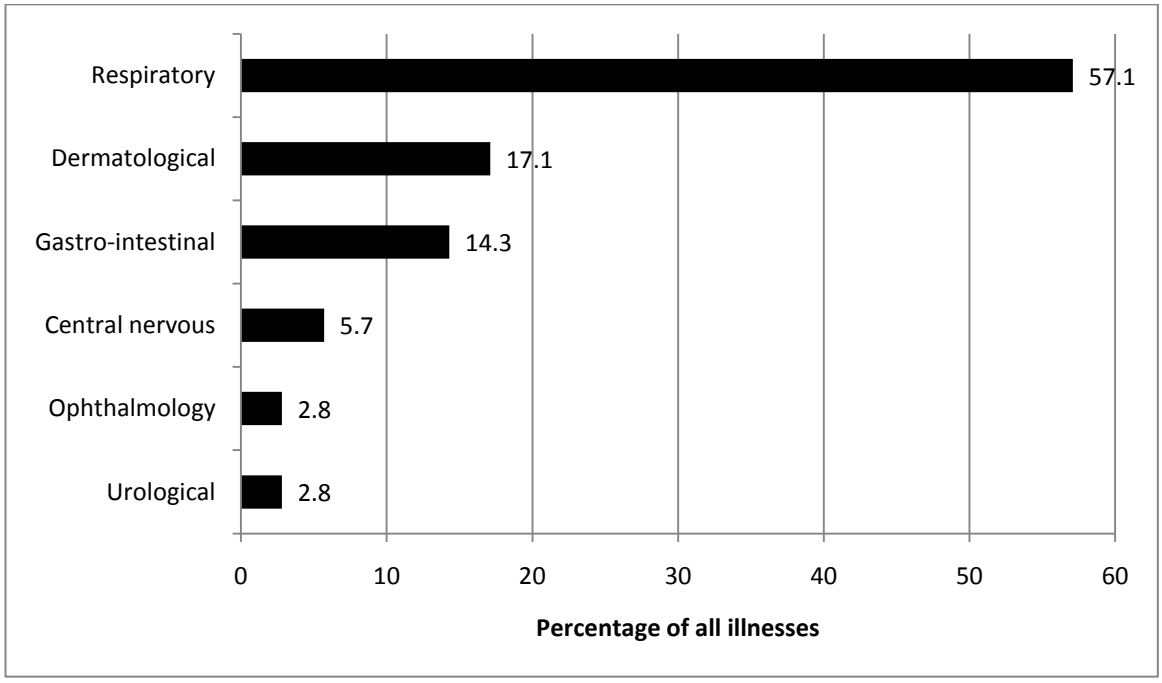

Figure 4.4.: The frequency of systems affected in the players participating in the 2009 Confederations Cup (expressed as % of all illnesses)

The frequency of main symptoms / signs reported, are depicted in figure 4.5. The most common main symptom or sign reported in the 35 illnesses was pain (31%) followed by a cough in (22.9%).

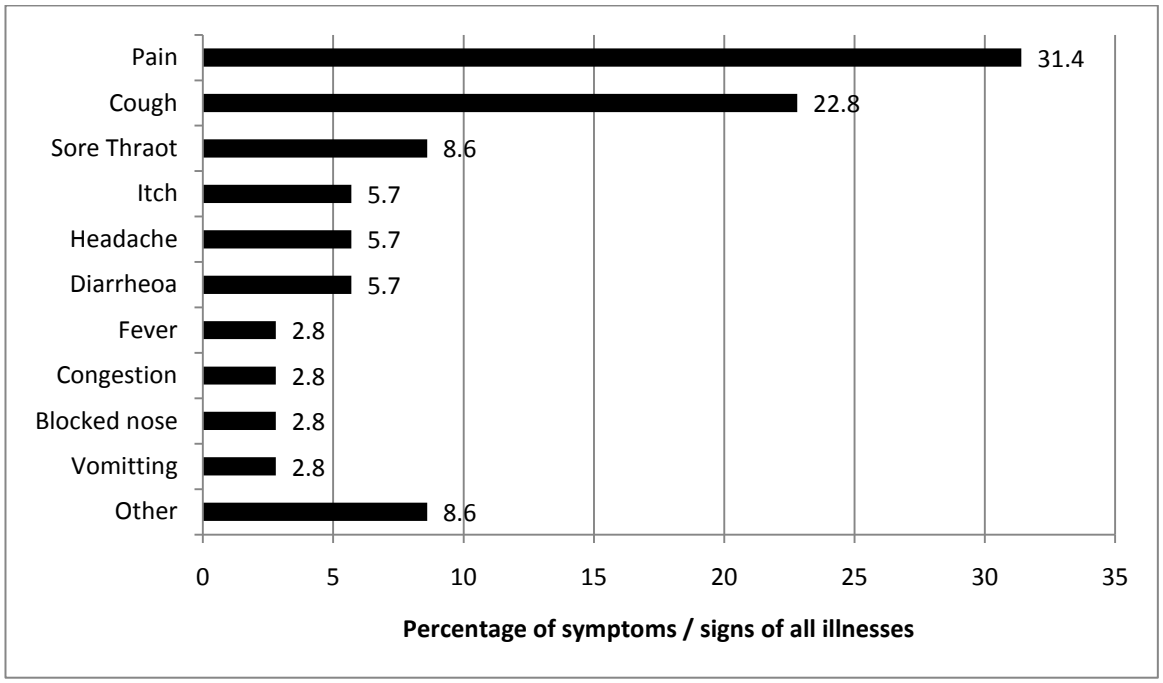

Figure 4.5.: Frequency of symptoms and signs affecting the players participating in the 2009 Confederations Cup (expressed as % of all illnesses)

The frequency of final diagnoses for the reported illnesses in the players, are depicted in figure 4.6. Sinusitis was the most common diagnosis made by the team physicians (31% of the illnesses that were diagnosed in the players) followed by influenza and fungal skin infections (14.5% each).

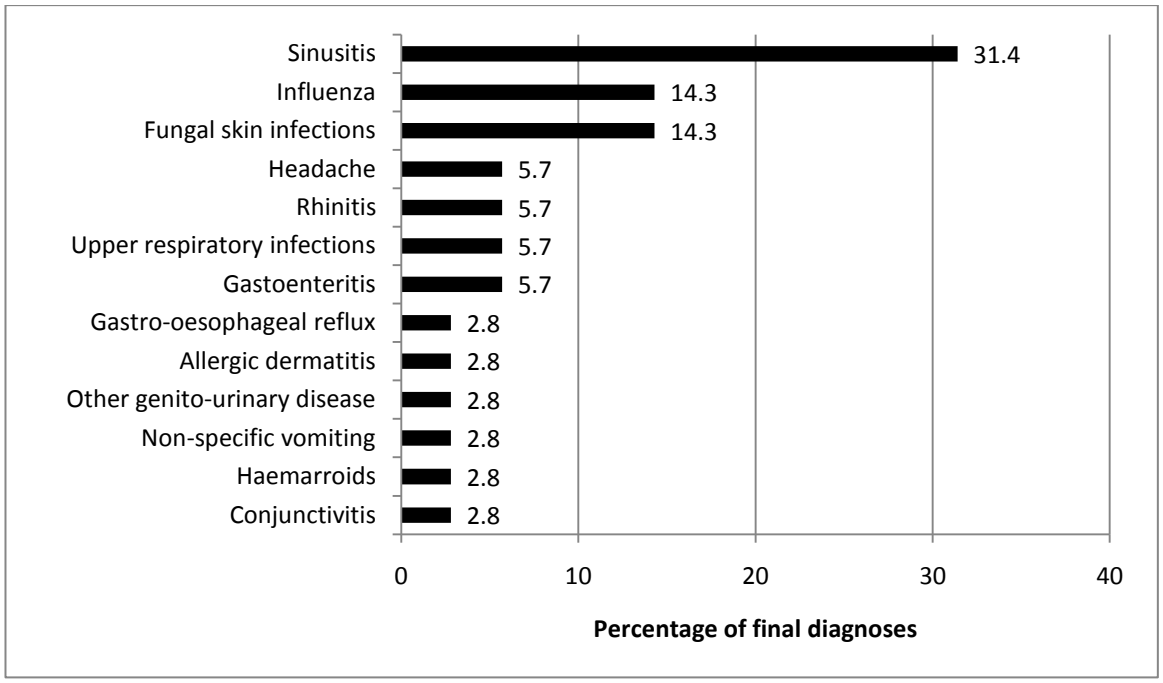

Figure 4.6.: The frequency of final diagnoses (made by the team physicians) due to illness in the players participating in the 2009 Confederations Cup (expressed as % of all illnesses)

The frequency of causes for the illnesses in the study, are depicted in figure 4.7. Of the illnesses reported by the team physicians, (42%) were reported to be due to environmental factors and (34.3%) were due to infections.

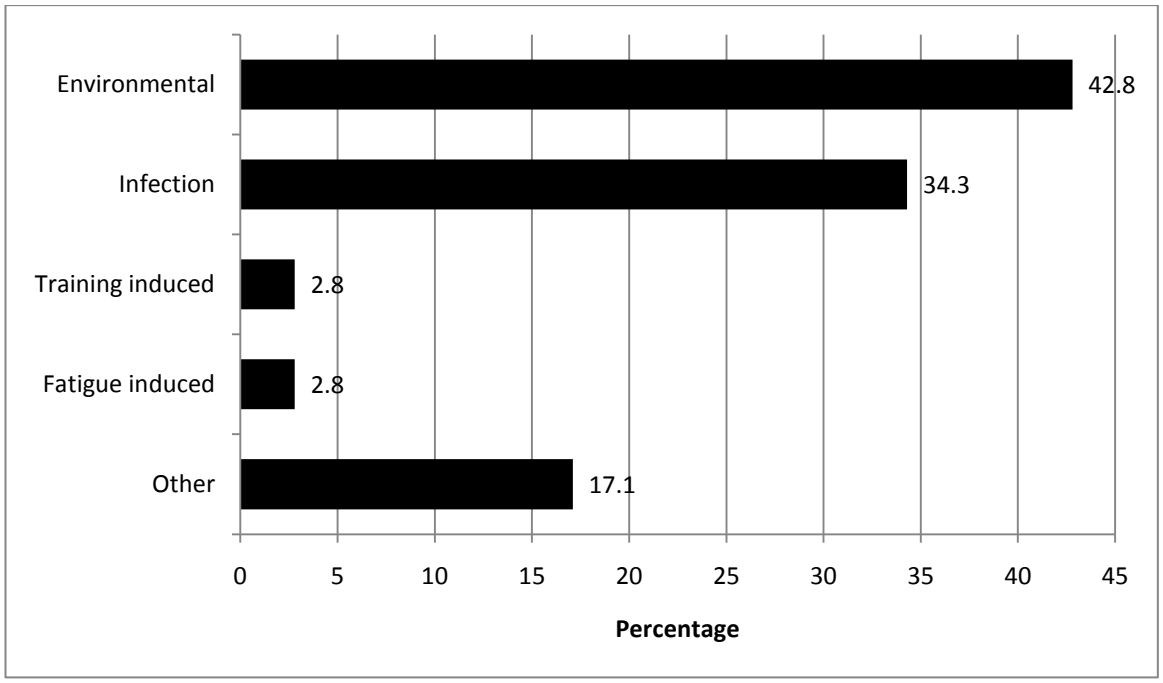

Figure 4.7.: The frequency of the causes of the illnesses in the players participating in the 2009 Confederations Cup (expressed as % of all illnesses)

The 35 illnesses reported resulted in 16 days of time lost to the players due to players being unable to train or play due to their illness. An average of 0.46 days, were therefore lost per illness for the tournament. In 26 (74%) of the illnesses no time was lost and the players could continue normal football activities after medical management. 1 and 2 days of time were lost in 4 (11%) of the illnesses each and 4 days in 1 (3%) player. During these days, the injured players were not able to train or play matches.

4.3.2.3. Comparison of injury and illness

The incidence of injury and illness per 100 player days and the time lost as result of injury and illness is depicted in figure 4.8 and 4.9., respectively. The time lost due to illness was half of that due to injury.

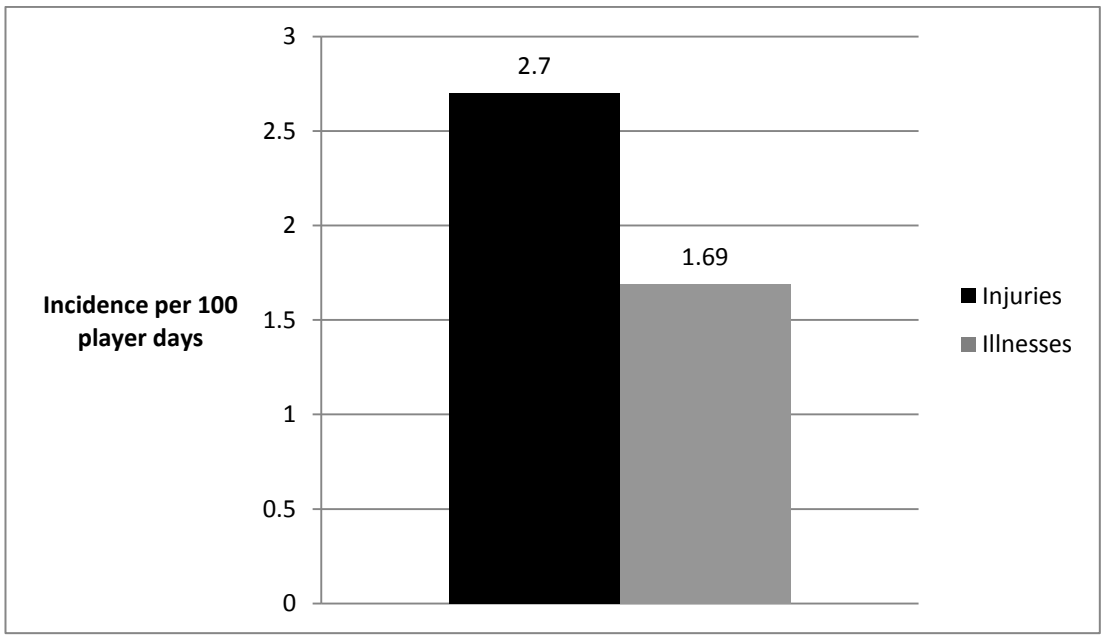

Figure 4.8.: The incidence of injuries and illnesses (per 100 player days) in the players participating in the 2009 Confederations Cup

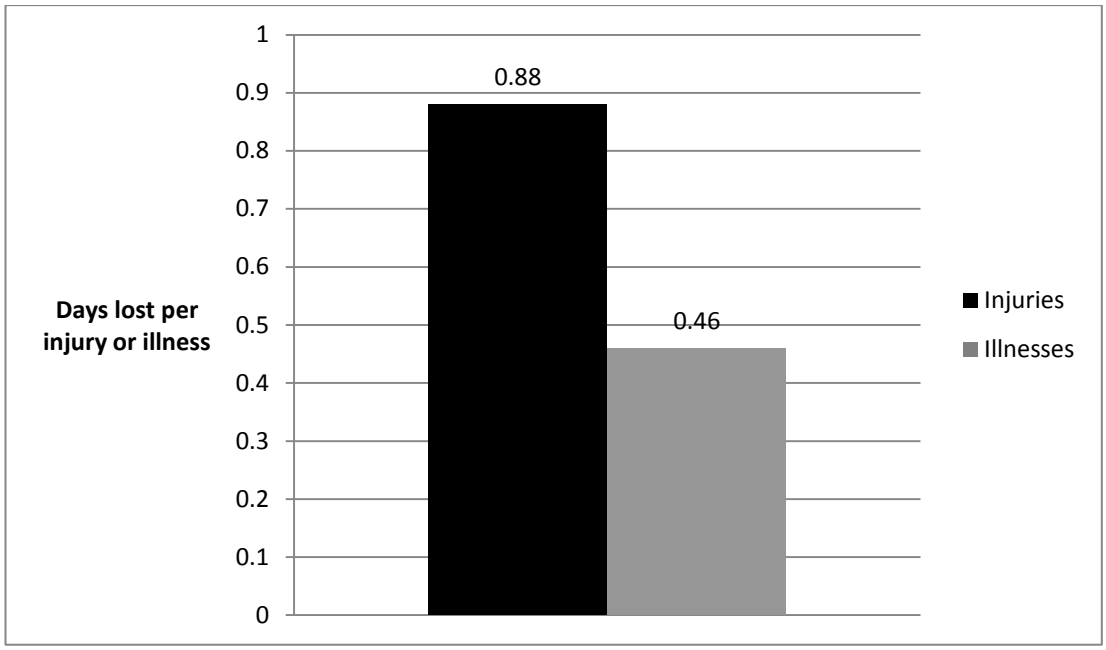

Figure 4.9.: The number of days lost per injury or illness reported in the players participating in the 2009 Confederations Cup

The number of daily reported injuries and illnesses per 100 player days, corrected for the number of players remaining in the tournament once teams had been eliminated, are depicted in figure 4.10. The greatest number of injuries reported per 100 player days was 4.89 injuries / 100 player days and these were reported on the first day of the tournament. The greatest number of illnesses reported per 100 player days was 4.35 illnesses / 100 player days and these were reported on the last day of the tournament.

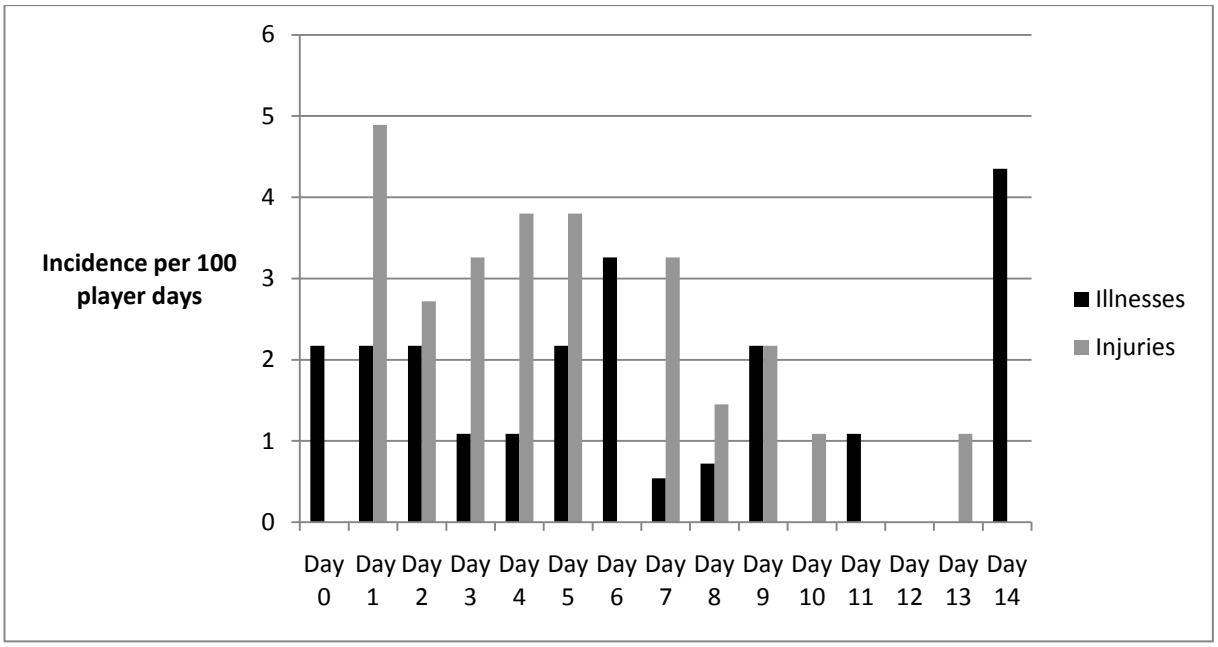

Figure 4.10.: The daily incidence of injuries and illnesses during the 2009 Confederations Cup tournament (incidence per 100 player days)

4.3.3. Environmental factors

During the competition, data regarding the environmental conditions at each of the host city venues, at team base camps and at competition venues were obtained from the South African Weather Service. The average minimum and maximum temperatures, humidity and wind speeds were recorded during the tournament and these are listed in Appendix 8.

4.4. Discussion

The aim of this study was to describe the incidence and nature of medical conditions and illness experienced by the elite professional football players participating in the 2009 Confederations Cup tournament.

The main findings of this study were that during the 2009 Confederations Cup Football tournament, 1) the overall rate of injuries was 64.4 injuries per 1000 match hours or 2.1 injuries per match, 2) 2.7 injuries and 1.7 illnesses were reported respectively per 100 player days, 3) 0.88 days were lost per injury and 0.46 days were lost per illness, 4) lower limb injuries were the most common injury, 5) respiratory tract symptoms were the most common illness reported.

4.4.1. Injuries

The overall injury rate of 64.4 injuries per 1000 match hours or 2.1 injuries per match is very consistent with that previously reported for the Confederations Cup 1999 (1.7 injuries per match) and the Confederations Cup 2001 (2.1 injuries per match)[26]. This injury rate is also slightly lower when it is compared with the 2.3 injuries per match were reported in the 2006 FIFA World Cup and 2.7 injuries per match that were reported in the 2002 FIFA World Cup[26]. The incidence and characteristics of the injury data that we report in this study is therefore comparable with the data collected at previous FIFA World Cup and Confederation Cup tournaments and has been summarized in table 4.1.

Table 4.1.: Incidence and characteristics of injuries recorded in 4 international FIFA football tournaments

Tournament	2002 World Cup Japan/Korea	2006 World Cup Germany	2001 Confederations Cup Japan/Korea	2009 Confederations Cup South Africa
No. of matches	64	64	16	16
Player match hours	2112	2112	528	528
No. of match injuries	171	145	33	34
Injuries per 1000 match hours	80.96	68.7	62.5	64.4
Injuries per match	2.7	2.3	2.06	2.1
Circumstances, %, (n/total number)				
Non-contact	27%, (45/167)	27%, (38/143)	9%, (3/33)	3%, (1/34)
Contact	73%,(122/167)	73%, (104/143)	91%, (30/33)	56%, (19/34)
Time, % (n)				
First half	54%, (88)	50%, (66)	45% (15)	29% (10)
Second half	46%, (72+3)	50%, (64+2)	55% (18)	68% (23)
Estimated severity, % (n)				
0 Days	33%, (53)	30%, (39)	61% (20)	70% (24)
1-3 days	37%, (59)	33%, (43)	18% (6)	21% (7)
>3 days	40%, (48)	37%, (49)	21% (7)	9% (3)
Time loss injuries	107	92	13	10
Injuries per 1000 hours	50.7	43.6	24.6	18.9
Injuries per match	1.7	1.4	0.81	0.63

Data from Dvorak[25] and Junge[26]

As reported in other studies, and documented in the present study, player contact was the most common cause of injury. It has previously been reported that 55% of injuries occur in the second half of the match. In our, study 68% of the injuries occurred in the 2nd half and this finding is therefore consistent with that previously reported.

In the present study, the days lost per injury were 1 day for every injury sustained during match play and 0.68 days lost for every injury sustained during training. This translates to an overall rate of 0.88 days lost per injury. These data cannot be compared to previous studies as days lost have not been reported in this way in previous studies. New injuries were reported on a daily basis and injuries already recorded were not followed up or progressively recorded for this study. The reported duration of time lost was thus an estimate based on the clinical diagnosis and experience of the team physician managing the player.

As reported in previous studies, the most common injuries were to the thigh and knee. Lower limb injuries in general were common. Contusions were the most common type of injury followed by sprains. The frequency, location, nature and severity of the injuries reported during match play in this present study were therefore similar to those described in previous literature (table 4.2.)[25.26]. However, the match play incidences of knee, ankle and head injuries were less common than those reported in previous tournaments[25,26]. Recent "rule" changes have prevented players from lifting their elbows when jumping for a high ball to possibly reduce the number of head injuries sustained during matches. This could have resulted in a reduction in the number of concussion injuries seen in the present study. Furthermore, the implementation of this "rule" may also be the reason for the

reduction in head injuries that we observed in our study. The lower incidence of knee and ankle injuries, when compared to previous studies, could not be explained from the data collected. Further studies are recommended to determine if this observation is consistent. It is possible that a reduction in injuries can be accounted to an improvement in medical care and physical conditioning of footballers over the last decade. In particular, F-MARC has recently launched its F11+ injury prevention program and the implementation of this programme in teams could perhaps have reduced the incidence of injuries in the present study.

Table 4.2.: Frequency of injury by location and type reported during match play in 4 international football tournaments

Location and diagnosis (n), %, n/1000h	2002 World Cup Japan/Korea	2006 World Cup Germany	2001 Confederations Cup Japan/Korea	2009 Confederations Cup South Africa
Head	(25), 15%, 11.8/1000h	(13), 8.9%, 6.1/1000h	(6), 18%, 11.3/1000h	(2), 6%, 3.8/1000h
Upper extremity	(8), 4.6%, 3.8/1000h	(12), 8.3%, 5.9/1000h	0	(3), 8.8%, 5.7/1000h
Groin	(9), 5.3%, 4.3/1000h	(6), 4%, 2.8/1000h	0	(1), 2.9%, 1.9/1000h
Lower leg	(29), 17%, 13.7/1000h	(30), 21%, 14.2/1000h	(5), 15%, 9.5/1000h	(5), 14.7%, 9.5/1000h
Ankle	(25), 15%, 11.8/1000h	(24), 17%, 11.4/1000h	(7), 21%, 13.2/1000h	(4), 11.8%, 7.6/1000h
Thigh	(30), 17%, 14.2/1000h	(21), 14%, 9.94/1000h	(4), 12%, 7.8/1000h	(7), 20.6%, 13.2/1000h
Knee	(22), 13%, 10/1000h	(18), 12%, 8.5/1000h	(5), 15%, 9.5/1000h	(2), 6%, 3.8/1000h
Contusion	49%	51%	(15), 45%, 28.4/1000h	(15), 44%, 28.4/1000h
Muscle strain	19%	15%	(5), 15%, 9.5/1000h	(5), 15%, 9.5/1000h
Ligament sprain	15%	14%	(5), 15%, 9.5/1000h	(4), 11%, 7.6/1000h

Data from Dvorak[25] and Junge[26]

4.4.2. Illness

The importance of non-traumatic medical conditions in elite footballers has been highlighted in this study. In this study, 56 injuries and 35 illnesses were reported, translating to an incidence of 2.7 injuries and 1.7 illnesses per 100 player days. Although the incidence of illness is less than the incidence of injury reporting, the results of this study show that illness constitutes a significant part of the medical management of elite football players. The number of days lost per illness is also half that of the number of days lost per injury, with an average of 0.46 days lost per illness. For every injury reported there are 0.6 illnesses reported and for every day lost due to injury there are 0.3 days lost due to illness. Illness therefore adds a significant burden of disease to a team and further research to help guide medical planning for events such as these is recommended.

In studies reporting the incidence of injuries and illness during other elite sporting events such as the Olympic Games, as many as 69% of the medical contacts are reported to be due to non-traumatic medical conditions (illness)[70]. The only study investigating the incidence of illness in football reported that 32.7% of the medical consultations were for illnesses[81]. In the present study, illness accounted for 38% of all the medical consultations. This is lower than that which has been published in other elite sporting events but is comparable to the only football specific study. In a retrospective study that investigated the incidence of injuries and illness of one team participating in two international football competitions, 102 (73%) of the football player consultations were for injuries and 38 (27%) were for illnesses[81]. The lower incidence of medical conditions in the football studies may be due to a relatively higher incidence of injuries in football, a contact sport when compared to multi-

disciplinary events such as the Olympic Games. Previous studies do not report their incidence data as (n) / 100 player days and therefore it is not possible to directly compare the incidence of illness from our study to that in other studies. Further studies with better methodology are needed to examine the possible differences.

The frequency of injury and illness has been reported for both athletes and officials in the three studies at the Olympic Games[70,71,104]. It is important to note that these studies report the number consultations and not the true incidence of cases. In addition, no mention is made of follow-up consultations. It is therefore not possible to compare the results of our study directly to the results from previous studies. In our study, incidence of illness was determined as each case was only recorded once (as a new illness). Follow-up medical consultations were not reported. The true burden of disease is underestimated and the burden on the team physician is higher as players with injury or illness will be re-assessed and managed daily.

In our study the injuries and illnesses were reported by team physicians, who were familiar with the players, their medical histories and the questionnaire used. Furthermore a previously validated questionnaire and coding system was adapted and then used. The injury report form comprised a single page on which all injuries (or where applicable the non-occurrence of injuries) during a given match was recorded. This method of documentation helped to distinguish the absence of injury or illness from missing data. The consistent findings outlined in this study, when compared to previous studies, is an indication of the reliability of the methodology used and the quality of the data collected.

Travel related medical conditions include allergies, minor infections, waterborne diseases, tropical diseases and HIV. The occurrence of tropical diseases such as malaria, tick-bite fever and bilharzias have previously been reported in athletes but not in elite professional footballers. A previous review of the travel related medical concerns, providing a framework on which medical planning can be based has been published for the Sydney Olympic Games[100]. Areas which need to be covered include immunisations, personal health, sexual health, dental assessments, jet lag, malaria prevention, culture shock and environmental factors.

Tropical infections have been reported in athletes participating in events in regions with a risk for developing such illnesses. None of the 2009 Confederations Cup matches were played in malaria endemic areas, but the teams may have combined their official match schedule with vacation periods on game farms or guest lodges in the bush. In such environments, the players could have been exposed to tropical diseases such as malaria, bilharzias and African tick bite fever. Fortunately, there were no tropical diseases reported by the subjects in this study. As the study period was in the winter month of June such tropical diseases are not generally prevalent.

As highlighted previously in this discussion, various environmental factors can impact on the frequency and nature of the medical conditions experienced by the participants of sporting competitions. Environmental considerations for athletic performance at the Beijing Olympic Games were reviewed previously and the importance of temperature, ultraviolet radiation, allergens atmospheric pollution and altitude on athletic performance and illness was highlighted[143]. Pollen and airborne allergen counts in midwinter in South Africa are low, other than the possibility of fungal spores in the Natal coastal region[144]. Players from warmer environments

may need a few days to acclimatize to the colder conditions but in general the winter weather is mild when compared to a European winter with temperatures rarely dropping below zero degrees centigrade.

Over the 15 day tournament, the incidence of injuries per 100 player days appears to have declined with 4.89 injuries per 100 player days reported on day 1 and no injuries reported on the last day of the tournament, day 14 (figure 4.10.). In contrast, it is interesting to note that the incidence of illness per 100 player days seemed to increase towards the end of the tournament, with 2.17 and 4.35 illnesses per 100 player days reported on day 1 and 14 respectively. As the study population was small, it was not possible to determine a statistical significance of this observation. It will be interesting to follow this study up with a bigger tournament with more players and a longer duration to determine the validity of this observation. It is presumed that the longer the tournament the greater the exposure to disease and the more fatigued and emotionally stressed the players will become, increasing their chance of becoming ill.

4.4.3. Strengths and limitations of this study

The main strengths of this study are that 1) it is the first study to document the incidence of illness during a football tournament, 2) it utilized a prospective cohort design, and 3) it utilized previously validated injury recording procedures. In addition, the methodology utilized in recording illness during this study can now be adapted and utilized in other sports settings.

The main limitation of this study is that the response rate for this study was only 70%. However, this response rate is compatible with the response rates in similar previous studies conducted by FIFA, where an average response rate of 84% for football studies has been reported (ranging from 47% for the Confederations Cup 1999 to 100% in the Confederations Cup 2001)[26]. The data collected can therefore be considered a good representation of the cohort group being studied. However, for future studies of a similar nature, an attempt must be made to ensure that the response rate is optimal. This can be achieved by better communication between the researcher and the team physicians and turn their communication with the players. Emphasis on the expected gain in knowledge and confidentiality of the collected data will help motivate participation. The importance of the study methodology and questionnaire relevance need to be addressed in future studies.

A further limitation of this study was that the sample size was relatively small and the duration of the tournament was relatively short (15 days). Therefore, a detailed analysis of some parameters such as patterns of illness and injury over the time period could not be conducted.

Finally, air pollution (sulphur dioxide, sulphides, oxides of nitrogen, particulate matter and Ozone) and pollen count data could not routinely be recorded in the host cities of this tournament. Therefore, any correlations between air pollution or aero-allergens and atopic or respiratory illnesses could not be made. Environmental data has previously been available prior to an elite sporting event, during the 2004 Athens Olympics, an aerobiological surveillance network was set up to provide athletes with information on the current pollen counts. Fortunately, air pollution and aero-allergen levels in South Africa do not appear to have a significant impact on

sporting events. However, due to the general occurrence of atopic disease, it would seem that the organizing officials of elite athletic events need to ensure that such facilities are in place for all major events such as the World Cup football tournament and team physicians must be provided with the relevant environmental data before the event.

4.5. Summary and conclusion

In summary, the present study provides new evidence that non-trauma related medical conditions contribute significantly to an international football tournament's need for medical care. Furthermore, the assessment of injury and illness data allows for future medical care planning provided to elite footballers. The data show that elite footballers are affected by a wide spectrum of medical conditions that are both related to athletic activity and to general medical conditions. The incidence of such a wide spectrum of medical conditions highlights the need for appropriate medical support for elite football players. The team physicians taking care of elite football players need to be well trained and have the necessary skills and experience to manage both injuries and a wide spectrum of medical conditions.

Chapter 5

Summary and conclusion

The purpose of this dissertation was to investigate medical conditions and illness in elite football players. Ultimately, the aim was to provide data and recommendations for future studies investigating medical conditions and illness in elite athletes in general and footballers in particular.

The first main novel contribution of this dissertation was a documentation of the most common pre-tournament medical conditions in the players participating in the 2009 Confederations Cup Football tournament (Table 5.1.).

Table 5.1.: The prevalence of general medical conditions reported in the players participating in the 2009 Confederations Cup Football tournament (expressed as number of players and % of all the players)

Condition	Number of players	Percentage
Exercise Associated Muscle Cramps (EAMC)	64	46%
Allergy	27	20%
Atopic family history	20	14%
Dermatological conditions	16	12%
Upper Respiratory Tract (URT) symptoms	12	8.7%
Gastrointestinal conditions	10	7%
Asthma	6	4%
Central nervous system conditions	6	4%

Pre-existing medical conditions may affect an athlete's performance and undiagnosed medical conditions may expose an athlete to a risk of medical complications. Therefore, the documentation of medical conditions in athletes will assist team physicians in the identification of risk patterns and help guide pre-participation medical examinations to improve medical care delivered to athletes. Only limited data are available on the prevalence of common medical conditions that may affect elite athletes and it appears that there are no data on the prevalence of medical conditions in elite footballers. From the data describing the prevalence of medical conditions and illness in athletes, it can be concluded that medical conditions are common in athletes and the prevalence of reported conditions depends on the condition reported and the population described. To date, the most common pre-existing medical conditions that have been reported in athletes are

gastrointestinal complaints, skin infections and allergic conditions. The most prevalent condition reported in this study is EAMC. This is the first study to report the lifetime prevalence of EAMC in footballers. This finding requires further investigation.

The second novel contribution from this dissertation is the documentation of the incidence of medical conditions and illness in elite football players participating in an international tournament. A literature review revealed that there are limited data on the incidence of illness during international sports competitions. From the limited research, it has been shown that the incidence of medical conditions and illness varies but that 27-69% of consultations in athletes are due to medical (non-trauma related) conditions. Where this has been documented, the incidence of illness is as common as the incidence of injury. Furthermore, the most common medical conditions reported in athletes are upper respiratory tract infections, gastrointestinal complaints and skin infections. The focus of this dissertation was on football players and the reason for this was that to date, there is only one study describing medical conditions and illness in elite footballers. These data are important because 1) many of these medical conditions may affect an athlete's performance and 2) this information can assist team physicians and event organisers with optimal planning of medical care to athletes in general and footballers in particular.

The data presented in this dissertation have contributed to the current body of scientific literature on the incidence of medical conditions in elite football players participating in an international tournament. The data represented in this dissertation can be summarized together with other data that are known (Table 5.2.).

Table 5.2.: The frequency (n = number of consultations) and percentage (%) of all formal medical consultations in elite athletes participating in tournaments / competitions [2000 and 2004 Olympic Games (South African and New Zealand teams), the 2003 Cricket World Cup (All teams), the 2006 FIFA World Cup and 2007 CONCACAF Gold Cup (Trinidad and Tobago team) and the 2009 Confederations Cup (All teams)]

	Sydney 2000 Olympic Games Team New Zealand[104]	Sydney 2000 Olympic Games Team South Africa[70]	Athens 2004 Olympic Games Team South Africa[71]	SA 2003 Cricket world Cup[94]	Trinidad and Tobago football[81]	Trinidad and Tobago football Players only[81]	Confed Cup 2009 South Africa
Injuries	(345) 53%	(108) 31%	(72) 40%	(48) 53%	(117) 67%	(102) 73%	(56) 62%
Illnesses	(308) 47%	(240) 69%	(108) 60%	(42) 47%	(57) 33%	(38) 27%	(35) 38%
Ear nose & throat	3%	18%	13%	0	4.5%	4%	14%
Respiratory	18%	16%	8%	14.5%	9%	9%	8%
Neurological	1%	16%	4%	3%	2%	2%	2%
Gastrointestinal	4%	6%	6%	7%	7%	2%	5.5%
Dermatological	7%	2.5%	16%	8%	3.5%	3%	6.5%
Urological	0.5%	2.5%	0.5%	3%	0	0	1%
Psychological	0	2%	3%	0	3.5%	3.5%	0
Cardiology	0.5%	1%	3%	0	0	0	0
Ophthalmology	2%	0.5%	0.5%	3%	0	0	1%
Other	11%	4.5%	6%	8.5%	3.5%	3.5%	0

Derman[70,71], Robinson[104], Kilian[94], Babwa[81]

Differences in study methodology make it difficult to directly compare the results of these studies. However, from the above data, it is evident that the medical conditions reported by the participants during various elite international sporting events account for a significant volume of the consultations that the team physician will need to tend to. Furthermore, the pattern of conditions reported is remarkably consistent through various sporting codes. It is also evident that specific travel related factors such as jet lag and environmental conditions such as seasonal patterns can influence the pattern of diseases encountered. It is thus essential that team physicians familiarize themselves with the teams travel plans and the competition venue environment when planning medical care.

The limitations of these studies have been identified and due to a growing interest in the documentation of medical condition and illness data, two additional studies investigating illness data have recently been published. Of note, the older "historical" studies have reported the frequency of illnesses as a percentage of all the consultations. In contrast, the latest research has followed the current standard reporting format used to document the incidence of injuries and illness by taking the exposure into account (reporting injuries per 1000 player days and illness per 1000 players). The types of illness are also reported as a percentage of all the illnesses reported. An important recommendation from this dissertation is that a standard illness reporting format be agreed upon and then followed for future studies. The medical condition and illness data from this study can be summarized and compared with two recently published studies where the reporting of the data follows the same format (Table 5.3.).

Table 5.3.: The frequency (n = number of consultations) and percentage (%) of all formal medical consultations and the incidence of injuries and illness (expressed as (n) / 1000 athletes or players) in elite athletes participating in tournaments (2009 Confederations Cup, 2009 FINA World Championship and 2010 Winter Olympic Games)

	Confederations Cup South Africa 2009	**FINA World Championships 2009**[145]	**Winter Olympics 2010**[119]
Injuries (n), % of all consultations	(56) 62%	(171) 48%	(287) 61%
Injuries / 1000 athletes	304.3	65.6	111.8
Illnesses (n), % of all consultations	(35) 38%	(184) 52%	(185) 39%
Illnesses / 1000 athletes	190.2	71.0	72.1

Engebretsen[119], Mountjoy[145]

The authors of both the FINA World Championships study and the Winter Olympic Games studies have reported the incidence of injuries and illnesses as (n) / 1000 athletes. In our study we reported incidence as (n) / 100 player days. Our opinion is that incidence data should be reported using an exposure time. We would therefore suggest that all future research investigating medical conditions and illness be reported as (n) / 100 player days.

The third novel contribution from this dissertation is the documentation of the nature of medical conditions and illness that elite athletes suffer from during tournaments or competitions. There are data from two recent studies available and these data can be compared with the data reported in this dissertation (Table 5.4.).

Table 5.4.: The frequency of general medical conditions reported in the players participating in the 2009 Confederations Cup, 2009 FINA World Championships and 2010 Winter Olympic Games (expressed as a % of all illnesses)

	Confederations Cup South Africa 2009	FINA World Championships 2009[145]	Winter Olympics 2010[119]
Affected systems			
Respiratory	57.1%	50.3%	62.8%
Dermatological	17.1%	-	4.4%
Gastrointestinal	14.3%	19.9%	20%
Neurological	5.7%	-	-
Urological	2.8%	-	-
Psychological	-	-	-
Cardiology	-	-	-
Ophthalmology	2.8%	-	-
Other	-	30.4%	12.2%
Illness causes			
Environmental	42.8%	27.6%	9.8%
Infection	34.3%	49.2%	63.8%
Illness symptoms and signs			
Pain	31.4%	Most common	27.9%
Cough	22.8%	-	21.2%
Sore throat	8.6%	-	-
Diarrhoea and vomiting	8.6%	-	9.5%
Headache	5.7	-	-
Fever	2.8%	-	8.9%
Diagnosis			
URTI/sinusitis	51.4%	-	54.0%
Otitis	-	16.8%	-
Tonsillitis	-	9.8%	-
Illness severity			
Time-loss injuries	25.7%	16.3%	35.1%

Engebretsen[119], Mountjoy[145]

The most common body system to be affected by illness in our study was the respiratory system, followed by the skin and gastrointestinal system. The most common diagnosis was that of sinusitis, followed by influenza. Fungal skin infections were also common. Pain and coughing were the most prominent symptoms reported. The opinion of the team physicians was that environmental factors and infections were the most frequent causes of illness.

A summary of these three studies confirm that respiratory tract symptoms are the most common medical problem encountered by team physicians. This is followed by gastrointestinal and dermatological conditions. The symptom reporting is consistent in the three studies, with pain being the most common symptom reported. However, the definition of illnesses and accurate diagnostic classification of illnesses is not consistent between studies and this needs further research. In particular, the distinction between respiratory and Ear Nose and Throat (ENT) conditions needs further clarification. It is recommended that a consensus be reached in the reporting of illness so that, in future, data between studies can be compared.

The fourth novel contribution from this dissertation is the documentation of the time loss (severity and impact) of medical illness in football players. From this study the time loss due to illness of 0.46 day per illness highlights the importance of medical conditions during elite sporting events. The most common medical condition being respiratory tract illness highlights to importance of airway disease and allergic conditions for the team physician managing a team. There are no data in the scientific literature where time loss due to illness has been reported in football

players. However, the general findings of this study are similar to previously reported data in other studies.

The results of this dissertation can also be applied to clinical practice and the following clinical recommendations can be made based on the data presented in this dissertation:

Sports physicians managing elite football players should be aware of the wide spectrum of medical conditions encountered in elite footballers.

Clinical data from pre-participation screening examinations needs to be published to increase the body of knowledge of the prevalence of medical condition in athletes.

It is important that the methodology of illness reporting be standardized and that future studies report the first consultation and follow-up consultation separately. This will enable team physicians to firstly assess the incidence of medical conditions and secondly the burden of disease to be managed by the medical team taking care of athletes.

There is a growing body of scientific data describing medical conditions and illness in athletes.

The high lifetime prevalence of Exercise Associated Muscle Cramping in footballers requires further investigation.

The natural immunity, vaccination status and travel related illnesses, in athletes has not been reported.

Assessment of the “local” environment and travel across time zones also need to be considered as it has been well documented that aero-allergens, local insects, air pollution, weather conditions and jet lag can affect the incidence and nature of medical consultations.

Assessment of injury and illness data of elite athletes participating tournaments allows for better future planning of the medical coverage of these events.

The composition of the medical team should include members capable of managing both injuries and common illnesses.

Finally, the data presented in this dissertation allows us to make some recommendations for future studies. Data collection methodology needs to be standardized bearing in mind that there should be sport specific modifications and simplification of the questionnaires. In general, data collection needs to be simplified and electronic data collection methods need to be investigated.

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Appendix 1

Table A.1.: 2009 Confederations Cup (South Africa) football tournament teams and their respective regional representation or qualifying status

Team	Title
Brazil	Copa America 2007 champions
Egypt	CAF African Cup of Nations 2008 champions
Iraq	AFC Asian Cup 2007 champions
Italy	2006 FIFA World Cup champions
New Zealand	OFC Nations Cup 2008 champions
South Africa	Host Nation
Spain	UEFA EURO 2008 champions
United States of America	CONCACAF Gold Cup 2007 champion

Appendix 2

UNIVERSITY OF CAPE TOWN

Health Sciences Faculty
Research Ethics Committee
Room E52-24 Groote Schuur Hospital Old Main Building
Observatory 7925
Telephone [021] 406 6338 • Facsimile [021] 406 6411
e-mail: nosi.tywabi@uct.ac.za

04 May 2009

REC REF: 159/2009

Prof M Schwellnus
Human Biology
Sports Science Institute

Dear Prof Schwellnus

PROJECT TITLE: MEDICAL CONDITIONS AND ILLNESS IN ELITE FOOTBALL PLAYERS DURING INTERNATIONAL COMPETITION: A PILOT STUDY

Thank you for submitting your study to the Research Ethics Committee for review.

DATE OF THE MEETING: 24 April 2009

DECISION:
It is a pleasure to inform you that the Ethics Committee has **formally approved** the above mentioned study.

Approval is granted for one year until 10 May 2010.

The first paragraph of the questionnaire speaks about "Olympic games", this needs to be changed to Confederation Cup.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please quote the REC. REF in all your correspondence.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, HSF HUMAN ETHICS
This serves to confirm that the University of Cape Town Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-

lemjedi

Appendix 3

SUBJECT INFORMATION SHEET:

THE RESEARCH STUDY TO BE CONDUCTED AT THE 2009 FIFA CONFEDERAIONS CUP FOOTBALL TOURNAMENT

A research study will be conducted to determine how common medical conditions and illnesses are in players who are participating in the 2009 FIFA Confederations Cup Football tournament in June 2009. This tournament will be held at four venues in South Africa. The detailed information on each of these components of the study is as follows:

The purpose of this study is to determine how common a variety of medical conditions and illnesses are in football players during a tournament. It is known that athletes, who train hard and then participate in strenuous competition, have increased respiratory tract symptoms (runny nose, sore throat, sinusitis, enlarged lymph glands in the neck, and even cough and chest pain with fever and headaches). However, these symptoms may not always be due to an infection but could be as a result of allergies or pollution. It has also been shown that one of the most common reasons for athletes at the Olympic Games see their doctor is gastro-intestinal symptoms and respiratory tract symptoms. However, this has not been studied in football players, particularly during competitions.

You will be given an opportunity to participate in a study where this will be investigated in football players. Prior to the competition, your team doctor will approach you and give you information about the study. You will then be given the opportunity to volunteer to participate in the study.

The details of the study are as follows:

- Before the competition, your team doctor will give you a medical questionnaire to complete. This medical questionnaire will be anonymous and only a coding system will be used to identify your team. Your personal details will not be on the form. The questionnaire deals with training information and medical information.
- At the time of the competition, your team doctor will ask you every day about possible medical conditions. This information will be recorded anonymously on a sheet which will be sent to the investigators. If you suffer from any disease/condition, your team doctor will treat it in the usual fashion.
- Further information about any medical conditions that you may have in the 2 weeks after the competition will also be recorded by your team doctor and that information will be sent to the investigators.

Potential risks of this study

- The completion of a questionnaire is not associated with any risk. The questionnaire and other clinical data (paper and electronic) will be kept confidential, will be kept secure, and will not be made available to any party other than the research team without the consent of the individual participants.
- All medical conditions will be treated by the team doctor.

Potential benefits of this study

- The anticipated benefits of this study are that the results will further our understanding of the possible cause/s of medical conditions in football players that travel to participate in international competitions.

As a participant in the 2009 Confederations Cup, you are given the choice to participate in this research effort. Your participation is entirely voluntary. Please read through the details of the study. The details of the study are explained in this document, and if you wish to participate in the study,

please read through and sign the INFORMED CONSENT FORM. Please feel free to contact your team doctor or members of the research team should you have any questions related to the study. Contact details of the research team are as follows: Cape Town +27-21-6504567, FMARC, Zurich +41432227777

Appendix 4

INFORMED CONSENT FORM

I, _____, agree voluntarily to participate in a study conducted by the UCT/MRC Research Unit for Exercise Science and Sports Medicine (University of Cape Town) and the FIFA Medical Assessment and Research Centre (FMARC), titled:

"Medical conditions and illness in elite football players during international competition: a pilot study"

I understand that my participation in this research project has no direct benefits to me during the 2009 FIFA Confederations Cup competition. However, I understand that my participation in the research project will advance the medical and scientific knowledge related to football. Therefore, information gathered through my participation in this project could advance the future medical care, training advice and performance of football players.

I have read the subject information sheet and the following procedures and concepts have been explained to me in full:

Completion of a questionnaire: (all components)

The questionnaire will not contain any personal particulars (name, contact details) that could identify me. The completion of training details, medical conditions, and lifestyle history questionnaires are not associated with any risk. All the questionnaire data and other clinical data (paper and electronic) will be kept confidential, will be kept secure, and will not be made available to any party other than the research team without the consent of the individual subjects.

I agree that the all the information, which will be collected by my team doctor before the tournament, may be used to answer scientific questions about the medical conditions associated with the participation in and completion of an football tournament.

Daily information during the football tournament and in the 2 weeks after tournament

I agree that the all the information, which will be collected by my team doctor on a daily basis during and for 2 weeks after the tournament, may be used to answer scientific questions about the medical conditions associated with the participation in and completion of an football tournament.

I have read (or, where appropriate, have had read to me) and understood the information about this study, and any questions I have asked have been answered to my satisfaction. I agree to participate in the study. I agree that research data provided by me or with my permission during the study may be included in a thesis, presented at conferences and published in journals on the condition that neither my name nor any other identifying information is used.

I have read the preceding subject information sheet and understand the testing procedures outlined therein. I understand any accompanying risks and discomforts. Knowing these risks and discomforts and having had the opportunity to pose questions answered to my satisfaction, I hereby consent to participate in this study. I understand that I may withdraw from this study at any time without further question. I have been informed that the individual data derived from my participation in these protocols will remain confidential. I understand that the medical staff and the research team have professional medical insurance.

Name of the player:	Name of investigator:
Signature of the player	Signature of Investigator:
Date:	Date:

Appendix 5

University

Of

Cape Town

2009 CONFEDERATIONS CUP

PRE-COMPETITION MEDICAL QUESTIONNAIRE

These questionnaires have been constructed by the Medical Research team, in conjunction with FIFA Medical Assessment and Research Centre (FMARC). The information obtained from these questionnaires is essential for the planning of medical care during events such as the FIFA Confederations Cup. We acknowledge that the questionnaire is long, but we are asking about 20-30 minutes of your valuable time to complete them. The completion of the questionnaires is voluntary; all the information will be kept confidential and will only be used for research and medical care planning purposes.

Prof Martin Schwellnus

Prof Jiri Dvorak

Instructions

Please answer each question by filling in the details in the allocated space or checking one or more of the option boxes.

Please hand the completed forms together with the signed consent form to your team physician.

Section A	Basic Details
Section B	Training History
Section C	History of Medication and Supplement Use as well as Lifestyle and Habits History
Section D	Family Medical History

Section E General Personal Medical History

Section A: Basic player details			
Team Code			
Players Code			
First Name			
Date of birth	y y y y - m m - d d		
Height	cm		
Weight	kg	Age (on first day of competition)	yrs
Dominant Hand	Left ☐ Right ☐ Both ☐	Dominant Leg	Left ☐ Right ☐ Both ☐
Player position			

Section B. Training history	
How many days a week did you train during **15 weeks before the competition**?	days/wk
How many hours a week did you **train** in an average week during the **15 weeks before the competition**?	hrs/wk
Please indicate what types of training you perform and the percentage of training during **15 weeks before the competition**?	☐ Football training on the pitch ___ % ☐ Strength training in a gymnasium ___ % ☐ Endurance training (running, jogging, cycling) ___ % ☐ Flexibility / agility training ___ % ☐ Other training _____ ___ %
How many days a week did you train during **2 weeks before the competition**?	days/wk
How many hours a week did you **train** in an average week during the **2 weeks before the competition**?	hrs/wk
Please indicate what types of training you perform and the percentage of training during 2 **weeks before the competition**?	☐ Football training on the pitch ___ % ☐ Strength training in a gymnasium ___ % ☐ Endurance training (running, jogging, cycling) ___ % ☐ Flexibility / agility training ___ % ☐ Other training _____ ___ %

How did your training commitment affect your social life?	☐ Not at all ☐ A fair amount ☐ A lot

Section C. History of medication and supplement use

What medication, if any, are you currently using? (please list)	Name of medication	Years taken
Are you currently taking dietary supplements/vitamins?		Yes ☐ No ☐

If **yes** to the above question, please list names of dietary, sports or vitamin supplements.	Name of supplement	Years taken
	☐ Multi-vitamins	_____
	☐ Anti-oxidants	_____
	☐ Immune boosters	_____
	☐ Protein powders/supplements, Protein bars. BCAAs	_____
	☐ Creatine	_____
	☐ Caffeine	_____
	☐ Fat cutters	_____
	☐ Carbohydrate drinks/powders/gels	_____
	☐ Other: _____	_____

Lifestyle and habits history

Please indicate your smoking status	Current smoker ☐	Ex smoker ☐	Never smoked ☐
If you answered yes, (past or current smoker) please complete the section on the right	Number of years of smoking:	If stopped, how many years ago:	
	What is (was) the average number of cigarettes per day:		

On average, how much alcohol do you drink per week (tots, glasses) of spirits, wine or beer?	_____ glasses beer/cider per week _____ glasses wine per week _____ tots of spirits per week

Section D. Family medical history

Have any of your blood (biological) relatives <u>ever</u> had the following?

Please tick yes or no. If yes, please tick the relationship of that person to you (You may tick more than one of the relationship blocks).

Description		**If Yes, please indicate the relationship**
Asthma	Yes ☐ No ☐	☐ Father ☐ Mother ☐ Brother ☐ Sister ☐ Child ☐ Grandfather ☐ Grandmother
Allergies (in general)	Yes ☐ No ☐	☐ Father ☐ Mother ☐ Brother ☐ Sister ☐ Child ☐ Grandfather ☐ Grandmother

Section E. General personal medical history

In this section, you are asked to read through 8 questions about your personal general medical history. If you answer "yes" to any of questions, please complete the additional questions about that symptom/condition.

Question 1: Flu symptoms

In the **6 weeks before the competition** (from 1st May) did you suffer from any **symptoms of flu** (fever, sore throat, blocked or runny nose, cough, wheeze, muscle aches and pains)?	Yes ☐ No ☐

If you answered **NO** to **question 1 – Please go to Question 2 below**

If you answered **YES** to **question 1 -** please complete the following additional questions

(1a) Please tick which of these flu symptoms you suffered from **in the last 6 weeks**.	☐ Fever ☐ Cough ☐ Joint pains ☐ Blocked nose ☐ Wheezing ☐ Sore Throat ☐ Runny nose ☐ Muscle aches ☐ Any other flu symptoms (Specify: _____)
(1b) Please tick which of these flu symptoms you suffered from **in the last 7 days**.	☐ Fever ☐ Cough ☐ Joint pains ☐ Blocked nose ☐ Wheezing ☐ Sore Throat ☐ Runny nose ☐ Muscle aches ☐ Any other flu symptoms (Specify: _____)

Question 2: Allergy symptoms

Have you **ever** in your football career suffered from **symptoms of allergies** including nose allergies (hay fever), allergic sinusitis, allergic asthma, skin allergies, a past history of allergies to medication, plant material or animal material?	Yes ☐ No ☐

If you answered **NO** to **question 2 – Please go to Question 3 below**

If you answered **YES** to **question 2 -** please complete the following Table

(7a) Please indicate how long (years) have you been suffering from allergies?	years

(7b) Please tick which type of allergy do you currently suffer from

Nose (hay fever)	Yes ☐ No ☐	Sinusitis	Yes ☐ No ☐	Asthma (allergic)	Yes ☐ No ☐

Skin allergies	Yes ☐ No ☐	Eye allergies	Yes ☐ No ☐	Allergy to plant material	Yes ☐ No ☐
Allergy to foods	Yes ☐ No ☐	Allergy to animals	Yes ☐ No ☐	Allergy to medication	Yes ☐ No ☐
(7c) Please tick which <u>type of allergy</u> do you <u>currently take medication</u> for					
Nose (hay fever)	Yes ☐ No ☐	Sinusitis	Yes ☐ No ☐	Asthma (allergic)	Yes ☐ No ☐
Skin allergies	Yes ☐ No ☐	Eye allergies	Yes ☐ No ☐	Allergy to plant material	Yes ☐ No ☐
Allergy to foods	Yes ☐ No ☐	Allergy to animals	Yes ☐ No ☐	Allergy to medication	Yes ☐ No ☐
(7d) Please tick which <u>type of medication</u> do you <u>currently take</u>					
Cortisone nose spray	Yes ☐ No ☐	Cortisone nose inhaler	Yes ☐ No ☐	Anti-histamine tablets	Yes ☐ No ☐
Cortisone cream	Yes ☐ No ☐	Anti-histamine cream	Yes ☐ No ☐	Other inhaler / tablets or cream	Yes ☐ No ☐
(7e) Please tick which <u>symptoms of allergy</u> do you <u>currently suffer</u> from					
Sneezing	Yes ☐ No ☐	Itchy runny nose	Yes ☐ No ☐	Headache	Yes ☐ No ☐
Itchy palate	Yes ☐ No ☐	Streaming eyes	Yes ☐ No ☐	Fatigue	Yes ☐ No ☐
Itchy eyes	Yes ☐ No ☐	Blocked nose	Yes ☐ No ☐	Poor sleep	Yes ☐ No ☐
Post nasal drip	Yes ☐ No ☐	Coughing	Yes ☐ No ☐	Wheezing	Yes ☐ No ☐
In which months of the year do you <u>currently</u> have symptoms of allergies? (You tick more than one)	☐ Jan ☐ Feb ☐ March ☐ April ☐ May ☐ June ☐ July ☐ Aug ☐ Sept ☐ Oct ☐ Nov ☐ Dec				
(7f) Please tick which <u>type of allergy</u> did you suffer from in the past (NOT currently)					
Nose (hay fever)	Yes ☐ No ☐	Sinusitis	Yes ☐ No ☐	Asthma (allergic)	Yes ☐ No ☐
Skin allergies	Yes ☐ No ☐	Eye allergies	Yes ☐ No ☐	Allergy to plant material	Yes ☐ No ☐
Allergy to foods	Yes ☐ No ☐	Allergy to animals	Yes ☐ No ☐	Allergy to medication	Yes ☐ No ☐

Question 3: Asthma

Do you **currently suffer from asthma** including exercise induced asthma, or symptoms of asthma such as shortness of breath, wheezing, or chronic coughing?	Yes ☐ No ☐
If you answered **NO** to **question 3 – Please go to Question 4 below** If you answered **YES** to **question 3 -** please complete the following questions	
(8a) How many years have you suffered from asthma?	(years)
(8b) How was your asthma diagnosed?	☐ A doctor taking a history and performing an examination ☐ Lung function test (blow test) but no exercise ☐ Lung function test (blow test) before and after exercise ☐ Metacholine challenge test ☐ Eucapnic hyperventilation test (rebreathing test) ☐ Other test (Specify: _____)
(8c) Which **type of asthma** do you currently suffer from?	☐ Asthma that occurs at any time but not during exercise ☐ Asthma that occurs at any time including during exercise ☐ Asthma that only occurs during exercise
(8d) Please indicate **how frequently do you currently experience the symptoms** of asthma (shortness of breath, wheezing, coughing or coughing after exercise)?	**Daytime symptoms (per week)** ☐ < 2 / week ☐ 2-4 / week ☐ >4 / week ☐ All the time **Night time symptoms (per month)** ☐ < 1 / month ☐ 2-3 / month ☐ ≥4 / month ☐ All the time **Exercise related symptoms (per 10 exercise sessions)** ☐ <1 per 10 sessions ☐ 2-3 per 10 sessions ☐ ≥4 per 10 sessions
(8e) Please indicate if you had symptoms of asthma that were severe enough to necessitate **hospital admission in the last 12 months**	☐ No hospital admission for asthma in the last 12 months ☐ 1-2 hospital admissions for asthma in the last 12 months ☐ 3-4 hospital admissions for asthma in the last 12 months ☐ >4 hospital admissions for asthma in the last 12 months

(8f) Which **symptoms of asthma** do you currently suffer from?	☐ Wheezing ☐ Dry cough ☐ Shortness of breath ☐ Tight chest ☐ Chest pain ☐ Other (Specify: _____)
(8g) What **medication do you currently use** for your asthma? (you may tick more than one option)	☐ Cortisone inhaler (e.g. Beclate, Becloforte, Becodisks, Becotide, Budeflam, Flixotide, Inflammide, Pulmicort, Qvar, etc) ☐ Salbutamol (bronchodilator) inhaler (e.g. Ventolin, Venteze, Vomax, Airomir, Asthavent etc.) ☐ Salmeterol (bronchodilator) inhaler (Serevent) ☐ Fenoterol (bronchodilator) inhaler (Berotec) ☐ Terbutaline (bronchodilator) inhaler (Bricanyl) ☐ Formoterol (bronchodilator) inhaler (e.g. Foradil, Foratec, Oxis) ☐ Ipratropium (bronchodilator) inhaler (Atrovent) ☐ Tiotropium (bronchodilator) inhaler (Spiriva) ☐ Combined cortisone and bronchodilator inhaler (e.g. Atrovent, Berodual, Combivent, Duolin, Duovent, Seretide, Symbicord) ☐ Cortisone tablets ☐ Bronchodilator tablets ☐ Leukotriene receptor antagonist tablets (e.g. Acccolate, Singulair) ☐ Other inhaler ☐ Other medication (Specify: _____)
(8h) **When do you use your medication** for your asthma?	☐ Daily (irrespective of exercise) ☐ Only before exercise ☐ Other (Specify: _____)
(8i) **How long before an exercise session** do you use your medication for asthma?	min
(8j) Have you obtained **TUE (therapeutic use exemption forms)** for your asthma medication?	Yes ☐ No ☐

Question 4: Muscle cramping during football

Have you **ever** in your football career suffered from **muscle cramping** (painful, spontaneous, sustained spasm of a muscle) during or immediately (within 6 hours) after exercise (in training or competition)?	Yes ☐ No ☐
If you answered **NO** to **question 4 – Please go to Question 5 below** If you answered **YES** to **question 4 -** please complete the following additional questions	
(2a) For how many years have you suffered from cramping?	(years)
(2b) Did you suffer from cramping during or after exercise in the **last 12 months**?	Yes ☐ No ☐
(2c) With what **type of training** is your cramping associated (You can tick more than one form of exercise)?	☐ Football ☐ Weight training ☐ Running ☐ Other
(2d) In the **last 10 matches or training sessions**, how many times have you experienced cramping?	Matches: _____/10 Training sessions: _____/10
(2e) What treatment/s have you had that **successfully relieved** an acute cramp? (can tick more than one)	☐ Stretching ☐ Resting ☐ Drinking fluid ☐ Ice application ☐ Massage ☐ Magnesium ☐ Salt (tablets or solution) ☐ Other (Specify: _____)
(2f) At **what point in the competition or training session** do you usually first experience cramping?	☐ First quarter ☐ Second quarter ☐ Third quarter ☐ Fourth quarter ☐ After the session ☐ No pattern
(2g) In which **muscles** do you usually cramp (please list the muscle by the one which cramps most frequently (as 1) and the others after that (2-4)?	☐ Calves ☐ Hamstrings ☐ Quadriceps (thigh) ☐ Foot muscles ☐ Other (Specify: _____)
(2h) Have you **ever** suffered from cramping in your **whole body** (arms and legs)?	Yes ☐ No ☐
(2i) Have you **ever** been **admitted to hospital** following cramping?	Yes ☐ No ☐
(2j) Have you **ever** been **confused or in a coma** during or after a cramping episode?	Yes ☐ No ☐

(2k) Have you ever had **"dark urine"** in the 3 days following a cramping episode?	Yes ☐ No ☐
(2l) If you cramp, **how long** does the cramp usually last for (min)?	(minutes)
(2m) If you cramp, how **severe** is the cramp usually? (please tick).	☐ Mild: < 5 minutes and you are able to continue exercising ☐ Moderate: 5-15 minutes and you are able to continue exercising ☐ Severe: >15 minutes or if you have to STOP exercising

Question 5: Gastro-intestinal symptoms during football

Have you **ever** in your running career suffered **gastrointestinal** symptoms **during football** including heartburn, nausea, vomiting, abdominal pain, urge to defecate (pass a stool), diarrhoea, or blood in the stools?	Yes ☐ No ☐

If you answered **NO** to **question 5 – Please go to Question 6 below**

If you answered **YES** to **question 5 -** please complete the following Table

Symptom	Number of times you experienced the GIT symptom in the last 12 months **(during football training or matches)**	Number of times you experienced the GIT symptom in the last 10 matches **(during football matches)**	Please indicate the **"severity" of the GIT symptom** during training or playing football
Nausea			☐ Does not affect training or playing ☐ Affects training/playing football (slow down or reduce time) ☐ Prevents training/playing football
Vomiting			☐ Does not affect training or playing ☐ Affects training/playing football (slow down or reduce time) ☐ Prevents training/playing football
Heartburn			☐ Does not affect training or playing ☐ Affects training/playing football (slow down or reduce time) ☐ Prevents training/playing football

Abdominal pain			☐ Does not affect training or playing ☐ Affects training/playing football (slow down or reduce time) ☐ Prevents training/playing football
Urge to pass a stool (defecate)			☐ Does not affect training or playing ☐ Affects training/playing football (slow down or reduce time) ☐ Prevents training/playing football
Diarrhoea			☐ Does not affect training or playing ☐ Affects training/playing football (slow down or reduce time) ☐ Prevents training/playing football
Passing blood in the stool			☐ Does not affect training or playing ☐ Affects training/playing football (slow down or reduce time) ☐ Prevents training/playing football
Please indicate if you previously suffered from or had any of the following (you may tick more than one)?			☐ History of heartburn ☐ Gastroscopy ☐ Ulcer (gastric, duodenal) ☐ Irritable bowel syndrome ☐ Allergy to milk products ☐ Other past history of GIT disease

Question 6: Nervous system symptoms during football

Have you **ever** in your football career suffered from symptoms of the **nervous system** including exercise induced headaches, depression, anxiety, nerve tingling or loss of sensation?	Yes ☐ No ☐

If you answered **NO** to **question 6 – Please go to Question 7 below**

If you answered **YES** to **question 6 -** please complete the following Table

Symptom	Number of times in the last 12 months **(during football training or matches)**	Number of times in last 10 races **(during football matches)**	Please indicate the **"severity" of the symptom** during training or playing football
Headaches			☐ Does not affect training or playing ☐ Affects training/playing football (slow down or reduce time) ☐ Prevents training/playing football
Depression			☐ Does not affect training or playing ☐ Affects training/playing football (slow down or reduce time) ☐ Prevents training/playing football
Anxiety			☐ Does not affect training or playing ☐ Affects training/playing football (slow down or reduce time) ☐ Prevents training/playing football
Nerve tingling in the hands			☐ Does not affect training or playing ☐ Affects training/playing football (slow down or reduce time) ☐ Prevents training/playing football
Loss of sensation in the hands			☐ Does not affect training or playing ☐ Affects training/playing football (slow down or reduce time) ☐ Prevents training/playing football

Nerve tingling in the feet			☐ Does not affect training or playing ☐ Affects training/playing football (slow down or reduce time) ☐ Prevents training/playing football
Loss of sensation in the feet			☐ Does not affect training or playing ☐ Affects training/playing football (slow down or reduce time) ☐ Prevents training/playing football

Question 7 and 8: Other medical history	
*7. Do you **currently**, or did you **in the last year**, suffer from any symptoms of **skin disease**?*	*Skin infections:* *Yes* ☐ *No* ☐ *Skin allergy:* *Yes* ☐ *No* ☐ *Sunburn:* *Yes* ☐ *No* ☐ *Skin cancer:* *Yes* ☐ *No* ☐ *Other skin damage resulting sun exposure:* *Yes* ☐ *No* ☐

8. *Please tick in which anatomical area you ever had **surgery** performed.*	☐ *Gastric (stomach)* ☐ *Oesophageal (swallowing pipe)* ☐ *Small bowel* ☐ *Large bowel (colon)* ☐ *Rectum* ☐ *Gallbladder* ☐ *Pancreas* ☐ *Liver* ☐ *Abdomen (general)* ☐ *Wrist* ☐ *Head* ☐ *Finger* ☐ *Neck* ☐ *Lower back* ☐ *Face* ☐ *Hip* ☐ *Front chest* ☐ *Thigh* ☐ *Back chest* ☐ *Knee* ☐ *Shoulder* ☐ *Lower leg* ☐ *Upper arm* ☐ *Achilles* ☐ *Elbow* ☐ *Ankle* ☐ *Forearm* ☐ *Foot* ☐ *Other (Specify: _____)*

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE!!

Appendix 6

Daily Report on Injuries and Illness

Country _______________ Physician's name _______________ Date of report _____/_____ 2009

Contact details Tel _____________ Fax _____________email _____________@_____________

Please report (1) **all injuries** (traumatic and overuse) and (2) **all illness** newly incurred in matches or training **during the FIFA Confederations Cup** regardless of the consequences with respect to absence from competition or training. This information is for medical and research purposes and will be treated confidentially.

(1) Injuries

Player number		Date of injury		Training or match		Time in the match
Injured body part	code	Type of injury	code	Cause of injury	code	Absence in days

Player number		Date of injury		Training or match		Time in the match
Injured body part	code	Type of injury	code	Cause of injury	code	Absence in days

Player number		Date of injury		Training or match		Time in the match
Injured body part	code	Type of injury	code	Cause of injury	code	Absence in days

Player number		Date of injury		Training or match		Time in the match
Injured body part	code	Type of injury	code	Cause of injury	code	Absence in days

Player number		Date of injury		Training or match		Time in the match
Injured body part	code	Type of injury	code	Cause of injury	code	Absence in days

(2) Illnesses

Player number		Affected system	code	Final diagnosis	code	Date of illness onset
Main symptoms/signs	code	Cause of illness	code	Treatment (free text)		Absence in days

Player number		Affected system	code	Final diagnosis	code	Date of illness onset
Main symptoms/signs	code	Cause of illness	code	Treatment (free text)		Absence in days

Player number		Affected system	code	Final diagnosis	code	Date of illness onset
Main symptoms/signs	code	Cause of illness	code	Treatment (free text)		Absence in days

Player number		Affected system	code	Final diagnosis	code	Date of illness onset
Main symptoms/signs	code	Cause of illness	code	Treatment (free text)		Absence in days

No injury or illness in any player of our team today ☐

Definitions and codes – see reverse. Please use additional forms if needed

Codes and classifications

For Injuries

Injured body part - Location of injury

Head and trunk	Upper extremity	Lower extremity
1 face (incl. eye, ear, nose)	11 shoulder / clavicle	21 hip
2 head	12 upper arm	22 groin
3 neck / cervical spine	13 elbow	23 thigh
4 thoracic spine / upper back	14 forearm	24 knee
5 sternum / ribs	15 wrist	25 lower leg
6 lumbar spine / lower back	16 hand	26 Achilles tendon
7 abdomen	17 finger	27 ankle
8 pelvis / sacrum / buttock	18 thumb	28 foot / toe

Type of injury - Diagnosis

1 concussion (regardless of loss of consciousness)	11 contusion / haematoma / bruise
2 fracture (traumatic)	12 tendinosis / tendinopathy
3 stress fracture (overuse)	13 arthritis / synovitis / bursitis
4 other bone injuries	14 fasciitis / aponeurosis injury
5 dislocation, subluxation	15 impingement
6 tendon rupture	16 laceration / abrasion / skin lesion
7 ligamentous rupture	17 dental injury / broken tooth
8 sprain (injury of joint and/or ligaments)	18 nerve injury / spinal cord injury
9 lesion of meniscus or cartilage	19 muscle cramps or spasm
10 strain / muscle rupture / tear	20 other

Cause of injury

1 overuse (gradual onset)	11 contact with another athlete	21 field of play conditions
2 overuse (sudden onset)	12 contact: moving object (e.g. ball)	22 weather condition
3 non-contact trauma	13 contact: stagnant object (e.g. wall)	23 equipment failure
4 recurrence of previous injury	14 violation of rules (foul play)	24 other

Estimated duration of **absence from training or competition** (in days)

Please provide an estimate of the number of days that the athlete will not be able to undertake his/her normal training programme or will not be able to compete.

0 = 0 days	14 = 2 weeks	> 30 = more than 4 weeks
1 = 1 day	21 = 3 weeks	>180= 6 months or more
2 = 2 days	28 = 4 weeks	
7 = 1 week		

Definitions and codes for illnesses see next page.

For Illnesses

Affected system (codes A to N)

A Respiratory system	H Endocrine, nutritional or metabolic diseases
B Ears and mastoid	I Mental and behavioural disorders
C Digestive system	J Nervous system
D Genitourinary system	K Skin & subcutaneous tissue
E Circulatory system	L Eye and adnexa
F Other infections and parasitic disease	M Specific medical conditions related to sports
G Hematological and immune system	N Other symptoms, signs, abnormal clinical and laboratory findings

Final diagnosis code (according to affected system)

Respiratory system – diagnostic codes: A		
A1 Acute upper respiratory infections	A5 Allergic sinusitis	A9 Exercise induced bronchospasm
A2 Acute infective rhinitis	A6 Influenza	A10 Other acute lower respiratory tract infection
A3 Acute infective sinusitis	A7 Pneumonia	A11 Other disease of the respiratory tract
A4 Allergic rhinitis	A8 Asthma	
Ears and mastoid – diagnostic codes: B		
B1 External ear infections	B3 Middle ear infections	B5 Inner ear disease
B2 Other external ear disease	B4 Other middle ear disease	B6 Other ear disease
Digestive system – diagnostic codes: C		
C1 Diarrhoea and gastroenteritis (infective)	C4 Gastro-oesophageal reflux	C7 Hernia
C2 Diarrhoea and gastroenteritis (non-infective)	C5 Dyspepsia	C8 Liver disease
C3 Vomiting (no diarrhea – non specific)	C6 Abdominal pain (non-specific)	C9 Other digestive system disease
Genito-urinary system – diagnostic codes: D		
D1 Urethritis (infective)	D4 Prostatitis	D7 Proteinuria
D2 Cystitis (infective)	D5 Nephritis (infective)	D8 Hematuria
D3 Testicular disease (infective)	D6 Other genitor-urinary infection	D9 Other genito-urinary disease
Circulatory system – diagnostic codes: E		
E1 Hypertension	E4 Pulmonary embolism	E7 Endocarditis
E2 Arrhythmia	E5 Pericarditis	E8 Peripheral vascular disease
E3 Ischaemic heart disease	E6 Myocarditis	E9 Other circulatory disease
Other infections and parasitic disease – diagnostic codes: F		
F1 Other viral infections	F3 Other fungal infections	F5 Other infections
F2 Other bacterial infections	F4 Other parasitic infections	
Haematology and immune system – diagnostic codes: G		
G1 Anaemia (iron deficiency)	G4 Bleeding disorder	G7 Other immune system disease
G2 Anaemia (other nutritional)	G5 Other hematological disease	
G3 Anaemia (other)	G6 Immune suppression	
Endocrine, nutritional and metabolic disease – diagnostic codes: H		
H1 Thyroid gland disorder	H3 Hypoglycemia	H5 Other metabolic disease
H2 Diabetes mellitus	H4 Other endocrine disease	
Mental and behavioural disorders – diagnostic codes: I		
I1 Depression	I3 Eating disorder	I5 Chronic fatigue
I2 Anxiety	I4 Sleep disorder	I6 Other mental or behavioral disorder
Nervous system disease – diagnostic codes: J		
J1 Headache	J2 Epilepsy	J3 Other nervous system/muscle disease
Skin and subcutaneous tissue – diagnostic codes: K		
K1 Viral skin infection	K4 Other skin infection	K7 Urticaria
K2 Bacterial skin infection	K5 Allergic dermatitis	K8 Sunburn
K3 Fungal skin infection	K6 Pruritis	K9 Other skin/subcutaneous diseases
Diseases of the eye and adnexa – diagnostic codes: L		
L1 Blepharitis (eyelid inflammation)	L3 Conjunctivitis (allergic)	L5 Other inflammatory eye disease
L2 Conjunctivitis (infective)	L4 Keratitis	L6 Other eye disease
Specific medical conditions related to sports participation – diagnostic codes: M		
M1 Hyperthermia (heat exhaustion)	M4 Collapse (post- exercise)	M7 Dehydration
M2 Hyperthermia (heat stroke)	M5 Collapse (during exercise)	M8 Other medical condition with exercise
M3 Hypothermia	M6 Muscle cramping (EAMC)	

Main symptom(s)/signs (codes 1 to 12)

1 fever	5 dyspnoea	9 palpitations	13 myalgia
2 pain	6 cough	10 fatigue (lethargy)	14 arthralgia
3 diarrhoea	7 sore throat	11 dizziness	15 pruritis (itchiness)
4 vomiting	8 chest pain	12 collapse	16 other

Cause of illness/symptom(s) (codes 1 to 6)

1 pre-existing (e.g. asthma, allergy)	3 exercise related (induced)	5 reaction to medication
2 infection	4 environmental	6 other

Appendix 7

TABLE A.2.: FIFA 2009 Confederation Cup tournament fixtures and respective player days

DAY	DATE	MATCH (TIME)	TEAMS	VENUE	MATCH (TIME)	TEAMS	VENUE	PLAYER DAYS
1	14th June	1 (16h00)	South Africa vs. Iraq	Johannesburg	2 (20h30)	New Zealand vs. Spain	Rustenburg	184
2	15th June	3 (16h00)	Brazil vs. Egypt	Mangaung	4 (20h30)	USA vs. Italy	Tshwane	184
3	16th June	REST DAY						184
4	17th June	5 (16h00)	Spain vs. Iraq	Mangaung	6 (20h30)	South Africa vs. New Zealand	Rustenburg	184
5	18th June	7 (16h00)	USA vs. Brazil	Tshwane	8 (20h30)	Egypt vs. Italy	Johannesburg	184
6	19th June	REST DAY						184
7	20th June	9 (20h30)	Iraq vs. New Zealand	Johannesburg	10 (20h30)	Spain vs. South Africa	Mangaung	184
8	21st June	11 (20h30)	Italy vs. Brazil	Tshwane	12 (20h30)	Egypt vs. USA	Rustenburg	138
9	22nd June	REST DAY						92
10	23rd June	REST DAY						92
11	24th June	13 (20h30)	Spain vs. USA	Mangaung				92
12	25th June	14 (20h30)	Brazil vs. South Africa	Johannesburg				92
13	26th June	REST DAY						92
14	27th June	REST DAY						92
15	28th June	15 (15h00)	Spain vs. South Africa	Rustenburg	16 (20h30)	USA vs. Brazil	Johannesburg	92

TOTAL PLAYER DAYS = 2070

Appendix 8

Table A.3.: Weather data reported by the South African Weather Service for the duration of the 2009 Confederations Cup at each of the tournament host cities

	Johannesburg	Mangaung	Rustenburg	Tshwane
Altitude	1695m	1353m	1695m	1308m
Highest temperature	20.7°C	20.9°C	25.5°C	23.7°C
Average maximum	16.5 ± 2.5°C	16.4 ± 4.1°C	21.3 ±2.4°C	19.9 ± 2.2°C
Lowest temperature	-0.7°C	-4.9°C	-1.2°C	0.4°C
Average minimum	6.2 ± 3.4°C	1.0 ± 4.4°C	7.3 ± 3.6°C	7.4 ± 3.5°C
Total rainfall	2.4mm	7.2mm	0.8mm	0.6mm
Average wind speed 08h00	4.2 ± 2.3m/s	1.1 ± 1.8m/s	1.0 ± 1.3m/s	0.4 ± 0.7m/s
Average wind speed 14h00	5.3 ± 2.3m/s	4.5 ± 2.0m/s	2.3 ± 1.0m/s	1.9 ± 0.6m/s
Average wind speed 20h00	2.9 .6m/s	1.8 ± 1.7m/s	1.3 ± 0.7m/s	0.1 ± 0.4m/s
Average humidity 08h00	71.5 ± 13.8%	90.9 ± 5.2%	73.1 ± 14.1%	73.8 ± 9.9%
Average humidity 14h00	33.9 ± 12.2%	45.1 ± 9.4%	32.2 ± 11.9%	32.8 ± 11.3%
Average humidity 20h00	50.3 ± 14.7%	74.1 ± 8.0%	58.9 ± 15.1%	55.9 ± 15.0%