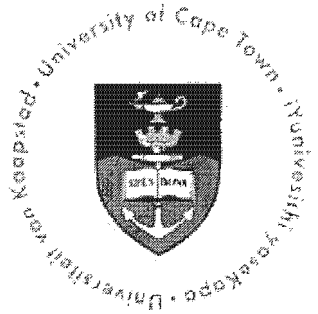


# RISK FACTORS ASSOCIATED WITH A PAST HISTORY OF EXERCISE ASSOCIATED MUSCLE CRAMPS (EAMC) IN IRONMAN TRIATHLETES - A CASE CONTROL STUDY



**A dissertation prepared by Gavin Sam Shang (SHNGAV003) in partial fulfillment of the requirements for the Master of Philosophy degree in Sports Medicine (MPhil Sports Medicine) from the University of Cape Town**

**November 2008**

# Declaration

I, Gavin Sam Shang, 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 at any other university.



(Signature)

Signed by candidate

08 November 2008

(Date)

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# List of Abbreviations

| | |
|---|---|
| ANOVA | Analysis of variance |
| BMI | Body mass index |
| cm | Centimetre |
| CON group | Control / No past history of EAMC group |
| CR group | Cramp group |
| °C | Degrees Celsius |
| EAMC | Exercise Associated Muscle Cramping |
| EAMC group | Self Reported Past History of EAMC group |
| EBM | Evidence-based medicine |
| EMG | Electromyography |
| hrs | Hours |
| hr/wk | Hours per week |
| kg | Kilogram |
| $kg/m^2$ | Kilograms per metres squared |
| km | Kilometre |
| km/hr | Kilometres per hour |
| km/wk | Kilometres per week |
| m/s | Metres per second |
| min | Minute |
| min/wk | Minutes per week |
| n | Number of subjects |
| NC group | Non cramp group |
| p | P value of significance |

| | |
|---|---|
| PB | Personal best |
| r | Correlation coefficient |
| SE | Standard error |
| sec | Seconds |
| sec/stretch | Seconds per stretch |
| WBGT | Wet bulb globe temperature |
| % | Percentage |

# Abstract

**Background:** Exercise Associated Muscle Cramping (EAMC) is a common medical condition with a high reported lifetime prevalence in endurance athletes [49]. EAMC can be defined as "painful, spasmodic, involuntary contraction of skeletal muscle that occurs during or immediately after exercise" [3]. Electrolyte depletion, dehydration and associated harsh environmental conditions have all traditionally been proposed as the main hypotheses in the development of EAMC. However, to date, the exact cause of EAMC and its associated risk factors have yet to be defined. These traditional hypotheses still dominate the current medical literature pertaining to EAMC, despite new emerging scientific data to the contrary [51]. The "altered neuromuscular control" hypothesis for the development of EAMC is a relatively novel concept which has gained increasing support over the last decade in the scientific literature. The basis of the hypothesis is that muscular fatigue during exercise may result in increased neuromuscular excitability which eventually leads to EAMC in localized muscles.

**Aims of the dissertation:** The main aims of this dissertation are 1) to review the existing medical literature on the possible intrinsic and extrinsic risk factors for EAMC, and 2) to investigate risk factors that are associated with a self reported past history of EAMC in Ironman triathletes. The focus of this research is to increase the understanding of possible causes of EAMC, so that prevention and treatment strategies can be optimized.

**Methods:** In the first section, the existing literature pertaining to the causes and risk factors for EAMC was reviewed. Using the PUBMED search engine and selected key words (exercise, muscle cramping, cramps, causes, risk factors) all the studies, which spanned from

1925 [16] up till 2008 [51], that have investigated the possible causes and risk factors for EAMC were identified.

Using an evidence-based approach, intrinsic and extrinsic risk factors for EAMC were discussed. In the second section, data from an original research study was presented. In this case-control study, triathletes participating in the 2006 and 2007 "Spec-Savers" Ironman Triathlons in Port Elizabeth, South Africa, were recruited as subjects. A detailed pre-race questionnaire was completed by 433 subjects who were then divided into two groups based on a self reported past history of EAMC; 216 subjects had a past history of EAMC (EAMC group) and 217 reported no past history of EAMC (CON group).

**Results:** The main novel findings of the research study were 1) that those triathletes with a self reported past history of EAMC were taller and heavier than the those in the control group, 2) triathletes with a self reported past history of EAMC had faster Ironman race times despite being of similar calibre (past personal best times), 3) triathletes with a self reported past history of EAMC predicted and achieved faster overall times during the 2006 and 2007 South African Ironman Triathlon, 4) most of the triathletes with a self reported past history of EAMC experienced the cramping during the final stages of an event, 4) there was an association between a positive family history for EAMC and self reported past history of EAMC, and 5) there was an association between past history of tendon and/or ligament injuries and self reported history of EAMC. Other findings were that EAMC was not confined to a certain component (swim, cycle or run) of the event but occurred during the swim and/or the cycle and/or the run components, EAMC was generally reported as mild in nature and was localized in the limbs that were involved in the exercise, and EAMC was most often and most effectively relieved by passive stretching techniques of the affected muscle groups.

**Conclusion:** The results of this study adds to the evidence that EAMC may be related to increased neuromuscular excitability resulting from muscle fatigue because of the association between a self reported past history of EAMC and exercise at a higher intensity during a race. Furthermore there was an increased likelihood of EAMC occurring in the latter stages of a race. There is also some evidence form this study that this association may be modified by inherited risk (positive family history) and a past history of tendon and/or ligament injury. However, further research is needed to determine a cause-effect relationship between these factors and the development of EAMC.

**Keywords:** Exercise Associated Muscle Cramping (EAMC), risk factors, muscular fatigue, altered neuromuscular control, Ironman triathlon.

# Chapter 1

## Introduction and Scope of the Dissertation

Exercise Associated Muscle Cramping (EAMC) is a common medical condition that has a high reported prevalence in endurance athletes [49]. EAMC can be defined as "painful, spasmodic, involuntary contraction of skeletal muscle that occurs during or immediately after exercise" [3]. The exact cause of, and risk factors for EAMC have yet to be defined.

More than a decade ago, a novel "muscle fatigue" hypothesis [3], proposed by Schwellnus et al. from the University of Cape Town's Exercise Science and Sports Medicine Research Unit, challenged the more traditional hypotheses for the development of EAMC. According to the traditional hypotheses, EAMC is caused by a combination of environmental extremes (usually heat, also referred to as "heat cramps") and dehydration and electrolyte disturbances, most notably with alterations in sodium homeostasis [1, 4, 5, 7, 13, 24, 32, 38-40].

In Chapter 2 of this dissertation, the aetiological mechanisms and risk factors (intrinsic and extrinsic) for EAMC will be critically reviewed using evidence-based criteria. In particular, evidence in support of the traditional hypotheses for EAMC as well as for the novel "muscle fatigue leading to altered neuromuscular control" hypothesis will be reviewed.

In Chapter 3, details of an original research study on Ironman Triathletes will be presented. The main aim of this study was to identify risk factors associated with a self reported past history of EAMC in triathletes who competed in the 2006 and 2007 "Spec-Savers" Ironman

Triathlons in Port Elizabeth, South Africa. The specific focus of this research study was to add to the body of evidence on the possible risk factors associated with EAMC in Ironman triathletes.

Finally, in Chapter 4, overall conclusions, practical recommendations and directions for future studies on EAMC will be presented.

# Chapter 2

# A review of the intrinsic and extrinsic risk factors for Exercise Associated Muscle Cramps (EAMC) in athletes

## 2.1. Introduction

Exercise associated muscle cramping (EAMC) is one of the most common medical conditions that can affect athletes of all sporting codes. Triathletes [5, 36, 40], marathon runners [7, 20, 32], rugby players [27], tennis players [4, 38] and American football players [1, 39] have all been reported to have suffered from EAMC. Despite the high prevalence of EAMC [49] in many sporting codes, the risk factors leading to the development of this condition remain poorly understood. This is mainly due to the conflicting hypotheses which still exist in the scientific literature regarding the development of EAMC. This conflict refers to the challenge of the novel "muscle fatigue" hypothesis [3, 51] querying the more traditional hypotheses of environmental extremes [1, 4, 38, 39], dehydration [4, 13, 24, 38] and electrolyte disturbances [5, 7, 32, 40] as the cause for the development of EAMC.

In this Chapter, the scientific evidence for the postulated intrinsic and extrinsic risk factors for the development EAMC in athletes will be reviewed using an evidence-based approach.

## 2.2. Definitions and terminology

Exercise Associated Muscle Cramps (EAMC) is a term that is now used frequently in the Sports Medicine literature [1, 4, 5, 7, 13, 20, 24, 27, 31, 32, 36, 38-40, 49]. EAMC has been used interchangeably with the terms "heat cramps" [4, 13, 24], "exertional heat cramps" [1, 41] and "cramps during sporting activity" [35] in the past. However, for the purposes of this review and this dissertation, EAMC will be defined as a "painful, spasmodic, involuntary contraction of skeletal muscle that occurs during or immediately after exercise", which is in accordance with the modern published literature [3, 22, 40, 41, 49]. EAMC therefore excludes 1) cramps that occur in smooth muscle, 2) cramping that occurs in skeletal muscle at rest and 3) muscle cramping that is associated with any underlying disease or use of drugs [3].

Over the years, many hypotheses have been proposed to attempt to explain the underlying factors involved with the development of EAMC. These include various traditional hypotheses such as electrolyte imbalances and metabolic abnormalities [5, 7, 32, 40], dehydration [4, 13, 24, 38] and exercise in extreme environmental conditions, mainly in hot and humid conditions [1, 4, 38, 39]. More than 10 years ago a novel hypothesis of muscle fatigue and concurrent, heightened neuromuscular activity as the primary factor underlying the development of EAMC was proposed [3], and this hypothesis has recently been refined [43, 49, 51].



## 2.3. Epidemiology of EAMC in athletes

Prevalence can be defined as the "overall proportion of a population who suffer from a disease" [26]. The lifetime prevalence of EAMC can be defined as the percentage of athletes who have suffered EAMC during some point in their athletic career. The lifetime prevalence

of EAMC in various sporting codes has been documented previously, with the highest prevalence being noted in triathletes [49].

**Table 2.1.: The lifetime prevalence of EAMC (%) for various sports [49].**

| Activity | Lifetime prevalence | Reference |
|---|---|---|
| **Rugby** | 52% | 27 |
| **Cycling** | 60% | 28 |
| **Marathon** (42.2km) | 39% | 10 |
| **Triathlon** | 67% – 68% | 6, 36 |

More recently, the high prevalence of EAMC in triathletes [6, 36] has again been confirmed [40] and this is the reason that the focus of this dissertation is on the development of EAMC in triathletes.



## 2.4. Brief historical perspective on EAMC

Muscle cramping during physical activity, has been anecdotally documented for many years. Some of the first papers published on this subject were case reports of labourers who worked in hot and humid conditions on steamships and in mines [24]. In these workers, cramping was attributed to dehydration and profuse sweating which was found concurrently with their symptoms in these extreme environmental conditions. Several case reports describing muscle cramping in similar environmental conditions were subsequently published [4, 13, 24], and thus the term "heat cramps" was first used to describe this condition.

These historical clinical descriptions of possible factors associated with EAMC led to several commonly held beliefs which became the cornerstones of the debate on the aetiology of EAMC. These "traditional" hypotheses for the cause of EAMC; could be termed the "dehydration hypothesis", the "electrolyte depletion hypothesis" and the "environmental" hypothesis.

However, it was only after a careful assessment of the evidence which formed the basis for these "traditional" hypotheses, that a novel hypothesis for the aetiology of EAMC was first proposed over 10 years ago [3]. This "altered neuromuscular control" hypothesis" has now gained increasing support from the scientific community as playing a central role in the development of EAMC. In this hypothesis, it is proposed that muscle fatigue and subsequent heightened neuromuscular activity result in sustained localized skeletal muscle contractions and eventual EAMC [3, 51]. The scientific evidence for the intrinsic and extrinsic risk factors that form the basis for the "traditional" hypotheses and this "novel" hypothesis for EAMC will now be reviewed.



### 2.5. Risk factors for EAMC in athletes

A number of intrinsic and extrinsic risk factors for the development of EAMC have been proposed [49]. These include intrinsic risk factors such as a personal and/or a familial past history of EAMC; exercise conducted at a higher intensity and/or a prolonged duration which would lead to muscle fatigue; dehydration and electrolyte disturbances; increased sweat sodium concentrations; older athletes; athletes with a long running history; athletes with a higher body mass index (BMI); shorter and/or irregular daily stretching times and habits; and extrinsic factors such as high environmental temperatures and humidity levels.

All of these potential risk factors associated with development of EAMC are listed at the end of this chapter in Table 2.2. [49]. The purpose of this Review Chapter is to apply a level of evidence rating system to the published data on risk factors for EAMC using a reliable classification from the American edition of The Journal of Bone and Joint Surgery, where studies are rated according to their methodological strengths and weaknesses [42]. The risk factors for the development of EAMC will be identified, examined and discussed according to this classification system: Level I (strong evidence) to Level IV (weak evidence or no evidence).

### 2.5.1. Extrinsic Risk Factors for EAMC

#### 2.5.1.1. Increased environmental temperature and humidity

As mentioned previously, "heat cramps" was first used as the term to describe skeletal muscle cramping occurring with physical labour in hot and humid environmental conditions [24]. There have been many published case reports and case series where extreme environmental conditions were listed as extrinsic risk factors in the development of EAMC [1, 4, 38, 39]. However, there is very little evidence from well conducted studies in support of extreme environmental conditions as a risk factor for EAMC. Evidence comes only from one study on exertional heat illness and environmental conditions on American football players [1]. In this prospective study it was observed that EAMC occurred more frequently at the beginning of the football season when the wet bulb globe temperatures (WBGT) index readings were in the high-risk to extreme-high-risk categories. As the temperatures cooled in the subsequent weeks, the incidence of EAMC decreased. This study is, however, limited as it doesn't

account for the high probability of poor fitness and poor football conditioning of the players in this pre-season training study. Players also would acclimatize to their surrounding conditions over the subsequent weeks; this together with improved fitness and conditioning would possibly be a better explanation of the decreased incidence of EAMC in their players as the weeks progressed despite the drop in surrounding temperatures and humidity.

Furthermore, EAMC has also been described in marathon runners in cool temperatures [25] and also in swimmers who have been exposed to extreme cold [2]. Studies have also shown that EAMC is not directly related to a rise in core temperature [7]; and that passive heating alone and at rest does not result in EAMC [3].

It therefore appears that extreme environmental temperatures may play a role in the development of EAMC and should be taken into account as one of the many possible risk factors of EAMC. However, there is no strong evidence that there is a direct causal relationship between EAMC and the environmental conditions. It can be argued that extreme environmental temperatures could possibly fatigue those participants faster than normal conditions would, thus leading to the development of EAMC in those individuals. Therefore, evidence for extreme environmental evidence as an extrinsic risk factor is limited to Level II evidence [49].

### 2.5.2. Intrinsic Risk Factors for EAMC

#### 2.5.2.1. Serum electrolyte disturbances (electrolyte depletion)

The "electrolyte depletion" hypothesis is currently the most popular hypothesis for the aetiology of EAMC [18, 19, 21, 29, 30]. Hypochloraemia, hyperkalaemia, hypomagnesaemia and hypocalaemia have all been proposed to play a role in this electrolyte disturbance [12, 13, 16, 17, 23, 24]; however, to date there is still not one study that has shown abnormal serum electrolyte concentrations or total body electrolyte depletion at the time of an acute episode of EAMC, when compared to non cramping athletes [51]. Despite the lack of any evidence, electrolyte depletion is still regarded as an important causal factor in the development of EAMC [18, 19, 21, 29, 30].

In contrast, there is now strong (Level I) evidence from four prospective cohort studies, from two different laboratories, that show no relationship between EAMC and altered serum electrolyte abnormalities in marathon runners or triathletes who suffer from EAMC [5, 7, 32, 40]. Two of these studies were recently conducted studies in the Ironman triathlon event [5, 40].

In all the studies, a similar study methodology was followed. Blood samples were taken from a cohort of triathletes before and after the race in athletes who cramped (CR group) and which had not cramped (NC group) during or immediately after the race. In some of these studies, blood samples were also taken during the recovery period after the race [11]. In a very consistent fashion, there were no significant differences between the groups in any of the serum electrolyte concentrations that were measured.

It should also be noted that, in general, patients with inherited metabolic abnormalities have a very low effort tolerance and that generalized cramping associated with the underlying disorder occurs infrequently [3, 35]. It has been documented that altered serum electrolyte concentrations as a result of disease or during renal dialysis can cause generalized skeletal muscle cramping at rest [22].

These findings conflict with the "electrolyte depletion" hypothesis as the EAMC experienced by athletes, who have high effort tolerance levels, occurs in localized muscle groups that have been repetitively used during their exercise, with no clinically significant changes in serum electrolyte concentrations at the onset, development or recovery stages of EAMC.

In summary, there is no strong scientific evidence to support the pathophysiological mechanisms proposed by the "electrolyte depletion" hypothesis. This hypothesis has been based on anecdotal reports originating from case series with a total of only eighteen cases and from one case control study which had ten subjects (weak Level IV evidence) [51]. In contrast, strong (Level I) evidence contesting this "electrolyte depletion" hypothesis now exists. This evidence is based on four large prospective cohort studies. Finally, proponents of the "electrolyte depletion" theory fail to link how the systemic nature of electrolyte depletion and generalized cramping is not consistent with the typical clinical presentation of localized cramping that is observed in EAMC.



#### 2.5.2.2. Excessive salt loss in sweat ("salty sweating") and EAMC

In recent years, it has been proposed that EAMC in athletes occurs as a result of excessive sodium chloride loss in the sweat during exercise ("salty sweaters") [4, 38, 39, 44]. The precise

mechanism by which "salty sweating" causes EAMC is not clear and has not been adequately explained by the proponents of this hypothesis [4, 44]. It has been suggested that the excess loss of sodium alters body fluid compartments, which then influences neural function [4].

The scientific evidence in support of this hypothesis comes from three studies. In these studies a combined total of twenty-three subjects were included: 1) a single case report of a single tennis player with EAMC [38], 2) a case series of seventeen tennis players with a past history of EAMC [4] and 3) a small observational study of ten American football players [39]. In all these studies there were no suitable control groups and the sample sizes were very small. Furthermore, sweat sodium concentrations were not measured at the time that athletes experienced EAMC [51] and other confounding variables were either not documented or taken into account. These variables included dietary sodium intake, acclimatization or level of conditioning of the athletes, the anatomical site variability of sweat collection, seasonal variability, different exercise durations, varying ages and genders of the athletes [51]. Furthermore, the reported sweat sodium concentrations in the "salty sweaters" group were in the normal to low ranges when compared to many reports of sweat sodium concentrations reported in the literature [4, 38, 39, 45-48].

In summary, the "salty sweater" hypothesis which is linked to the "electrolyte depletion" hypothesis for the development of EAMC is based on a small body of evidence collected from twenty-three subjects in three different case studies (weak Level IV evidence). Proponents of this hypothesis also fail to link how a systemic abnormality causes a local disruption in homeostasis [44].

### 2.5.2.3. Dehydration and EAMC

The "dehydration" hypothesis is another popular hypothesis for the development of EAMC and is still frequently linked to the "electrolyte depletion" hypothesis [41]. The origin of the dehydration hypothesis stems from observations in early case reports of labourers where skeletal muscle cramps were thought to be due to excessive sweating and associated dehydration [13, 24]. It was suggested in a case series in tennis players that profuse sweating in hot and humid conditions resulted in dehydration and EAMC [4, 38]. In another report, training in extreme heat and humidity with subsequent sweating and apparent dehydration was the suggested cause of EAMC in American football players [39]. However, these are all anecdotal accounts – in none of these studies was hydration status documented, no control groups were included; and measures were not done at the time of EAMC but rather on subjects with a past history of cramping. Evidence that dehydration causes EAMC is therefore very weak (Level IV evidence).

In contrast, four prospective cohort studies, two of which were in Ironman Triathletes [5, 40] and two of which were of marathon runners [7, 32], have since investigated this relationship of hydration status and EAMC. In these studies, actual pre- and post-race changes in body weight were measured in athletes suffering from EAMC at the time of cramping. In one study, pre- and post-race changes in blood and plasma volumes were also calculated [11]. In all four studies, measurements from cramping athletes and non-cramping athletes were compared. In a very consistent manner, the results of all these studies showed that there was no significant difference in hydration status of cramping athletes compared with non-cramping athletes. Therefore, there was no direct relationship between dehydration and EAMC (Level I evidence).

### 2.5.2.4. Muscle fatigue and altered neuromuscular control as a risk factor for EAMC

Muscle fatigue [3] and subsequent altered neuromuscular control [43, 49] has also been proposed as a risk factor for EAMC. The basis for this proposed mechanism has arisen from the "muscle fatigue" hypothesis which preceded it. This "muscle fatigue" hypothesis was based on evidence from epidemiological studies, animal experimental data on spinal reflex activity during fatigue [3] and electromyographic (EMG) data recorded during bouts of acute cramping after fatiguing exercise [22].

Muscle fatigue has been shown to disrupt the normal functioning of peripheral receptors of skeletal muscle [14, 15]. It has been shown that there is an increased firing rate of type Ia and type II muscle spindle afferents as well as a decreased firing of type Ib Golgi tendon organ afferents when muscle is fatigued [14, 15]. This increased excitatory effect on the muscle spindle and the decreased inhibition of the Golgi tendon organ would result in sustained alpha motor neuron activity from its control at a spinal level [3]. Clinically, this would present as fasciculations and increased EMG activity [40]. In one study in Ironman Triathletes, EMG activity in cramping and non-cramping muscle in the same athlete was measured [11]. The results of this study showed that there was increased EMG activity in the cramping muscle (post-exercise but not during an acute EAMC episode) when compared to non-cramping muscles in the same athlete.

The effectiveness of passive stretching as a treatment for EAMC, whereby tension in the muscle is increased and the Golgi tendon organ's inhibitory effect is heightened, further supports the theory that an abnormal spinal reflex is associated with EAMC [3, 8, 9, 14].

Cramping has also been induced in contracted muscle in a shortened position [8, 9]. Contracting a muscle in a shortened position would decrease the tension in the tendons during contraction and this would further decrease the reflex inhibitory effect of the Golgi tendon organ [3].

Athletes who experienced EAMC, consistently report that EAMC is preceded by a subjective feeling of muscle tiredness [10, 20, 27, 28]. Furthermore, many observational studies have reported that there is an increased incidence of EAMC in athletes that are not well conditioned, who exercise at a higher intensity and who exercise for a longer duration [31]. All these factors would contribute to the development of premature muscle fatigue during exercise.

In one study of American football players, an increased incidence of EAMC was reported at the beginning of the season and when players were exposed to twice-daily practice sessions [1]. The incidence of EAMC declined once the players' fitness levels had improved, the two-a-day practice sessions were stopped. In an observational study on tennis players who experienced EAMC, it was noted that the players seemed more prone to EAMC during the second matches of the day or when a match had been preceded by an intense practice session [4]. In two cross sectional descriptive studies on Ironman Triathletes [36, 40] it was also shown that most triathletes experienced cramping during the last quarter of the race when they were more likely to be fatigued.

There are also data from observational studies to suggest [26] that with the administration of a carbohydrate containing solution, the onset of EAMC can be delayed [31]. However, studies to measure the actual decline of glycogen stores in exercising skeletal muscle have yet to be conducted. This would require muscle biopsy procedures which will have to be performed on

the athletes participating in such a study. However, it is possible that with the administration of a carbohydrate supplement that the depletion in muscle glycogen stores; and thus fatigue, could have been delayed.

Further indirect evidence to support muscle fatigue and the subsequent altered neuromuscular control as a risk factor for EAMC, comes from studies that show that EAMC is more frequent in athletes who exercise at a higher intensity [20, 40]. In these two studies of marathon runners and triathletes respectively; the distances and times of the athletes during their training periods and their races were recorded. EAMC was noted in those athletes that covered the distances in a shorter time. Thus, this confirmed previously demonstrated laboratory findings [26]; that athletes exercising at a higher intensity exercise had a higher occurrence of EAMC in fatigued, localized muscle groups [20, 31, 40].

EAMC occurring in the presence of high intense, prolonged activity which allows fatigue to induce alter neuromuscular activity in those localized muscles, forms the basis for this hypothesis. Level I [40] and Level III [20] scientific evidence exists that supports increased exercise intensity in this mechanism for the development of EAMC [40]. Level III [20, 27, 36] and Level IV evidence also exists in support of increased exercise duration and muscle fatiguing exercise in the aetiology of EAMC.



#### 2.5.2.5. Other intrinsic risk factors for EAMC

There are a number of other suggested intrinsic risk factors for EAMC but these still require further investigation. These risk factors include irregular stretching habits, shorter daily stretching times, a higher body mass index (BMI), older age group, longer personal running

history and a reported family history of EAMC [20]. However, these risk factors are based on anecdotal clinical observations rather than data from well conducted epidemiological studies and therefore require further investigation.

In one recent study of Ironman Triathletes there was no association between an increased BMI and the incidence of EAMC [40]. However, in the same study a previous history of EAMC was strongly associated with an increased susceptibility to EAMC [40]. Therefore, the possibility of a genetic component as a risk factor for EAMC has to be investigated in future studies.



### 2.6. Summary and conclusions

The scientific evidence based literature for risk factors underlying the epidemiology for the development of EAMC have been summarized in Table 2.2.

**Table 2.2.: Intrinsic and Extrinsic Risk Factors for EAMC in Athletes – level of evidence according to evidence-based medicine (EBM) criteria [49].**

| Intrinsic Risk Factors | | |
|---|---|---|
| | **Study Details and Reference/s** | **Level of Evidence (I – IV)** |
| **Past history of EAMC** | **Positive association:** | |
| | Prospective cohort study – triathletes [40] | I |
| **Increased Exercise Intensity (race pace or subjective assessment)** | **Positive association:** | |
| | Prospective cohort study – triathletes [40] | I |
| | Cross sectional study – marathon runners [20] | III |

| | Study Details and Reference/s | Level of Evidence (I – IV) |
|---|---|---|
| **Muscle Fatiguing Exercise** | **Positive association:** | |
| | Cross sectional study – marathon runners [20] | III |
| | Case series – laboratory study in human subjects | IV |
| **Increased Exercise Duration (time, last quarter of an event)** | **Positive association:** | |
| | Cross sectional studies – marathon runners [20], rugby players [27], triathletes [36] | III |
| **Dehydration** | **Positive association:** | |
| | Case series – laborers [13, 24], tennis players [4, 38] | IV |
| | **No association:** | |
| | Case series – American football players [39] | |
| | Prospective cohort studies – marathon runners, triathletes [5, 7, 32, 40] | I<br>I |
| **Serum Electrolyte Disturbances (sodium, chloride, magnesium, calcium)** | **Positive association:** | |
| | Case series – laborers | IV |
| | **No association:** | |
| | Prospective cohort studies – marathon runners, triathletes [5, 7, 32, 40] | I |
| **Increased Sweat Sodium Concentration** | **Positive association:** | |
| | Case series – tennis players [4, 38], American football players [39] | IV |

| | Study Details and Reference/s | Level of Evidence (I – IV) |
|---|---|---|
| **Increased Age** | **Positive association:** | |
| | Cross sectional study – marathon runners [20] | III |
| **Longer History of Running** | **Positive association:** | |
| | Cross sectional study – marathon runners [20] | III |
| **Higher Body Mass Index (BMI)** | **Positive association:** | |
| | Cross sectional study – marathon runners [20] | III |
| | **No association:** | |
| | Prospective cohort studies – triathletes [40] | I |
| **Shorter Daily Stretching Time** | **Positive association:** | |
| | Cross sectional study – marathon runners [20] | III |
| **Irregular Stretching Habits** | **Positive association:** | |
| | Cross sectional study – marathon runners [20] | III |
| **Positive Family History of Cramping** | **Positive association:** | |
| | Cross sectional study – marathon runners [20] | III |

**Extrinsic Risk Factors**

| | Study Details and Reference/s | Level of Evidence (I – IV) |
|---|---|---|
| **High environmental temperatures and humidity** | **Positive association:** | |
| | Retrospective cohort study – American football [1] | II |
| | Case series – tennis players [4, 38] | IV |
| | Case-control - American football players [39] | III |
| | Anecdotal observations – marathon races, triathlon events | IV |

There is strong (Level I) evidence that the following are associated with EAMC: a past history EAMC [40] and increased exercise intensity (relative race pace) [40]. There is also strong (Level I) evidence that the following are not associated with EAMC: dehydration [5, 7, 32, 39, 40], increased BMI [40] and serum electrolyte abnormalities [5, 7, 32, 40].

There is limited (Level II and III) evidence that the following are positively associated with EAMC: muscle fatiguing exercise [20], prolonged exercise [20,27, 36], increased age [20], a longer history of running [20], shorter stretching times [20],irregular stretching habits [20], increased environmental temperature and humidity [1, 39].

It is also evident from this review that further research is required to investigate the possible risk factors associated with EAMC.

# Chapter 3

# Factors associated with a self reported past history of Exercise Associated Muscle Cramps (EAMC) in Ironman triathletes: A case-control study

## 3.1. Introduction

The Ironman Triathlon consists of a 3.8km open water swim, a 180km road cycle and a 42.2km run. Ultra-endurance events of this nature present a substantial physiological and mental challenge for the competitors. It is therefore not surprising that medical conditions commonly occur as a result of training and competition in the Ironman Triathlon [37]. One of the most common medical conditions that Ironman triathletes suffer from, are Exercise Associated Muscle Cramps (EAMC) [5, 36, 37, 40].

Exercise Associated Muscle Cramping (EAMC) can be defined as "painful, spasmodic, involuntary contraction of skeletal muscle that occurs during or immediately after exercise" [3]. Clinically EAMC presents as painful, spasmodic muscle cramps; localized to exercising muscle groups [49].

The precise intrinsic and extrinsic risk factors associated with EAMC has been the topic of much scientific debate over the years and this was reviewed in Chapter 2. The traditional risk factors for the development of EAMC are a combination of extreme environmental heat and

humidity, dehydration and electrolyte disturbances, in particular sodium depletion. It is still commonly assumed that dehydration, and sodium depletion are the main aetiological factors in the development of EAMC [41, 44, 50] despite the fact that evidence for these risk factors is weak (Chapter 2).

The "altered neuromuscular control" hypothesis has been proposed as an alternative hypothesis for the development of EAMC [3, 43, 49, 51]. This hypothesis is been based on evidence from clinical observations and experimental studies (animal and human) which suggest that the development of muscular fatigue leads to abnormally increased neuromuscular excitability in the fatigued skeletal muscle. This hypothesis, and the supporting evidence for it, has recently been reviewed [22, 43, 49, 51] and has been summarized in Chapter 2.

It is clear from the review presented in Chapter 2 that further research is required to determine the risk factors for EAMC in endurance athletes. The Ironman Triathlon is an ideal field setting to further this research effort because EAMC is particularly common in this event and therefore many triathletes have a past history of EAMC. Descriptive studies undertaken in this group of triathletes could therefore lead to a further understanding of the possible risk factors associated with EAMC in endurance athletes. To our knowledge, a large descriptive study of this nature in this group of triathletes has not been undertaken.

Thus, the aim of this study was to investigate risk factors associated with a self reported past history of Exercise Associated Muscle Cramping (EAMC) in triathletes participating in the 2006 and 2007 "Spec-Savers" South African Ironman Triathlon.

## 3.2. Methods

### 3.2.1. Type of Study

This is a case-control study of Ironman triathletes.

### 3.2.2. Subjects

All the triathletes who entered the 2006 and 2007 "Spec-Savers" Ironman Triathlons in Port Elizabeth, South Africa (3.8km swim, 180km cycle and a 42.2km run), which was held in March of 2006 and in April of 2007, were considered as potential subjects for this study. There were 1136 (85% male and 15% female) and 1566 (75% male and 25% female) entrants in the 2006 and 2007 events respectively.

Two months prior to each event, information regarding the study was posted on the official race website. This information included details of the studies and the study procedures (Appendix 1 and 2), the informed consent form (Appendix 3 and 4) as well as copies of the questionnaires (Appendix 5 and 6) that could be completed before registration. A service was also provided for the triathletes to ask questions about the research that was to be conducted either by telephone or by email.

Prior to the study, the protocols were approved by the Research and Ethics Committee of the Faculty of Health Sciences at the University of Cape Town (REC ref no 425/2005 and 002/2007) (Appendix 6 and 7), as well as the general organizing committees and the medical

sub-committees of the 2006 and 2007 "Spec-Savers" Port Elizabeth South African Ironman Triathlons.

Recruitment of subjects for the study began three days prior to the race day at the registration area of the Ironman event. A research area was established in close proximity to the registration desks. As triathletes reported for registration, they were informed about the nature and purpose of the study. Triathletes were then able to decide to volunteer or to decline participation in the study. Willing subjects then reported to the research staff on hand, where further information was given and any additional questions were answered. Once they had given their informed, written consent to be part of the study, they then proceeded with the completion of the pre-race questionnaire.

Subjects were encouraged to complete the pre-race questionnaire whilst remaining in the research area and the majority did comply with this request. Alternatively, the triathletes were allowed to complete the pre-race questionnaire at their own leisure and return it completed prior to race day. Less than 10% of the pre-race questionnaires were completed and returned by the latter method.

Four-hundred and seventy pre-race questionnaires were completed in either the 2006 or 2007 event. Twenty-nine triathletes completed both the 2006 and 2007 questionnaires of which three were excluded from the analysis because they reported that they hadn't ever experience EAMC in the 2007 questionnaire, but reported a previous history of EAMC in the 2006 questionnaire.

Data from the 2006 questionnaires was used in this study for those triathletes who completed the questionnaire in both years. The pre-race questionnaire was completed by 438 different triathletes (276 from 2006 and 162 from 2007). However five triathletes did not answer the specific question related to EAMC: "Have you ever in your triathlon career suffered from muscle cramping during or immediately after exercise" and were therefore also excluded from this study. Thus, 433 subjects were finally included in this study; 216 with a past history of EAMC and 217 with no past history of EAMC.

### 3.2.3. Pre-Race Questionnaire

For the purpose of this study, a previously validated pre-race questionnaire was modified and used [5, 33, 34]. This pre-race questionnaire consisted of various sections and included details for each of the triathlete's personal particulars, family history and personal medical history, training and racing histories (Appendix 5 and 6).

The information gathered from this pre-race questionnaire was used in a number of studies that were conducted at this event. For this particular study, information from the following sections in both questionnaires was used: (1) demographic details (including age, height, weight and gender); (2) previous participation history in distance running (10km, 21.1km and 42.2km) and triathlon events (including personal best times); (3) training details in the last 15 weeks before the actual event (training distances and hours spent training); (4) frequency of flexibility training and stretching exercises; (5) family history of EAMC as well as nocturnal cramping; (6) personal general medical history, including a past history of EAMC.

## 3.3. Results

### 3.3.1. Subject and cramping characteristics

The general characteristics and occupational history of the 216 triathletes with a self reported past history of exercise associated muscle cramping (EAMC group) and the 217 triathletes with no past history of EAMC (CON group) are depicted in Table 3.1. There were no significant differences in age, BMI or any of the occupational variables that were taken into account. There were however, significantly more males (p=0.011) in the EAMC group. The triathletes in the EAMC group were also significantly taller (p<0.001) and heavier (p=0.003) than the CON group. This significant difference in height remained even when co-varied for gender (p=0.007).



**Table 3.1.: The general characteristics and occupational history of the triathletes with a self reported past history of exercise associated muscle cramps (EAMC) and those with no history of EAMC (CON).**

| | EAMC Group (n=216) | CON Group (n=217) | p value | Co-Varied p value [c] |
|---|---|---|---|---|
| **Age** (years) | 38.8 ± 9.4 (197) | 38.3 ± 7.9 (200) | 0.604 | n.d. |
| **Height** (cm) [a] | 179.6 ± 7.4 (200) | 176.5 ± 8.6 (193) | <0.001 | 0.007 |
| **Weight** (kg) [a] | 76.7 ± 10.1 (207) | 73.4 ± 12.0 (209) | 0.003 | 0.123 |
| **BMI** ($kg/m^2$) [b] | 23.8 ± 2.3 (198) | 23.6 ± 2.9 (191) | 0.493 | 0.840 |
| **Gender** (% males) | 88.3 (213) | 78.7 (211) | 0.011 | n.d. |

| | EAMC Group (n=216) | CON Group (n=217) | p value | Co-Varied p value [c] |
|---|---|---|---|---|
| **Occupation Time Sitting** (%) | 54.2 ± 28.4 (212) | 52.4 ± 30.7 (211) | 0.535 | n.d. |
| **Occupation Time Standing** (%) | 22.8 ± 21.2 (211) | 20.1 ± 18.9 (210) | 0.171 | n.d. |
| **Occupation Time Walking** (%) | 19.1 ± 18.7 (212) | 20.9 ± 20.0 (210) | 0.343 | n.d. |
| **Manual Labour** (%) | 8.1 ± 16.3 (211) | 9.9 ± 19.0 (210) | 0.303 | n.d. |

Gender and occupation are expressed as a frequency (%).
Other values are expressed as average ± standard deviation.
The number of subjects (n) is in parentheses.
[a] Weight and height are the athletes' self reported normal values.
[b] Body mass index (BMI) is calculated as weight (kg) divided by height (cm) squared.
[c] Co-varied for gender.
n.d., not determined.

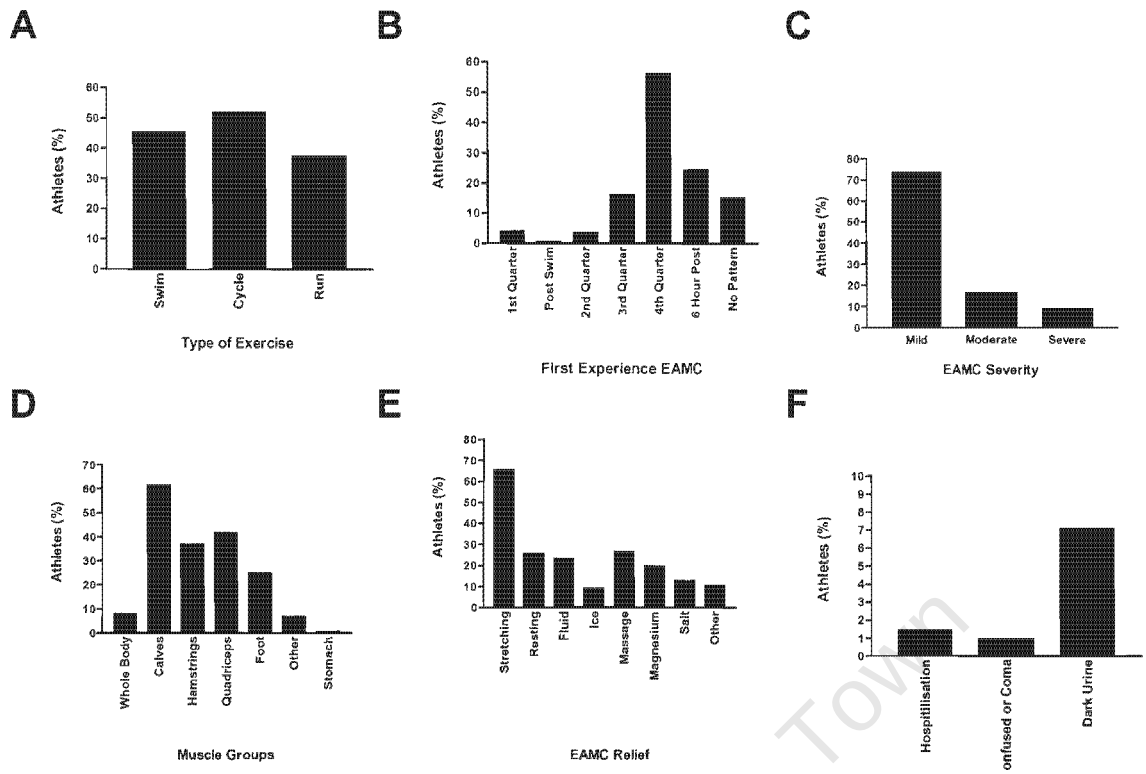


**Figure 3.1.: General characteristics of the reported cramping experienced by the triathletes during or within 6 hours after the Ironman Triathlon.**

**(A)** The relative number of triathletes in the exercise associated muscle (EAMC) group who reported experiencing muscle cramps while swimming, cycling, and/or running. **(B)** The relative number of triathletes who reported experiencing their first muscle cramps during which portion of the triathlon. **(C)** The relative number of triathletes who reported experiencing mild (less than 5 minutes and the triathlete was able to continue exercising), moderate (5-15 minutes and the triathlete was able to continue exercising) or severe (greater than 15 minutes or if the triathlete had to STOP exercising) muscle cramps during or immediately after the triathlon. **(D)** The relative number of triathletes who reported experiencing whole body or specific muscle group cramps. **(E)** The relative number of triathletes who reported using the specific treatment to relieve the cramping. **(F)** Associated symptoms, signs and medical care.



The triathletes reported an average past history of EAMC lasting 7.3 ± 8.6 years (n=145). 76% (155 of 202) of the triathletes reported experiencing EAMC during or immediately after exercise during the 12 months prior to the triathlon. Cramping was associated with swimming, cycling and running in 92 (45.5%), 106 (52.4%) and 116 (57.4%) of the triathletes, respectively (Figure 3.1A). The majority of triathletes usually first reported experiencing EAMC within the last quarter (n=108, 56.0%) or immediately after (n=50,

25.9%) a race or training session (Figure 3.1B). The majority of the triathletes (n=144, 73.8%) reported experiencing only mild (less than 5 minutes and the triathlete was able to continue exercising) muscle cramps, while only (n=38, 19.5%) and (n=18, 9.2%) reported expediency moderate (5-15 minutes and the triathlete was able to continue exercising) or severe (greater than 15 minutes or if the triathlete had to stop exercising) muscle cramps, respectively (Figure 3.1C). The average duration of these cramps was 4.5 ± 8.4 min (n=181) and ranged from 0.1 to 60.0 mins.

The muscle groups that the triathletes usually experienced cramps in, are summarised in Figure 3.1D, while the treatments used by the triathletes to relieve the cramping are summarized in Figure 3.1E. Interestingly, the majority (n=142, 65.7%) of the triathletes reported stretching the muscle to relieve the cramping. A variety of other treatments were also used by the triathletes. The associated symptoms, signs and medical attention required by triathletes who experienced cramping are depicted in Figure 3.1F. Five (2.3%) of the athletes have sought medical attention or have been confused or comatose as a result of experiencing muscle cramps. Fourteen (6.5%) of triathletes a history of EAMC reported that they have had dark urine.

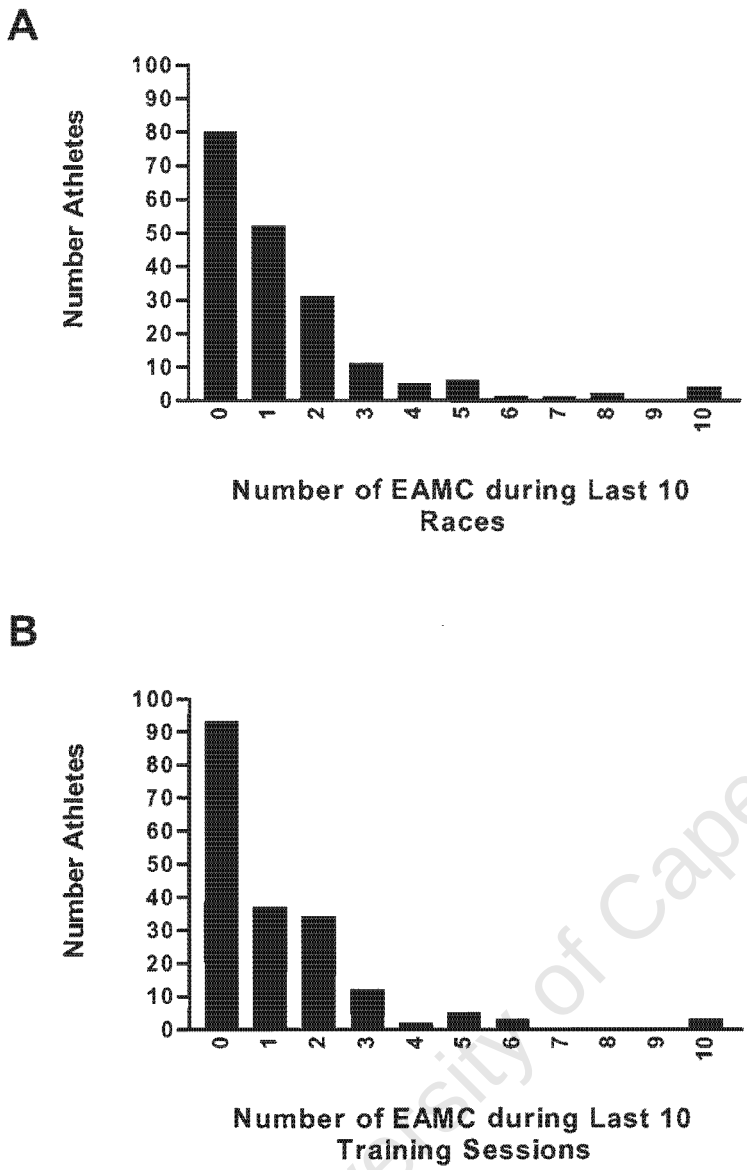




**Figure 3.2.:** The number of triathletes and the number of times that they have experienced EAMC during their last ten races **(A)** and last ten training sessions **(B)** respectively.

The number of triathletes and the number of times that they have experienced EAMC in their last 10 races and last 10 training sessions is depicted in Figure 3.2. The majority of triathletes (n=163, 84.5%) reported experiencing cramping during 3 or less of their last 10 races and (n=164, 86.8%) reported experiencing cramping during 3 or less of their last 10 training sessions.

### 3.3.2. Performance and training history

The career and more recent personal best times for previous triathlons (standard and Ironman) and previous running distances (10km, 21.1km and 42.2km) of the EAMC and CON groups are depicted in Table 3.2. The average career (adjusted p=0.011), but not the previous 12 month (adjusted p=0.139), Ironman personal best times were significantly faster in the EAMC group than in the CON group. There were no significant differences in personal best times of the standard triathlon or any of the road running events between the two groups, indicating that both groups were similarly matched for previous performances. There were also no significant differences in the both the duration, distance and speed of the cycling races the triathletes in the EAMC and CON groups predicated in during the 15 weeks prior to the 2007 Triathlon.

**Table 3.2.:** Triathlon (standard and Ironman) and running (10km, 21.1km and 42.2km) career personal best times (PB) and best times achieved over the last 12 months or 15 weeks before the race of the triathletes with a self reported past history of exercise associated muscle cramps (EAMC) and those with no history of EAMC (CON).

| | | EAMC Group (n=216) | CON Group (n=217) | p value | Co-varied p value [a] |
|---|---|---|---|---|---|
| **Triathlon Career PB** | **Standard** (min) | 150 ± 37 (131) | 157 ± 52 (108) | 0.192 | 0.506 |
| | **Ironman** (min) | 730 ± 91 (109) | 764 ± 98 (79) | 0.015 | 0.011 |
| **Triathlon 12 Months PB** | **Standard** (min) | 156 ± 48 (96) | 169 ± 62 (94) | 0.122 | 0.260 |
| | **Ironman** (min) | 748 ± 98 (80) | 771 ± 92 (61) | 0.153 | 0.139 |
| **Running Career PB** | **10km** (min) | 42 ± 7 (163) | 43 ± 7 (165) | 0.495 | 1.000 |
| | **21.1km** (min) | 96 ± 15 (174) | 98 ± 19 (169) | 0.153 | 0.500 |
| | **42.2km** (min) | 213 ± 35 (148) | 213 ± 32 (148) | 0.957 | 0.426 |
| **Running 15 Weeks PB** | **10km** (min) | 48 ± 10 (72) | 46 ± 7 (84) | 0.344 | 0.164 |
| | **21.1km** (min) | 106 ± 16 (95) | 109 ± 20 (92) | 0.229 | 0.536 |
| | **42.2km** (min) | 231 ± 48 (58) | 233 ± 32 (49) | 0.811 | 0.837 |
| **Cycling 15 Weeks PB** [b] | **Duration** (min) | 209 ± 52 (47) | 202 ± 45 (50) | 0.485 | 0.346 |
| | **Distance** (km) | 106 ± 16 (47) | 102 ± 21 (50) | 0.233 | 0.259 |
| | **Speed** (km/hr) | 31.4 ± 4.7 (47) | 30.7 ± 3.5 (50) | 0.409 | 0.714 |

Values are expressed as average ± standard deviation, with the number of subjects (n) in parentheses.
[a] Co-varied for gender.
[b] Data from the only the 2007 Questionnaires.
PB, personal best time.

The total training frequency, distances and durations for each individual and all of the disciplines within the triathlon, for the 1 week and 15 week period before the race are summarized in Table 3.3. There were no significant differences in the training frequency, as well as the, swim, cycle, run or total distances and times spent training during the 15 weeks or 1 week prior to the Ironman events between the EAMC or CON groups. Although not significant (adjusted p=0.128), the triathletes in the EAMC group cycled on average 1km/h faster (27.8 ± 5.7km/h, n=178) during the 15 week training period prior to the Ironman Triathlons compared to the control group (26.8 ± 5.9km/h, n=178).

Interestingly, although only asked in the 2007 questionnaire, the triathletes in the EAMC group reported significantly more fast or hard cycling and running training sessions during the 8 week period prior to the event than those in the CON group (Table 3.3).



**Table 3.3.:** The swimming, cycling, running and/or total training frequency, distances and durations for the 1 and 15 week period before the triathlon of the triathletes with a self reported past history of exercise associated muscle cramps (EAMC) and those with no history of EAMC (CON).

| | | EAMC Group (n=216) | CON Group (n=217) | p value | Co-varied p value [a] |
|---|---|---|---|---|---|
| **Training Frequency** (days/wk) | | 5.7 ± 0.9 (199) | 5.7 ± 0.9 (196) | 0.503 | 0.372 |
| **15 week Training Time** | **Swim** (hrs/wk) | 3.2 ± 1.9 (202) | 3.1 ± 1.5 (201) | 0.742 | 0.550 |
| | **Cycle** (hrs/wk) | 9.1 ± 13.5 (188) | 8.2 ± 2.9 (183) | 0.379 | 0.367 |
| | **Run** (hrs/wk) | 5.0 ± 4.2 (195) | 4.6 ± 1.7 (191) | 0.198 | 0.126 |
| | **Total** (hrs/wk) [b] | 17 ± 18 (182) | 16 ± 5 (175) | 0.309 | 0.263 |

| | | EAMC Group (n=216) | CON Group (n=217) | p value | Co-varied p value [a] |
|---|---|---|---|---|---|
| **15 week Training Distance** | **Swim** (km/wk) | 8.5 ± 22.8 (201) | 6.4 ± 3.1 (206) | 0.207 | 0.205 |
| | **Cycle** (km/wk) | 229 ± 134 (186) | 217 ± 82 (184) | 0.307 | 0.274 |
| | **Run** (km/wk) | 47 ± 22 (197) | 47 ± 19 (202) | 0.832 | 0.930 |
| | **Total** (km/wk) [b] | 236 ± 80 (170) | 229 ± 82 (168) | 0.428 | 0.538 |
| **1 week Training Time** | **Swim** (hrs) | 1.3 ± 1.7 (205) | 1.3 ± 1.3 (199) | 0.619 | 0.570 |
| | **Cycle** (hrs) | 2.8 ± 3.4 (199) | 2.5 ± 2.3 (193) | 0.305 | 0.486 |
| | **Run** (hrs) | 1.5 ± 2.6 (199) | 1.3 ± 1.1 (197) | 0.445 | 0.908 |
| | **Total** (hrs) [b] | 5.6 ± 6.4 (192) | 5.1 ± 3.7 (186) | 0.390 | 0.582 |
| **1 week Training Distance** | **Swim** (km) | 2.7 ± 2.1 (200) | 2.4 ± 2.1 (204) | 0.155 | 0.117 |
| | **Cycle** (km) | 66 ± 55 (200) | 63 ± 56 (195) | 0.509 | 0.424 |
| | **Run** (km) | 14 ± 11 (191) | 13 ± 12 (194) | 0.686 | 0.450 |
| | **Total** (km) [b] | 84 ± 64 (188) | 77 ± 61 (186) | 0.288 | 0.170 |
| **8 week Number of Fast or Hard Training Sessions** [c] | **Swim** | 3.2 ± 4.2 (64) | 2.0 ± 2.6 (72) | 0.056 | 0.067 |
| | **Cycle** | 4.1 ± 4.4 (66) | 2.1 ± 2.4 (73) | 0.001 | 0.002 |
| | **Run** | 3.4 ± 3.7 (65) | 1.9 ± 2.6 (74) | 0.008 | 0.010 |

Values are expressed as average ± standard deviation, with the number of subjects (n) in parentheses.
[a] Co-varied for gender.
[b] The totals are the sum of the swim, cycle and run disciplines.
[c] Data from the only the 2007 Questionnaires.
n.d., not determined.

### 3.3.3. Ironman Triathlon performance

The self reported pre-race predicted, actual and relative performance times of the triathletes for the Ironman Triathlon are depicted in Table 3.4. The predicted overall time for the EAMC group (p=0.032, adjusted p=0.090), as well as the predicted times for the swimming (p=0.015, adjusted p=0.019) and cycling (p=0.008, adjusted p=0.036) legs of the Ironman were significantly faster when compared to the CON group's predicted times. The subjects in the EAMC group also achieved faster overall times (p=0.008, adjusted p=0.018) for the actual race than the CON group. The EAMC group also achieved faster times for the swimming leg (p=0.016, adjusted p=0.034) and for the cycling leg (p=0.001, adjusted p=0.004) during the actual race. There was no significant difference noted for the running section of the Ironman for predicted (p=0.110) or actual (p=0.322) times achieved by the triathletes.

Although the triathletes in the EAMC group (27.7 ± 2.9km/h, n=202) cycled significantly faster than those in the CON group (26.7 ± 2.5km/h, n=205, p<0.001, p value adjusted for gender = 0.002), there were no significant differences between the EAMC (102.5 ± 22.4%, n=167) and CON (106.1 ± 42.9%, n=168) groups when the actual Ironman Triathlon cycle speed was expressed relative to the training cycling speed during the 15 weeks prior to the events (p=0.344, p value adjusted for gender = 0.324). Similarly, there were also no significant differences between the EAMC (113.8 ± 14.5%, n=46) and CON (113.7 ± 10.4%, n=46) groups when the actual 2007 Ironman Triathlon cycle speed was expressed relative to 15 weeks prior to the event cycling personal best speed (p=0.998).

**Table 3.4.:** The predicted, as reported in the pre-race questionnaire, and actual performance times of the triathletes with a self reported past history of exercise associated muscle cramps (EAMC) and those with no history of EAMC (CON).

| | | EAMC Group (n=216) | CON Group (n=217) | p value | Co-varied p value [a] |
|---|---|---|---|---|---|
| **Predicted Times** | **Overall** (min) | 753 ± 105 (205) | 775 ± 100 (200) | 0.032 | 0.090 |
| | **Swim** (min) | 84 ± 19 (211) | 89 ± 29 (207) | 0.015 | 0.019 |
| | **Cycle** (min) | 384 ± 49 (211) | 396 ± 47 (206) | 0.008 | 0.036 |
| | **Run** (min) | 276 ± 49 (210) | 284 ± 52 (205) | 0.110 | 0.171 |
| **Actual Times** | **Overall** (min) | 777 ± 97 (203) | 802 ± 91 (205) | 0.008 | 0.018 |
| | **Swim** (min) | 89 ± 17 (205) | 92 ± 15 (206) | 0.016 | 0.034 |
| | **Cycle** (min) | 395 ± 41 (202) | 408 ± 39 (205) | 0.001 | 0.004 |
| | **Run** (min) | 289 ± 51 (202) | 294 ± 50 (204) | 0.322 | 0.349 |
| **% Predicted Times** | **Overall** (%) [b] | 104.5 ± 7.7 (195) | 104.9 ± 11.3 (188) | 0.686 | n.d. |
| | **Swim** (%) [b] | 109.4 ± 13.2 (201) | 107.5 ± 16.8 (197) | 0.213 | n.d. |
| | **Cycle** (%) [b] | 104.2 ± 7.9 (198) | 104.2 ± 10.4 (195) | 0.991 | n.d. |
| | **Run** (%) [b] | 106.3 ± 13.4 (197) | 104.9 ± 15.0 (193) | 0.347 | n.d. |

Values are expressed as average ± standard deviation, with the number of subjects (n) in parentheses.
[a] Co-varied for gender.
[b] Actual times expresses relative to the predicted split and overall times.
n.d., not determined.

### 3.3.4. Family history of EAMC, family history of nocturnal cramping and other past medical history

Significantly more triathletes in the EAMC reported a family history of EAMC when compared to those in the CON group (odds ratio 3.0, 95% confidence interval 1.9 to 4.7, $p<0.001$) (Table 3.5). Interestingly, 68.9% (n=62) and 69.5% (n=32) of the triathletes in the EAMC and CON groups, respectively, reported that a male (father and/or brother) biological relatives have experienced muscle cramps during exercise. There was however no significant difference in the self-reported family history of nocturnal cramps between the two groups ($p=0.064$) (Table 3.5). With respect to nocturnal cramps 56.4% (n=31) and 63.1% (n=24) of the triathletes in the EAMC and CON groups, respectively, reported that a female (grandmother, mother and/or sister) biological relatives have experienced nocturnal cramps.



**Table 3.5.:** The family history of Exercise Associated Muscle Cramping (EAMC) and family history of nocturnal cramping of the triathletes with a self reported past history of exercise associated muscle cramps (EAMC) and those with no history of EAMC (CON).

| | **EAMC Group** (n=216) | **CON Group** (n=217) | **p value** |
|---|---|---|---|
| **Family history of EAMC** (% yes) | 36.6 (202) | 16.4 (208) | < 0.001 |
| **Family history of nocturnal cramping** (% yes) | 23.3 (202) | 15.5 (206) | 0.064 |

Values are expressed as frequencies, with the number of subjects (n) in parentheses.

Other medical risk factors for the development of EAMC are depicted in Table 3.6. Significantly more triathletes in the EAMC reported a history of tendon and/or ligament injuries (odds ratio 2.4, 95% confidence interval 1.6 to 3.5, p<0.001) and sunburn (odds ratio 2.0, 95% confidence interval 1.3 to 2.9, p=0.001) than those in the CON group (Table 3.6). There was also a trend (p=0.067) of allergies being more common in the EAMC group than the CON group.

**Table 3.6.:** Other past medical history in the triathletes with a self reported past history of EAMC and those with no history of EAMC (CON).

| | **EAMC Group** (n=216) | **CON Group** (n=217) | **p value** |
|---|---|---|---|
| **Flu symptoms** (% yes) | 49.1 (214) | 49.3 (217) | 0.963 |
| **Tendon ligament injury** (% yes) | 48.8 (215) | 28.7 (216) | <0.001 |
| **Medication** (% yes) | 34.3 (216) | 27.2 (217) | 0.136 |
| **GIT symptoms** (% yes) | 48.6 (216) | 36.9 (217) | 0.176 |
| **Nervous system** (% yes) | 16.7 (216) | 19.4 (216) | 0.532 |
| **Genital injury** (% yes) | 28.2 (216) | 21.7 (217) | 0.141 |
| **Allergies** (% yes) | 38.3 (214) | 29.5 (217) | 0.067 |
| **Asthma** (% yes) | 9.3 (216) | 7.8 (217) | 0.720 |
| **Collapsed** (% yes) | 9.3 (216) | 5.1 (217) | 0.132 |
| **Current injury** (% yes) | 29.3 (215) | 23.5 (213) | 0.208 |
| **Sunburn** (% yes) | 45.5 (213) | 29.7 (212) | 0.001 |

| | EAMC Group (n=216) | CON Group (n=217) | p value |
|---|---|---|---|
| **Skin cancer** (% yes) | 3.4 (208) | 1.5 (206) | 0.345 |
| **Other skin damage** (% yes) | 7.4 (203) | 3.5 (200) | 0.134 |
| **Surgery** (% yes) | 82.2 (157) | 79.3 (164) | 0.606 |

Values are expressed as frequencies, with the number of subjects (n) in parentheses.

### 3.3.5. Flexibility training

The flexibility training history of the EAMC and the CON groups are depicted in Table 3.7. There were no significant differences between the two groups with respect to the number of times each muscle group was stretched (p=0.377); the total duration of stretching (p=0.706); stretching before (p=0.380) or after (p=0.137) exercise; and any of the muscle groups that were stretched. Significantly more triathletes in the CON group reported stretching during exercise (p=0.026) than those in the EAMC.



**Table 3.7.:** The flexibility training history of the triathletes with a self reported past history of exercise associated muscle cramps (EAMC) and those with no history of EAMC (CON).

| | EAMC Group (n=216) | CON Group (n=217) | p value | Co-Varied p value [a] |
|---|---|---|---|---|
| **Stretch Training** (% yes) | 59.72 (216) | 58.69 (213) | 0.904 | n.d. |
| **Frequency** (days/wk) | 3.7 ± 1.8 (126) | 3.8 ± 1.8 (128) | 0.652 | 0.422 |

| | EAMC Group (n=216) | CON Group (n=217) | p value | Co-Varied p value [a] |
|---|---|---|---|---|
| **Frequency** (times/day) | 1.3 ± 1.4 (119) | 1.3 ± 0.8 (118) | 0.900 | 0.959 |
| **Duration** (sec/stretch) | 24 ± 13 (131) | 26 ± 13 (127) | 0.163 | 0.120 |
| **Number of Times Each Muscle Group Stretched** | 2.3 ± 1.1 (136) | 2.2 ± 1.1 (129) | 0.377 | 0.478 |
| **Total Duration** (min/wk) [b] | 5.8 ± 12.7 (112) | 5.2 ± 5.9 (111) | 0.706 | 0.944 |
| **Stretch before Exercise** (% yes) | 53.5 (101) | 60.6 (99) | 0.380 | n.d. |
| **Stretch during Exercise** (% yes) | 19.4 (98) | 35.5 (76) | 0.026 | n.d. |
| **Stretch after Exercise** (% yes) | 91.7 (133) | 96.8 (126) | 0.137 | n.d. |
| **Soleus** (%) | 47.2 (102) | 42.9 (93) | 0.414 | n.d. |
| **Gastrocnemius** (%) | 55.1 (119) | 54.4 (118) | 0.958 | n.d. |
| **Groin** (%) | 36.1 (78) | 36.9 (80) | 0.949 | n.d. |
| **Hamstring** (%) | 59.3 (128) | 59.0 (128) | 0.968 | n.d. |
| **Quadriceps** (%) | 54.2 (117) | 53.5 (116) | 0.959 | n.d. |
| **Upper body** (%) | 36.6 (79) | 37.8 (82) | 0.871 | n.d. |
| **Other** (%) | 19.9 (43) | 18.0 (39) | 0.696 | n.d. |

Values are expressed as average ± standard deviation or a frequency, with the number of subjects (n) in parentheses.

[a] Co-varied for gender.

[b] The total weekly stretching time (min/week) was calculated as duration of stretch (min) X number of times each muscle group was stretched per day (number) X stretch sessions per day (number) X days of stretching per week (number).

n.d., not determined.

### 3.3.6. Regression analysis - risk factors for a history of EAMC in triathletes

The results of the regression analysis to determine the independent risk factors for a history of EAMC in Ironman triathletes are presented in Table 3.8. The significant independent risk factors for a self reported history of EAMC in Ironman triathletes were height (p=0.003), overall finishing time for the 2006 or 2007 Ironman triathlon (p=0.043), a past history of tendon and/or ligament injuries (p=0.022) and a family history of EAMC (p=0.001). There was a strong correlation between the triathletes Ironman personal best (PB) times and their overall finishing time for the 2006 or 2007 Ironman triathlon (r=0.762, n=180, p>0.001). In addition there was also a positive correlation between the triathletes age and overall finishing times (r=0.234, n=373, p>0.001), with the older athletes completing the event in slower times. Because the relative small sample size of the PB data, the overall finishing times and age were used in the analysis as a proxy for their PBs. Since 48.4% (77 of 159) of the triathletes with a history of tendon and/or ligament injuries also reported a history of sunburn compared to 33.3% (88 of 264) of the triathletes with no history of tendon and ligament injuries (p=0.003), only a history of tendon and/or ligament injuries was included in the analysis.

**Table 3.8.:** Regression analysis for the determination of independent risk factors EAMC in Ironman triathletes (SE = Standard Error).

| | Level of Effect | Estimate ± SE | Wald Stat | p value |
|---|---|---|---|---|
| **Height** (cm) | | 0.049 ± 0.017 | 8.60 | 0.003 |
| **Age** (years) | | 0.024 ± 0.015 | 2.64 | 0.104 |
| **Overall Time** (min) | | -0.003 ± 0.001 | 4.11 | 0.043 |
| **History of Tendon and Ligament Injury** | Yes | -0.329 ± 0.144 | 5.21 | 0.022 |
| **Family History EAMC** | Yes | 0.493 ± 0.143 | 11.84 | 0.001 |
| **History of Tendon and Ligament Injury X Family History EAMC** | | -0.125 ± 0.143 | 0.76 | 0.382 |



### 3.3. Discussion

To our knowledge, this is one of the largest case-control studies investigating the risk factors associated with a self reported past history of EAMC in endurance athletes to date. The main findings from this study were that the independent risk factors for a self reported past history of EAMC in Ironman triathletes were 1) overall faster finishing times for the Ironman Triathlon, 2) a past history of tendon and/or ligament injuries, 3) a family history of EAMC, and 4) an increased height.

This case-control study was undertaken as a field study where the main tool for obtaining the data was a questionnaire. Therefore, this study has inherent limitations, which require

discussion before the results are discussed and interpreted. Firstly, subjects for this study were recruited at the registration area in the three days before the event, were self selected, and therefore do not necessarily represent all Ironman triathletes. However, as the main aim was to compare triathletes with a past history of EAMC to those with no past history, it was important to recruit similar numbers of subjects in each group, and this was achieved.

A second limitation of this study design was the use of a questionnaire to obtain the data. Although a previously validated questionnaire was used, data collected in this manner relies on recall of the subjects. Recall bias is therefore an inherent problem with this study. However, it is important to point out that these athletes are usually very familiar with their physiology and their medical history as the nature of this event requires an in-depth analysis and understanding of the physiological demands of the sport. Furthermore, it is likely that any recall bias would be equally applicable to each of the two study groups. However, the result has to be interpreted with possible recall bias in mind.

A third limitation of this study design is that no cause-effect relationship can be determined from these results. Results have to be interpreted purely as associations, where one variable may have either caused an effect, could have occurred as a result of an effect, or two variables may have been related through another variable. Once again, the results of this study have to be interpreted with this limitation in mind.

This study design also has some inherent strengths. Firstly, it is novel and is, to our knowledge the largest study of this nature in endurance athletes. There were similar number of cases and controls, and a large number of variables could be studied. Because of the large sample sizes, statistical power was sufficient to allow for the in-depth analysis of the variables

(adjusting for variables) as well as performing a regression analysis to determine independent variables. Finally, it is important to note that descriptive studies, such as this, are very important to identify novel risk factors associated with a condition. Further cause-effect relationships can then be studied using a prospective cohort or intervention study designs.

The first novel finding of this study was that triathletes with a self reported past history of EAMC (EAMC group) had overall faster finishing times for the Ironman triathlon compared with the group reporting no past history of EAMC (CON group). The obvious confounding variable that could account for this finding is that triathletes in the EAMC group were the better athletes (higher calibre athletes). However, expect for their Ironman career personal best times, an in-depth analysis of career and recent personal best times for triathlon and road running events showed that there were no significant differences between these groups of athletes, indicating that both groups were probably evenly matched for ability in their endurance race career. Furthermore, the two groups were also similarly matched with no significant differences in their training frequencies times and distances leading up to the event. However, the EAMC group did report higher intensity levels during their training sessions compared with the CON group during the 8 weeks prior to the event (only 2007 data were available for this variable). It therefore appears that both groups were similarly matched in athletic ability and in training. A faster finishing time in the race therefore indicates (but not proves) that triathletes In EAMC group competed at faster pace, and therefore a higher relative exercise intensity, compared with the CON group.

Data in support of this observation is that the triathletes in the EAMC group also predicted the faster racing times (data obtained before the event at the time of registration) and then subsequently achieved the faster finishing times compared with the triathlete in the CON

group (Table 3.4.). This was most significantly noted in the swimming and cycling legs; and even though the running section was not found to be significant, the times reported for both predicted and actual overall race times were also faster in the EAMC group than in the CON group (Table 3.4.). It therefore appears that despite similar athletic ability and training triathletes with a past history of EAMC predicted and then competed at a faster pace. This type of triathlete would be competing at a higher relative exercise intensity which could increase the risk of developing muscle fatigue.

Finally, in one recent prospective cohort study in Ironman triathletes, similar findings were noted. In this study, triathletes who developed EAMC during the race predicted and then competed at faster times compared with a group that did not develop EAMC [40]. Therefore, these data from our study and the prospective cohort study [40] appear to indicate that triathletes who develop cramping, exercise at higher intensity; and this may lead to premature muscle fatigue. Indirectly these data appear to support the neuromuscular hypothesis for the development of EAMC.

The second novel finding of this study was the association between a past history of tendon and/or ligament injuries and a past history of EAMC. This possible risk factor has not been reported before, and there is no definitive explanation for this finding. However, in a recent review, it has been suggested that soft tissue injury could perhaps be a trigger for increased neuromuscular excitability in muscles leading to EAMC [51] or that previously injured areas, which are weaker, may be susceptible to the development of premature fatigue. It has been suggested that an injury could disrupt normal afferent and efferent neuromuscular pathways which may result in increased reflex alpha motor activity, possibly leading to EAMC in these areas. This area also clearly requires further investigation.

The third finding of this study was that a positive family history for EAMC was significantly associated with a past history of EAMC (Table 3.5.). It was of particular interest to note that there was a significant family history of EAMC on the male side of the family; and a significant family history of nocturnal cramping in the female side of the family. These observations suggest that there may be an inherent genetic risk factor for the development of EAMC, and this has also recently been suggested [51]. This is also an area that would require further investigation.

The final novel finding of this study was that triathletes with a self reported past history of EAMC were taller than those who did not report any past EAMC. This has not been reported in any previous studies. In other one other study, increased body mass index (BMI) but not increased height was reported as a possible risk factor for EAMC [49]. There is no apparent physiological explanation for increased height to be a factor for EAMC. It could be speculated that this may as a result of biomechanical differences during running or cycling, or that this may be linked to genetic factors that are related to height. Increased height as a true risk factor for EAMC clearly requires further investigation.



The descriptive data from the group the triathletes with a past history of EAMC also showed some interesting observations. Triathletes with a past history of EAMC reported that cramping occurred during any one of the three disciplines (Figure 3.1A); were mild in nature (Figure 3.1C); and were relieved most often by passive stretching (Figure 3.1E). Furthermore, cramping was confined to exercising muscle groups and was not generalized in their distribution (Figure 3.1D), and most triathletes reported cramping in lower body exercising muscle groups (calves, hamstrings, quadriceps and feet). These data support the observation

that EAMC occurs in localized muscle areas and not generally as with systemic abnormalities such as dehydration or electrolyte depletion [43, 49].

Shorter daily stretching and irregular stretching habits have previously been suggested as risk factors for the development of EAMC [49]. However, findings in this study did not support this (Table 3.7.), although triathletes in the CON group reported increased stretching during exercise compared to triathletes in the EAMC group (Table 3.7.). Flexibility training histories of the triathletes in both groups were similar.

Other previously reported risk factors for the development of EAMC (Chapter 2) such as dehydration and electrolyte disturbances were not investigated in this study. These risk factors were studied using a prospective cohort design in the 2006 Ironman and were reported [40]. In this prospective cohort study, neither dehydration (as measured by pre- and post-race body weight changes) nor serum electrolyte concentrations were associated with the development of EAMC, supporting the findings of other prospective studies (Chapter 2 review).

In summary, this study identified novel independent risk factors that are associated with a self reported past history of EAMC in Ironman triathletes. These factors were overall faster finishing times for the Ironman triathlon, a past history of tendon and/or ligament injuries, a family history of EAMC, and an increased height. The nature of the study methodology used does not allow us to conclude that these factors are causally related to EAMC in triathletes. Further scientific studies are needed to determine this causal relationship.

# Chapter 4

# Summary and practical clinical recommendations

## 4.1. Risk factors for EAMC in endurance athletes

In this dissertation, the risk factors for EAMC in endurance athletes were investigated. An in depth review of the risk factors (Chapter 2) identified 1) that there are a number of intrinsic and extrinsic risk factors that have been identified for EAMC, but 2) in general, there is little scientific evidence to support these risk factors. Therefore a research study was undertaken in Ironman triathletes to identify risk factors associated with a past history of EAMC.

Novel independent risk factors for a past history of EAMC were identified and included the following: 1) predicting (deciding before the race) and then competing at a faster race time, 2) a past history of tendon and/or ligament injuries, 3) a family history of EAMC, and 4) an increased height.



However, because of the limitations of this study, these findings all require further investigation using a prospective cohort study design or an intervention trail to determine a cause-effect relationship between the risk factors and EAMC in endurance athletes.

However, the findings from this research study do add to the body of knowledge on the risk factors associated with EAMC. Therefore, the risk factors for EAMC presented in Chapter 2 can now be modified and summarized as follows (Table 4.1.)

**Table 4.1.: Intrinsic and Extrinsic Risk Factors for EAMC in Athletes – level of evidence according to evidence-based medicine (EBM) criteria [49] (Revised).**

| Intrinsic Risk Factors | | |
|---|---|---|
| | **Study Details and Reference/s** | **Level of Evidence (I – IV)** |
| **Past history of EAMC** | **Positive association:** | |
| | Prospective cohort study – triathletes [40] | I |
| **Increased Exercise Intensity (race pace or subjective assessment)** | **Positive association:** | |
| | Prospective cohort study – triathletes [40] | I |
| | Cross sectional study – marathon runners [20] | III |
| | Case-control study (past history of EAMC) (dissertation) | III |
| **Muscle Fatiguing Exercise** | **Positive association:** | |
| | Cross sectional study – marathon runners [20] | III |
| | Case series – laboratory study in human subjects | IV |
| **Increased Exercise Duration (time, last quarter of an event)** | **Positive association:** | |
| | Cross sectional studies – marathon runners [20], rugby players [27], triathletes [36] | III |
| | Case-control study (past history of EAMC) (dissertation) | III |

| | Study Details and Reference/s | Level of Evidence (I – IV) |
|---|---|---|
| **Dehydration** | **Positive association:** | |
| | Case series – laborers [13, 24], tennis players [4, 38] | IV |
| | **No association:** | |
| | Case series – American football players [39] | |
| | Prospective cohort studies – marathon runners, | I |
| | triathletes [5, 7, 32, 40] | I |
| **Serum Electrolyte Disturbances (sodium, chloride, magnesium, calcium)** | **Positive association:** | |
| | Case series – laborers | IV |
| | **No association:** | |
| | Prospective cohort studies – marathon runners, | I |
| | triathletes [5, 7, 32, 40] | |
| **Increased Sweat Sodium Concentration** | **Positive association:** | |
| | Case series – tennis players [4, 38], American | IV |
| | football players [39] | |
| **Increased Age** | **Positive association:** | |
| | Cross sectional study – marathon runners [20] | III |
| | **No association:** | |
| | Case-control study (past history of EAMC) | |
| | (dissertation) | III |

| | Study Details and Reference/s | Level of Evidence (I – IV) |
|---|---|---|
| **Longer History of Running** | **Positive association:** | |
| | Cross sectional study – marathon runners [20] | III |
| | **No association:** | |
| | Case-control study (past history of EAMC) (dissertation) | III |
| **Higher Body Mass Index (BMI)** | **Positive association:** | |
| | Cross sectional study – marathon runners [20] | III |
| | **No association:** | |
| | Prospective cohort studies – triathletes [40] | I |
| | Case-control study (past history of EAMC) (dissertation) | III |
| **Increased height** | **Positive association:** | |
| | Case-control study (past history of EAMC) (dissertation) | III |
| **Past history of tendon/ligament injury** | **Positive association:** | |
| | Case-control study (past history of EAMC) (dissertation) | III |
| **Shorter Daily Stretching Time** | **Positive association:** | |
| | Cross sectional study – marathon runners [20] | III |
| **Irregular Stretching Habits** | **Positive association:** | |
| | Cross sectional study – marathon runners [20] | III |

| | Study Details and Reference/s | Level of Evidence (I – IV) |
|---|---|---|
| **Positive Family History of Cramping** | **Positive association:** | |
| | Cross sectional study – marathon runners [20] | III |
| | Case-control study (past history of EAMC) (dissertation) | III |
| | **Extrinsic Risk Factors** | |
| **High environmental temperatures and humidity** | **Positive association:** | |
| | Retrospective cohort study – American football [1] | II |
| | Case series – tennis players [4, 38] | IV |
| | Case-control - American football players [39] | III |
| | Anecdotal observations – marathon races, triathlon events | IV |

## 4.2. Practical clinical recommendations for endurance athletes to reduce the risk of EAMC

Based on the review of the risk factors for EAMC in endurance athletes, and the findings from the original research study in this dissertation, the following practical recommendations can be given to endurance athlete to reduce the risk of developing EAMC (Table 4.2):

**Table 4.2.: Practical clinical recommendations to reduce the risk of EAMC in endurance athletes, based on current known and postulated risk factors for EAMC.**

| Risk factor | Practical clinical recommendation |
|---|---|
| **Past history of EAMC** | • Non-modifiable risk factor (be aware of the increased risk for EAMC) |
| **Increased Exercise Intensity (race pace or subjective assessment)** | • Be realistic in predicting and then competing at a specific race intensity<br>• Be aware of other factors that may influence the development of premature muscle fatigue (energy depletion, environmental conditions – temperature, humidity, wind speed) |
| **Premature Muscle Fatigue** | • Be aware of other factors that may influence the development of premature muscle fatigue (energy depletion, environmental conditions – temperature, humidity, wind speed) |

| Risk factor | Practical clinical recommendation |
|---|---|
| **Increased Exercise Duration (time, last quarter of an event)** | • Be well prepared (conditioned) for the event<br>• Be aware of other factors that may influence the development of premature muscle fatigue (energy depletion, environmental conditions – temperature, humidity, wind speed) |
| **Dehydration** | • Be aware that dehydration is not a risk factor for EAMC<br>• In general, there is evidence that body weight loss of up to 5% is not associated with any risk of medical complications |
| **Serum Electrolyte Disturbances (sodium, chloride, magnesium, calcium)** | • Be aware that electrolyte depletion is not a well established risk factor for EAMC<br>• Relying on salt or other electrolyte supplements to prevent EAMC is not based on good scientific evidence |
| **Increased Sweat Sodium Concentration** | • There is only very weak scientific evidence to suggest that increased sweat sodium concentration is a risk factor for EAMC |
| **Increased Age** | • Non-modifiable risk factor (be aware of the possible increased risk for EAMC) |
| **Longer History of Running** | • Non-modifiable risk factor (be aware of the possible increased risk for EAMC) |
| **Higher Body Mass Index (BMI)** | • Reducing body weight if BMI is in excess of 25 may decrease the risk of developing EAMC |
| **Increased height** | • Non-modifiable risk factor (be aware of the possible increased risk for EAMC) |

| Risk factor | Practical clinical recommendation |
|---|---|
| **Past history of tendon/ligament injury** | • Non-modifiable risk factor (be aware of the possible increased risk for EAMC)<br>• Although there is no evidence to date, comprehensive rehabilitation after injury is recommended to reduce the risk of EAMC |
| **Shorter Daily Stretching Time** | • Although evidence for this risk factor is weak, flexibility training (regular stretching) of the lower limb muscles where EAMC mostly occurs is recommended |
| **Irregular Stretching Habits** | • Although evidence for this risk factor is weak, flexibility training (regular stretching) of the lower limb muscles where EAMC mostly occurs is recommended |
| **Positive Family History of Cramping** | • Non-modifiable risk factor (be aware of the probable increased risk for EAMC) |
| **High environmental temperatures and humidity** | • Increased temperature and humidity are associated with the increased risk of EAMC – reducing exercise intensity and duration in these conditions is recommended to reduce the risk of EAMC |

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# Appendices

# Appendix 1

# Welcome to the Spec-Savers Ironman South Africa Research programme - 2006

Dear Triathlete

We have the privilege to inform you that scientific and medical research at the Port Elizabeth Spec-Savers Ironman South Africa triathlon has been planned in collaboration with the UCT/MRC Research Unit for Exercise Science and Sports Medicine based at the Sports Science Institute of South Africa, and Tswane University in Pretoria. This will provide a unique opportunity for a research programme to address important medical and physiological problems that are associated with participation in the Spec-Savers Ironman South Africa triathlon.

The research study will concentrate on the following 6 main components that will ultimately assist you to **improve your performance** and **improve the standard of your medical treatment** at future triathlons and other endurance events:

- Management of the collapsed triathlete
- Causes and treatment of Exercise Associated Muscle Cramping
- Preventing post-exercise decreases in immune function and upper respiratory tract (URT) symptoms
- Genetic basis for performance and physiological responses during an Ironman Triathlon
- Identifying causes of chronic Achilles tendon injuries in triathletes
- Identifying the relationship between training history, perception of effort (RPE) during the race and the subsequent recovery after the race.

## How can I volunteer to participate in the research study?

As a participant in the Port Elizabeth Spec-Savers Ironman South Africa triathlon, you will be given the unique opportunity to participate in this research effort. Please understand that your participation is entirely voluntary. Please read through the details of the following six components of the study. You will be given the opportunity to participate in any number, or all the components of the study. The details of each component are summarized below and a detailed explanation of each component can be downloaded as a PDF file. If you wish to participate in the study, please **download** the information related to each component of the study (PDF file), and read through it carefully. Please bring the INFORMED CONSENT FORM of the study with you to Port Elizabeth, and then visit our RESEARCH area at the registration venue. Here we will discuss any questions you may have, and then sign the INFORMED CONSENT FORM with you. In addition please download and complete the QUESTIONNAIRES. We will let you know once the questionnaires are available. Printed copies of all the documentation will also be available at the REGISTRATION research area.

## Will my participation in the research affect my preparation, race participation, or recovery after the race?

All the components of this study have been carefully designed NOT to 1) interfere with your preparation or participation in the Ironman, 2) affect your performance on race day, and 3) your recovery after the event. All the tests are not painful and non-invasive (apart from a small blood sample taken at registration and after the race).

## Will I have access to the results of the study?

Once the study results are known, you will be able to access a summary of the findings of the study on the website and you can also request, this be sent to you by email. You will also be given the opportunity to attend a feedback meeting where the results of the study will be discussed. The results will only be that of the whole group, and no individual results will be made public.

## Who can I contact for more information?

In the next few weeks, please feel free to contact members of the research team should you have any questions related to the study (or any component of the study). Contact details of the research team are as follows: ironman@sports.uct.ac.za or (021) 650 4572.

## The following documents can be downloaded:-

1. Subject information sheets (PDF File)
2. Consent form (PDF File)
3. Questionnaires (MS Word document)
4. Summary of the study (This web page) (PDF File)
5. Adobe Acrobat Reader



## Summary of each component of the research study:-

### 1. Management of the collapsed triathlete

The precise causes and best treatment of collapsed endurance athletes is still widely debated. We would like to see if collapsed athletes have a greater incidence of serum sodium and plasma volume abnormalities than athletes who do not collapse at the end of the race. Accordingly, if these abnormalities do exist in collapsed athletes, are intravenous fluids superior to oral fluids in the treatment and restoration of sodium and plasma volume levels? Close monitoring of sodium levels, heart rate and blood pressure and time to discharge will help our team answer these questions.

### 2. Exercise associated muscle cramping

The precise causes of Exercise Associated Muscle Cramping (EAMC) are still widely debated. Contrary to popular belief, heat, dehydration and electrolyte (salt) abnormalities may NOT be the cause of EAMC. In this component of the study we would like to measure these changes in triathletes who cramp, and then follow what happens once we treat these athletes. We also want to measure the muscle "twitchiness" during the recovery period, once again trying to see if these related to changes in serum electrolyte concentrations (salt). Triathletes who are prone to EAMC may well be interested in this component of the study.

3. **Post-exercise upper respiratory tract (URT) symptoms**

It is well documented that intense training, as well as participation in a prolonged strenuous endurance events (such as the Ironman) can cause changes in the immune system, and may increase the risk of infections (mainly of the upper respiratory tract). In this component of the study we want to examine the immune changes, as well as find out what causes the upper respiratory tract symptoms in endurance athletes after participation in the Ironman. Triathletes that are prone to developing symptoms such as sore throat, runny or blocked nose or cough after a race may well be specifically interested in participating in this component of the study.

4. **Genetic basis for performance and physiological responses during an Ironman Triathlon**

Athletic ability is partly determined by an intervals genetic make-up. Various gene (DNA material) have been shown to be associated with endurance performance, including the South African Ironman Triathlons. In addition it has also been suggested that the inter-individual physiological responses, such as blood salt and water imbalance, as well as the development of tendon overuse injuries, during endurance activities is partially determined by ones genes. The aim of this component of the study is to identify genes associated with performance and susceptibility to salt and water imbalances and indicators of underlying tendon pathology during the Ironman Triathlon. Volunteers for this component of the study will be asked to complete a questionnaire. At registration they will be asked to donate a small blood sample from which your genetic material (DNA) will be extracted and your blood salt levels measured. You will also be weighed before the swim and again immediately after the race. A second blood sample will also be taken after the measure to measure your blood salt levels. Some volunteers will also have their Achilles tendons scanned at registration.

5. **Chronic Achilles tendon injuries in triathletes**

Chronic Achilles tendon injuries are common in athletes participating in weight-bearing sports. It is well established that repetitive forces that are applied to the Achilles tendon (such as during running) may cause microscopic damage to the tendon. In the initial phases this may not cause any symptoms (pain or swelling). However, these changes can be observed using a technique known as soft tissue diagnostic ultrasound (non painful scan of the tendon). In this component of the study we wish to assess the changes in the Achilles tendon before and then after (immediately and 6 weeks later) the Ironman. In particular we wish to find out what damage (if any) takes place in the tendon as a result of the race, and how does this recover after 6 weeks. The findings of this study will also be linked to the genetic basis component (described in 4 above). Here we will be able to determine if your genetic make up determines how your tendons respond to a race such as the Ironman.

**6. The relationship between training history, perception of effort during the race and the subsequent recovery after the race.**

The relationship between training history, perception of effort during the race and the subsequent recovery after the race is poorly understood. Knowing more about this relationship is important as it will have practical implications for the preparation for the race and minimise any health risks associated with too much physical stress which may occur after the race. Volunteers for this study will be asked to complete a short questionnaire on their training habits in preparation for the Ironman. During the race subjects will be asked to shout out a "perception of effort" score at they go past one of the 8 stations along the route. A researcher at the station will record the race number and the score. Volunteers will be sent emails on a daily basis for a week after the race with a short questionnaire on their recovery. Thereafter, they will be sent an email on a weekly basis for 12 weeks. Volunteers living near a big centre will be asked to donate a small blood sample at 1, 3, 5, 7 and 9 days after the race for the measurement of creatine kinase, a marker of muscle damage (however, blood donations are not essential for entry into the study)

## If I decide to participate in the research study, what will be required of me?

The following table summarises the details of your participation in the study:-

| | **Details of Your Participation in the Study** |
|---|---|
| **Before Race** | 1. Download information sheets, questionnaires and consent forms from web page<br>2. Complete questionnaires using Microsoft Word<br>3. E-mail completed questionnaires to researchers at ironman@sports.uct.ac.za |
| **At Registration** | 1. Hand in and sign the informed consent forms<br>2. Donate a sample of blood<br><br>Ultrasound scan of both Achilles tendons in some athletes (Achilles Tendon component - No 5)<br><br>Donate a saliva sample and have a throat swab (URT component - No 3) |
| **Before Swim (Race Day)** | 1. Have yourself weighed near the start of the swim before donning your wetsuit in your costume |
| **During Race** | 1. Shout out a "perception of effort" score at they go past one of the 8 stations along the route (RPE component - No 6) |

| | |
|---|---|
| **Immediately After Race (Medical Tent)** | 1. Have yourself weighed in your running gear, without shoes, at the medical tent<br>2. Donate a sample of blood<br><br>Ultrasound scan of both Achilles tendons in those athletes who had a scan during registration (Achilles Tendon component - No 5)<br><br>Donate saliva samples and have throat swabs (URT component - No 3)<br><br>Treatment of athletes with cramps and testing of unaffected volunteers (cramps component- No 2)<br><br>Treatment of the collapsed athletes (collapsed athlete component - No 1) |
| **Continuing Follow-up** | **At 6 Weeks:** Ultrasound scan of both Achilles tendons (Achilles Tendon component - No 5)<br><br>**Daily for 2 Weeks:** Complete symptoms questionnaire, available for telephonic surveillance calls every second day, **and only if required,** visit a designated centre for a clinical examination, donation of saliva and blood samples and have a throat swab taken (URT component - No 3)<br><br>**For 12 weeks after the race:** Complete a short electronic questionnaire on your recovery daily for a week after the race, thereafter, on a weekly basis for 12 weeks. Volunteers living near a big centre will be asked to donate a blood sample at 1, 3, 5, 7 and 9 days after the race (however, blood donations are not essential for entry into this component of the study) (RPE component - No 6) |

We look forward to meeting you at the Spec-Savers Ironman South Africa Registration area, and wish you well in your race preparation and participation.

Prof Martin Schwellnus, Dr Malcolm Collins, Prof Tim Noakes, and the rest of the Ironman Research Team

# Appendix 2

## Invitation to participate in the Medical Research at Ironman 2007

Once again, the medical research team will conduct studies at the 2007 Ironman in Port Elizabeth. We anticipate that the findings ultimately will assist you in improving your performance and improving the standard of your medical treatment at future triathlons and other endurance events:

**Research results from Ironman 2006**

Attached is a summary of the main results from the research we conducted last year at the Ironman 2006 (please download the attachment). A number of the research projects are ongoing, and the same or similar questions will again be examined this year.

**What are the research questions the team wishes to answer?**

The following research questions have been identified and will be investigated:

1. What is the best treatment of a collapsed triathlete?
2. Does training affect the risk of developing Exercise Associated Muscle Cramping in Ironman triathletes?
3. Why can Ironman triathletes cope so well with pain and discomfort during training and competition?
4. How does your genetic make-up affect your performance and possible medical complications during an Ironman triathlon?
5. Does your brain become exhausted during an Ironman event – what is the evidence?
6. What are the causes of gastro-intestinal (GIT) distress in Ironman triathletes? (It was very evident from the research findings of 2006, that this is a very common problem)

**How can you volunteer to participate in the research studies in 2007?**

As a participant in the Port Elizabeth IRONMAN 2007 triathlon, you will be given the unique opportunity to participate in this research effort. The following are very important:

- Please understand that your participation is entirely voluntary
- You will be given the opportunity to participate in any number, or all components of the study
- Brief information of each component is given below, but more details of the research studies and precise instructions on how to participate in the research are attached
- Please download and read the following documents:
  1. Subject information sheet (this will give you detailed information about each component of the research)
  2. Informed consent form (If you wish to participate, this document needs to be signed in the presence of a member of the research team – at the time of registration in Port Elizabeth)
  3. Medical and training questionnaire (Please complete this questionnaire in the 2-3 weeks before registration, and bring it with you to the research stand at the registration area – this questionnaire can be completed even if you do not wish to participate in all the research studies)
- We acknowledge that the questionnaire is long, and we therefore suggest that you complete it over a few days and perhaps section by section. Your assistance is MUCH appreciated.

**Brief information on each component of the research study**

**1. Treatment of the collapsed triathlete**

In this study we wish to determine which of two commonly used forms of treatment (drinking fluids, or receiving fluids into you vein through a "drip") are most effective in the treatment of collapsed athletes. Under the expert care of the medical team in the medical tent, you will be able to voluntarily participate in this study (either before, or on admission to the medical tent).

**2. Exercise associated muscle cramping**

In this study, we wish to determine whether there is a training-related factor that may play a role in the risk of developing cramping. Information for this study will be obtained by completing the medical questionnaire and by getting your "effort rating" during the race (this will be explained to you). Further information will also be obtained from those of you that have your own recording and down-loadable type heart rate monitor. If you are interested in participating in this study, please start (or continue if you already do this) monitor your heart rate during training in the 4-6 weeks before the race and during the race. It will be necessary to download the heart rate data and then to submit this to us via email or you can bring the data on your flash-drive to registration. We could even get this information from you after the event!

**3. Pain coping strategies in Ironman triathletes**

As you are all well aware, intense training and competing in an extreme endurance event such as the Ironman is associated with discomfort and physical pain. In this study, we wish to identify strategies used by triathletes to cope with pain experienced during extreme physical exercise. This information will be obtained by a questionnaire (completed before the race), and by testing your level of concentration, heart rate variability and your pain threshold before the race (20-30 min test). This information will be determined 1-4 weeks before the race at a research centre in Cape Town or it can be done at registration before the race. Some of these tests will be repeated after the race.

**4. Genetic make-up and performance, physiological responses and medical complications during an Ironman triathlon**

In this study, we wish to determine whether genetic markers are associated with performance and medical complications during an Ironman triathlon. Information for this study will be obtained by completing a questionnaire. In addition, we will need volunteers to donate a small blood sample (1 teaspoon) from which your genetic material (DNA) will be extracted for the identification of gene variants. This information and the blood sample will be obtained at registration before the race.

**5. Brain "exhaustion" after an Ironman Triathlon**

In this study, we wish to measure the effect of the Ironman on brain and nerve processing and the nerve activity that, for instance, controls your heart rate. Using an electroencephalogram (EEG) machine (measured through a cap, similar to a swim cap, that has electrodes that only record nerve activity) we will be measuring brainwave patterns and heart rate variability during a simple mental test before and immediately after (within 60min of completing) the Ironman. This test is not painful, and takes about 20-30 min. It will be conducted 1-4 weeks before the race at the Sports Science Institute in Cape Town, or at the registration area before the race.

**6. Possible causes of gastro-intestinal (GIT) distress in Ironman Triathletes**

In this study we wish to find out why such a large percentage of triathletes suffer from stomach and other abdominal upsets during training and racing. Volunteers for this component of the study will be asked to complete the questionnaire. In addition, in a smaller group of volunteers, we wish to measure the blood flow to the intestines using an ultrasound machine (such as used in scans during pregnancy or when we scan the tendons) before the race (during registration in Port Elizabeth) and then again immediately after the race (particularly in those triathletes who regularly develop abdominal problems). This scan is not painful, and will take about 10 minutes.

**A final word from the medical team and the research team**

One of the main components of the projects is the completion of a detailed medical questionnaire. The information obtained form this questionnaire will be very useful for the medical team and can lead to improvements in medical care if you need it. We therefore encourage all of you to complete the questionnaire, and also consider participating in some (or all) of these other tests.

| Medical Research Director | Chief Medical Officer | Race Director |
|---|---|---|
| Prof Martin Schwellnus | Dr Peter Schwartz | Mr Paul Wolff |

# Appendix 3

# SUBJECT INFORMATION SHEET - 2006

Dear Triathlete

We have the privilege to inform you that scientific research at the Port Elizabeth IRONMAN triathlon has been planned in collaboration with the UCT/MRC Research Unit for Exercise Science and Sports Medicine based at the Sports Science Institute of South Africa. This will provide a unique opportunity for a research programme to address important medical and physiological problems associated with the IRONMAN triathlon. Each participant will be able to access a summary of the findings of the study by email, and the website, once it has been completed. You will also be given the opportunity to attend a feedback meeting where the results of the study will be discussed. The results will only be that of the whole group, and no individual results will be made public.

The research study will concentrate on the following 6 main components that will ultimately improve your performance and improve the standard of your medical treatment at future triathlons and other endurance events:

- Management of the collapsed triathlete
- Exercise-associated muscle cramping
- Post-exercise upper respiratory tract symptoms
- Genetic basis for performance and physiological responses during an Ironman Triathlon
- Chronic Achilles tendon injuries in triathletes
- The relationship between training history, perception of effort during the race and the subsequent recovery after the race.

As a participant in the Port Elizabeth IRONMAN Triathlon, you will be given the choice to participate in this research effort. Your participation is entirely voluntary. Please read through the details of the following six components of the study. You will be given the opportunity to participate in one or more components of the study. The details of each component are explained in this document, and if you wish to participate in one or more components of the study, please read through and sign the INFORMED CONSENT FORMS that relate to each component of the study. Please feel free to contact members of the research team should you have any questions related to the study (or any component of the study). Contact details of the research team are as follows: ironman@sports.uct.ac.za or (021) 650 4572.

# SUBJECT INFORMATION SHEET:

## COMPONENTS OF THE RESEARCH STUDY TO BE CONDUCTED AT THE 2006 IRONMAN TRIATHLON IN PART ELIZABETH

**The research study at the 2006 Ironman Triathlon, comprise of six components. The detailed information on each of these components of the study is as follows:**



## Component 1: A study on the management of the collapsed triathlete

**General information:**

The aim of this study is to evaluate the optimum treatment strategies for which to treat collapsed triathletes, after an Ironman race. Although intravenous (IV) fluid replacement is a common practice in the treatment of collapsed triathletes, medical personnel need to be advised of a treatment method that will prevent possible fluid overload (hyponatraemia) which can be a very severe condition. Your participation in this trial will aid in the understanding and management of how best to correct any fluid imbalance following this race.

If you collapse during or after the Ironman Triathlon and are brought into the medical tent, you will be evaluated and treated according to the current best standard of care principles. Your legs will be elevated and your heart rate, blood pressure, mental status and serum sodium concentration will be measured. If you are confused and your sodium level is normal, other laboratory tests will be performed such as an evaluation of your body temperature and blood sugar levels. If your body temperature is normal and do not have evidence for another treatable medical condition, an IV line will be placed in your arm and the appropriate fluid will be administered - IV or oral fluid (ad libitum – you choose how much you wish to drink) - until you recover and can leave the medical tent without assistance. Your discharge will be at the discretion of the supervising medical officer. If your condition deteriorates at any time, you will be immediately removed from the trial, treated appropriately and transported to the nearest hospital.

The risk of adverse affects of placement of an intravenous line include: infection, delayed healing, bruising, physical pain, mental discomfort and possible injury to a nerve or vessel. The risk of

these adverse effects are rare and every attempt to minimize these risks will be undertaken by the use of sterile technique and use of disposable, single use, material. Your blood will be used for evaluation of serum sodium or blood glucose concentration only. No other tests will be performed on your blood and your blood samples will be appropriately discarded after these tests are performed.

We will obey the strict practices of confidentiality and anonymity. Each subject's identity will be known only to the researchers and numbers will be assigned to each sample in lieu of names. No results will be publicly available and the scientific publication of results will never disclose subject identity.

**Potential risks of this component of the study**

- The completion of a questionnaire is not associated with any risk. 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 subjects.
- The potential risks to subjects of blood collection are minimal and are related to 1) blood sample collection technique, and 2) the volume of blood collected prior to racing and the potential risk of a decreased performance in the race. The potential risks associated with blood collection technique from the ante-cubital veins are: infection, delayed healing, haematoma, physical pain, mental discomfort and injury to a nerve or a vessel. These risks are small and will be minimized by the use of trained phlebotomists, use of sterile techniques and the use of disposable, single use materials. The risk of decreased performance as a result of blood collection will be reduced by not subjecting any participant to the collection of a blood volume exceeding 15ml prior to the race.
- Body weight will be measured using a standard electronic scale, and there is no risk associated with this procedure.
- The risks associated with participation in this component of the study do not exceed the risks associated with competing in the Ironman competition. The administration of IV fluids will involve an invasive placement of an intravenous line. The risks associated with the placement of an intravenous line include: infection, delayed healing, haematoma, physical pain, mental discomfort and injury to a nerve or vessel. These risks will be minimized by the use of trained phlebotomists, sterile technique and disposable, single use materials. If at any time the condition of a collapsed triathlete deteriorates, the most appropriate treatment will be initiated, the trial terminated and the patient will be transported to the local hospital if necessary. The support form the local hospital is part of the normal standard medical care associated with this event.

**Potential benefits of this component of the study**

- The data collected in this component of the study will aid in the development of optimal treatment strategies for collapsed triathletes. Although intravenous fluid replacement is a common practice in the treatment of collapsed triathletes, medical personnel need to be advised of a more judicious approach to treatment as to avoid the deleterious effects of fluid overload (hyponatraemia). This information will aid in the understanding and management of serum sodium disorders in collapsed triathletes by scientifically 1) evaluating the efficacy of intravenous versus oral rehydration and 2) assessing if the normalization of serum sodium levels are important in the recovery of collapsed triathletes.

## Component 2: A study to determine the cause of Exercise-Associated Muscle Cramping (EAMC)

**General information**

The purpose of this component of the study is to determine the possible cause of exercise-associated muscle cramping (EAMC) in endurance athletes. At registration, triathletes will be given the opportunity to volunteer to participate in this component of the study.

Details of the study are as follows:

- Prior to or at registration, a questionnaire detailing personal particulars, medical information, training information, and history of muscle cramping will be completed.
- At registration, a blood sample (5ml – 1 teaspoon) will be collected from the vein in the arm using standard procedures.
- Body weight will be determined at the time of registration, and on the morning before the race starts by stepping onto an electronic scale
- Should you develop muscle cramping during or immediately after the race, and if you agree to participate, you will be admitted to a designated area of the medical facility at the finish of the race.
- At the finish your core body temperature will be measured using a rectal thermometer. This procedure will take place in privacy, and entails placing a thermometer in the rectum (backside) for about 3 minutes. This procedure may be associated with mild discomfort but no pain. Normal precautions will be taken to ensure that the thermometer is clean and properly lubricated. Trained medical staff will perform this procedure.
- Disposable surface patches (electrodes) will be attached to your cramping muscle/s and also to your arm (back of the arm on the triceps muscle) to record the electrical activity of the muscles. This procedure is not associated with any pain or discomfort.

- During the time of your admission to the medial facility you will be treated for cramping using standard accepted medical procedures.
- You will be asked to stand and walk periodically (every 15min), unless you are still actively cramping. Once you are able to stand and walk with no cramping, you will be discharged from the medical facility.
- Should you develop any medical complications or if your condition deteriorates, you will be treated according to normal accepted medical practices, and this can include admission to hospital if required.

**Potential risks of this component of the study**

- The completion of a questionnaire is not associated with any risk. 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 subjects.
- The potential risks to subjects of blood collection are minimal and are related to 1) blood sample collection technique, and 2) the volume of blood collected prior to racing and the potential risk of a decreased performance in the race. The potential risks associated with blood collection technique from the ante-cubital veins are: infection, delayed healing, haematoma, physical pain, mental discomfort and injury to a nerve or a vessel. These risks are small and will be minimized by the use of trained phlebotomists, use of sterile techniques and the use of disposable, single use materials. The risk of decreased performance as a result of blood collection will be reduced by not subjecting any participant to the collection of a blood volume exceeding 15ml prior to the race.
- Body weight will be measured using a standard electronic scale, and there is no risk associated with this procedure.
- All medical conditions, including EAMC, will be treated appropriately, based on the current standard of care or evidenced based paradigms. If at any time the condition of a triathlete with EAMC deteriorates, the most appropriate treatment will be initiated, the trial terminated and the patient will be transported to the local hospital if necessary. The support form the local hospital is part of the normal standard medical care associated with this event. Surface electrode placement and measurement of EMG activity is not associated with any known risk to the subject.

**Potential benefits of this component of the study**

- The anticipated benefits of this component of the study are that the results will further our understanding of the possible cause/s of EAMC in endurance athletes. In particular, once the aetiology of EAMC is better understood, this will improve our ability to prevent this condition, and to treat it effectively if it does occur.

## Component 3. A study to determine the cause of post-exercise upper respiratory tract symptoms

**General information**

Upper respiratory tract (URT) symptoms such as a sore throat, runny or blocked nose, and throat irritation are particularly common in ultra distance athletes including triathletes. These symptoms occur mostly in the 2 weeks after a race. It has been shown to occur in 30-50% of all athletes after endurance events. It is important to understanding the relationship between exercise and URT symptoms as it is known that infections have potential negative effects for the athlete. Having an infection or not may mean the difference between being able to compete safely, performing at a sub-optimum level at risk, or missing the event altogether because of illness. In recent years we have become aware that the symptoms of URT infections that endurance athletes suffer from after a race may NOT be caused by an infection. Instead this may reflect an irritation of the inner cell lining of the nose and throat due to allergy or perhaps pollution. However, we still need more evidence to prove this.

The aim of this component of our research is to determine if the symptoms experienced by athletes after an Ironman race are due to an infective cause (microbial agent such as a virus or a bacteria) or due to a non-infective inflammatory process in the upper respiratory tract.

The study will involve recruiting in excess of 120 triathletes who participate in the Port Elizabeth IRONMAN endurance race. You will be requested to report to a specific area at the registration desks in the 3 days prior to the event. At this time you will be asked to complete a questionnaire, and have a blood sample taken from your vein in the forearm. In addition nasal and throat swabs will be taken and you will be required give a specimen of your saliva (spit).

Immediately after you finished the race, you will be asked to report to a specific section of the medial tent at the finish, where a further blood sample and saliva sample will be taken.

You will then be asked to be available for a follow up in the 14 days after the race. Follow-up will take place in four cities (Cape Town, Port Elizabeth, Durban and Gauteng).You will be required to

complete a short symptom chart every day, and you will be contact regularly (every 2 days) by a member of the research team to obtain this information. Should you develop any symptoms of upper respiratory tract irritation (such as blocked nose, runny nose, sore throat, cough) you will be asked to report to a research centre in the city (as mentioned above). There will be no financial compensation to attend this centre, but the medical consultation will be free of charge. During that visit you will be seen by a doctor, who will take a medical history, and conduct a medical examination of your upper respiratory tract (ears, nose throat and chest). In addition a blood and saliva samples will be taken. You will receive treatment and advice for the management of these symptoms.

**Potential risks of this component of the study**

- The completion of a questionnaire is not associated with any risk. 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 subjects.
- The potential risks to you during blood collection are minimal and are related to 1) blood sample collection technique, and 2) the volume of blood collected prior to racing and the potential risk of a decreased performance in the race. The potential risks associated with blood collection technique from the ante-cubital veins are: infection, delayed healing, haematoma, physical pain, mental discomfort and injury to a nerve or a vessel. These risks are small and will be minimized by the use of trained phlebotomists, use of sterile techniques and the use of disposable, single use materials. The risk of decreased performance as a result of blood collection will be reduced by not subjecting any participant to the collection of a blood volume exceeding 15ml prior to the race.
- The potential risks associated with the collection of saliva and throat swabs are minimal. Local minimal and transient discomfort in the upper respiratory tract is the only anticipated risk. The collection procedure will be conducted by trained staff.

**Potential benefits of this component of the study**

- The anticipated benefits to subjects participating in this component of the study are firstly that the knowledge of the cause of the symptoms of the URT after an endurance event will be known, secondly that the treatment of these symptoms will be based on sound scientific and clinical evidence and finally, that triathletes can be given accurate and safe advice on training during the recovery period.

## Component 4: A study to determine the genetic basis for performance and physiological responses during an Ironman Triathlon

### General information

**A study to determine the genetic basis for performance and physiological responses during an Ironman Triathlon will be conducted by the UCT/MRC Research Unit for Exercise Science and Sports Medicine at the University of Cape Town in Cape Town, South Africa, in conjunction with the Molecular Genetics Department B and Laboratory of Forensic Genetics of the Cyprus Institute of Neurology and Genetics in Nicosia, Cyprus.**

**The study involves donate ten millilitres (2 teaspoons) of venous blood and this will be done at race registration and after the race (five millilitres - 1 teaspoon). Five millilitres of the sample will be used for the extraction and analysis of genetic material (DNA), while the remainder of the sample will be used to measure serum electrolyte (salt) levels. In addition, body weight will be measured prior to the start of the race and again in the medical tent on completion of the race.**

**The DNA will only be used for scientific research purposes relating to the genetic basis of (1) athletic ability, (2) tendon and ligament overuse injuries and (3) dysnatraemia during ultra-endurance events. Personal particulars and sporting and medical questionnaires will have to be completed and this information will be treated with the strictest confidentiality and will only be used for scientific research purposes. All data will be analysed anonymously and DNA samples will be destroyed on completion of the study.**

**Part of the DNA extracted form the donated blood sample will be sent to the Cyprus Institute of Neurology and Genetics in Cyprus for analysis. DNA samples will be shipped to and analysed in Cyprus anonymously. DNA will be genotyped (analysed) for variations (polymorphisms) within genes relating to the genetic basis of athletic ability, tendon and ligament overuse injuries as well as water and salt imbalance during ultra-endurance events only.**

### Potential risks of this component of the study

- The completion of a questionnaire is not associated with any risk. 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 subjects.

- The potential risks to you during blood collection are minimal and are related to 1) blood sample collection technique, and 2) the volume of blood collected prior to racing and the potential risk of a decreased performance in the race. The potential risks associated with blood collection technique from the ante-cubital veins are: infection, delayed healing, haematoma, physical pain, mental discomfort and injury to a nerve or a vessel. These risks are small and will be minimized by the use of trained phlebotomists, use of sterile techniques and the use of disposable, single use materials. The risk of decreased performance as a result of blood collection will be reduced by not subjecting any participant to the collection of a blood volume exceeding 15ml prior to the race.

**Potential benefits of this component of the study**

The anticipated benefits of this component of the research study are to identify genetic factors that may predispose to 1) improved performance or 2) increased risk of medical consequences (such as abnormal electrolyte imbalances). This information will eventually assist triathletes in predicting and improving their performance, and decrease their risk of medical complications during participation in triathlon.

## Component 5. A study to determine the genetic risk/s associated with chronic Achilles tendon injuries in triathletes

**General information**

The purpose of this component of the research study is to determine if there are specific genetic factors (refer to the details for component 4) that are associated with the development of chronic tendon injuries. In addition, we want to determine what the effect of an endurance event (such as the Ironman) is on the structure of the Achilles tendon.

At registration you will be required to complete a questionnaire with personal details, training details, past injury details, and details about family history. In addition, a 5ml (1 teaspoon) blood sample will be taken from a vein in your arm. Finally, a qualified radiologist will examine both you Achilles tendons using a soft tissue diagnostic ultrasound machine. This procedure entails putting a clear jelly on your skin, and then using a probe to examine the tendon by passing it over the skin. This is not associated with any discomfort.

After you complete the race, you will be asked to undergo the same procedure (blood collection and ultrasound examination) in the medical facility at the finish. If possible, you will be asked to report to a medical centre close to your home for a final ultrasound examination approximately 6

weeks after the race. The cost of this will be free, but you will not receive any financial compensation to attend this centre.

**Potential risks of this component of the study**

- The completion of a questionnaire is not associated with any risk. 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 subjects.
- The potential risks to you during blood collection are minimal and are related to 1) blood sample collection technique, and 2) the volume of blood collected prior to racing and the potential risk of a decreased performance in the race. The potential risks associated with blood collection technique from the ante-cubital veins are: infection, delayed healing, haematoma, physical pain, mental discomfort and injury to a nerve or a vessel. These risks are small and will be minimized by the use of trained phlebotomists, use of sterile techniques and the use of disposable, single use materials. The risk of decreased performance as a result of blood collection will be reduced by not subjecting any participant to the collection of a blood volume exceeding 15ml prior to the race.
- Soft tissue diagnostic ultrasound is a well described and common clinical diagnostic procedure that is associated with no known risk. This procedure will be undertaken by a trained radiologist.

**Potential benefits of this component of the study**

- The anticipated benefits of this component of the study are that the results will clarify why certain triathletes may be more or less prone to chronic tendon injuries, based on their genetic make-up. In future, this work may lead to the screening and early identification of an increased risk for tendon injuries, so that preventative measures can be undertaken.

## Component 6: A study to determine the relationship between training history, perception of effort during the race and the subsequent recovery after the race

**General information**

The purpose of this component of the study is to investigate whether the strain experienced in the recovery period after an Ironman is directly proportional to the perception of effort and racing intensity in a group of similarly trained triathletes. The answer to this question has a practical application for training and also contributes to a better understanding of the physiological responses of ultra endurance events.

The research project will involve the following:

- About 1 week before the race you will be asked to complete a questionnaire on your training habits for swimming, cycling and running in preparation for the Ironman and your personal best times for the 3 disciplines. This will take about 30 minutes.
- You will be familiarised with the subjective scores for "perception of effort rating" and "pain assessment" before the race.
- During the race researchers will be allocated to about 12 stages throughout the race. As you swim, run or cycle past these researchers they will hold up two boards with the scores for "perception of effort rating" and "pain assessment". You will be asked to shout out your respective scores as you go past them and they will record these scores against your race number.
- You will be sent an email on a daily basis for a week after the race with a short questionnaire on your subjective perception of recovery. This questionnaire will take about 2 minutes to complete. Thereafter, you will be sent an email on a weekly basis for 12 weeks with the same short questionnaire.
- Blood samples after the race will be obtained 1, 3, 5, 7 and 9 days later for the measurement of creatine kinase.

**Potential risks of this component of the study**

- The completion of a questionnaire is not associated with any risk. 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 subjects.
- The potential risks to you during blood collection are minimal and are related to 1) blood sample collection technique, and 2) the volume of blood collected prior to racing and the potential risk of a decreased performance in the race. The potential risks associated with blood collection technique from the ante-cubital veins are: infection, delayed healing, haematoma, physical pain, mental discomfort and injury to a nerve or a vessel. These risks are small and will be minimized by the use of trained phlebotomists, use of sterile techniques and the use of disposable, single use materials. The risk of decreased performance as a result of blood collection will be reduced by not subjecting any participant to the collection of a blood volume exceeding 15ml prior to the race.
- Data for this component of the study will involve contact with subjects during the race. There is a potential risk that in the process of data collection, the performance of subjects in the race will be interfered with. This risk will be minimal, as the nature of the data collection is such that subjects will only be asked to shout out two numbers as they pass members of the research team at designated points in the race. However, should triathletes feel that this

affects their performance during the race; they will be free to withdraw from this component of the study. There will be no interference with other race participants during this data collection process.

**Potential benefits of this component of the study**

- The anticipated benefits of this component of the study are firstly that subjects will receive a full summary of their individual results, as well as the overall findings from this component of the study. Secondly, and more specifically, the individual results will include information about their training and development of fatigue during the race which will be of interest. Finally, these results may assist triathletes in modifying their training to improve their performance.

# Appendix 4

## SUBJECT INFORMATION SHEET - 2007

Dear Tri-athlete

We have the privilege to inform you that scientific research at the Port Elizabeth Spec-Savers Ironman South Africa triathlon has been planned in collaboration with the MRC/UCT Research Unit for Exercise Science and Sports Medicine based at the Sports Science Institute of South Africa. This will provide a unique opportunity for a research programme to address important medical and physiological problems associated with the Ironman triathlon. Each participant will be able to access a summary of the findings of the study, once it has been completed. The research study will concentrate on the following 6 main components that will ultimately lead to an **improvement in medical and physiological knowledge which may improve training strategies and medical treatment** at future triathlons and other endurance events:

- Management of the collapsed tri-athlete
- Causes of exercise associated muscle cramping (EAMC) in Ironman triathletes
- Pain coping strategies in Ironman Triathletes
- Genetic basis for performance, physiological responses and medical complications during an Ironman Triathlon
- Neural fatigue following an Ironman Triathlon

As a participant in the Port Elizabeth Spec-Savers Ironman South Africa triathlon, you will be given the choice to participate in this research effort. Your participation is entirely voluntary. Please read through the details of the following six components of the study. You will be given the opportunity to participate in one or more components of the study. The details of each component are explained in this document, and if you wish to participate in one or more components of the study, please read through and sign the INFORMED CONSENT FORMS that relate to each component of the study. Please feel free to contact members of the research team should you have any questions related to

the study (or any component of the study). Contact details of the research team are as follows: Ironman@sports.uct.ac.za or (021) 650 4567

SUBJECT INFORMATION SHEET:

COMPONENTS OF THE RESEARCH STUDY TO BE CONDUCTED AT THE 2007 IRONMAN TRIATHLON IN PORT ELIZABETH



**The research study at the 2007 Spec-Savers Ironman South Africa triathlon, comprise of six components. The detailed information on each of these components of the study is as follows:**

**Component 1: Management of the collapsed Tri-athlete**

**General information:**

The aim of this study is to evaluate the optimum treatment strategies for which to treat collapsed tri-athletes, after an Ironman race. Although intravenous (fluid that is infused through a needle into one of your veins – also referred to as IV fluid) fluid replacement is a common practice in the treatment of collapsed tri-athletes, medical personnel need to be advised of a treatment method that will prevent possible fluid overload, which can cause hyponatraemia. Hyponatraemia can be a very severe condition. Your participation in this trial will aid in the understanding and management of how best to correct any fluid imbalance following this race.

If you collapse during or after the Ironman Triathlon and are brought into the medical tent, you will be evaluated and treated according to the current best standard of care principles. Your legs will be elevated and your heart rate, blood pressure, mental status and serum sodium concentration will be measured. If you are confused and your sodium level is normal, other laboratory tests will be performed such as an evaluation of your

body temperature and blood sugar levels. If your body temperature is normal and do not have evidence for another treatable medical condition, a small needle and tube will be placed into a vein in your arm. The appropriate fluid (into your vein or drinking normally by mouth) (ad libitum – you chose how much you wish to drink) – will be given to you until you recover and can leave the medical tent without assistance. Your discharge will be at the discretion of the supervising medical officer. If your condition deteriorates at any time, you will be immediately removed from the trial, treated appropriately and transported to the nearest hospital. At all stages of the research study and medical care, the highest standard of safety and medical country as practiced in this country will be adhered to.

The risk of adverse affects of placement of an intravenous line include: infection, delayed healing, bruising, physical pain, mental discomfort and possible injury to a nerve or vessel. The risk of these adverse effects are rare and every attempt to minimize these risks will be undertaken by the use of sterile technique and use of disposable, single use, material. Your blood will be used for evaluation of serum sodium or blood glucose concentration only. No other tests will be performed on your blood and your blood samples will be appropriately discarded after these tests are performed.

We will obey the strict practices of confidentiality and anonymity. Each subject's identity will be known only to the researchers and numbers will be assigned to each sample in lieu of names. No results will be publicly available and the scientific publication of results will never disclose subject identity. Upon specific request, data such as electrolyte analyses will be made available to subjects.



**Potential risks of this component of the study**

- The completion of personal details, racing, training, equipment use, medical, supplement use, fluid use and lifestyle history questionnaires are not associated with any risk. Completion of self-rated behavioral questionnaires has not previously been shown to be associated with risk. A potential risk is that people who have experienced significant past trauma will find questionnaires on this uncomfortable. The questions within the behavioral questionnaires are asking are about temperament and none of the scales are directed at picking up psychopathology. 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 subjects.

- The risks associated with participation in this component of the study do not exceed the risks associated with competing in the Ironman competition. The administration of fluid into your vein will involve an invasive placement of an intravenous line (a small needle and tube). The risks associated with the placement of an intravenous line include: infection, delayed healing, hematoma, physical pain, mental discomfort and injury to a nerve or vessel. These risks will be minimized by the use of trained phlebotomists, sterile technique and disposable, single use materials. If at any time the condition of a collapsed tri-athlete deteriorates, the most appropriate treatment will be initiated, the trial terminated and the patient will be transported to the local hospital if necessary. The support form the local hospital is part of the normal standard medical care associated with this event.

**Potential benefits of this component of the study**

- The data collected in this component of the study will aid in the development of optimal treatment strategies for collapsed tri-athletes. Although fluid replacement directly into your vein is a common practice in the treatment of collapsed tri-athletes, medical personnel need to be advised of a more judicious approach to treatment as to avoid the deleterious effects of fluid overload (hyponatraemia). This information will aid in the understanding and management of serum sodium disorders in collapsed tri-athletes by scientifically 1) evaluating the efficacy of fluid replacement directly into your vein versus oral rehydration and 2) assessing if the normalization of serum sodium levels are important in the recovery of collapsed tri-athletes.

**Component 2: Causes of Exercise Associated Muscle Cramping (EAMC) in Ironman Triathletes**

**General information**

The purpose of this component of the study is to determine the possible cause of exercise associated muscle cramping (EAMC) in endurance athletes. Tri-athletes will be contacted as soon as possible and given the opportunity to volunteer to participate in

this component of the study. Anyone who owns a recording heart rate monitor will be eligible to participate.
Details of the study are as follows:

- A questionnaire detailing personal particulars, training and racing history, psychological and behavioural, medical information, and history of muscle cramping will be completed.
- Each triathlete will be asked to send a file via email to the Sports Science Institute of their weekly heart rate data as recorded during their training and racing using their personal recording heart rate monitors.
- You will be asked to complete a questionnaire on your training habits for swimming, cycling and running in preparation for the Ironman and your personal best times for the 3 disciplines.
- You will be familiarized with the subjective scores for *"perception of effort rating"* before the race. During the race researchers will be allocated to about 12 stages throughout the race. As you swim, run or cycle past these researchers they will hold up a board with the scores for *"perception of effort rating"*. You will be asked to shout out your score as you go past them and they will record these scores against your race number.

**Potential risks of this component of the study**

- The completion of personal details, racing, training, equipment use, medical, supplement use, fluid use and lifestyle history questionnaires are not associated with any risk. Completion of self-rated behavioral questionnaires has not previously been shown to be associated with risk. A potential risk is that people who have experienced significant past trauma will find questionnaires on this uncomfortable. The questions within the behavioral questionnaires are asking are about temperament and none of the scales are directed at picking up psychopathology. 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 subjects.
- Data for this component of the study will involve contact with subjects during the race. There is a potential risk that in the process of data collection, the performance of subjects in the race will be interfered with. This risk will be minimal, as the nature

of the data collection is such that subjects will only be asked to shout out a number as they pass members of the research team at designated points in the race. However, should tri-athletes feel that this affects their performance during the race; they will be free to withdraw from this component of the study during the race. There will be no interference with other race participants during this data collection process.

**Potential benefits of this component of the study**

- The anticipated benefits of this component of the study are that the results will further our understanding of the possible cause/s of EAMC in endurance athletes. In particular, once the aetiology of EAMC is better understood, this will improve our ability to prevent this condition.



**Component 3: Pain coping strategies in Ironman Triathletes**

**General information**

The purpose of this component of the research study is to determine if athletes participating in an endurance event (such as the Ironman) use a common coping strategy to endure pain that is related to exercise.

- Before the race you will be required to visit a centre, designated to your area (either in Cape Town, Port Elisabeth, Durban, Bloemfontein or Johannesburg), where you will be asked to complete a questionnaire with personal details, training details, past injury, pain and medical details, details about family history and a psychological questionnaire. You will also be asked to perform a stroop test. The stroop test is a simple, computer based test. The mental concentration that is required for the test is relevant for the data collection and not the outcome of the test. During the test your heart rate variability will be recorded. This procedure entails wearing a heart rate monitor strapped around your chest. This procedure is not associated with any discomfort. While the EEG recordings themselves are completely painless, a slight (1) measure of discomfort may be experienced when the electro-cap is pulled (2) over the scalp - similar to pulling a swimming cap over the scalp. (3) When the electro gel is applied it may feel cold and sludgy - cleaning towels and water will be

available to freshen up afterwards. In addition, your pain threshold will be assessed with a digital probe. As the onset of pain will be assessed, this procedure is associated with minimal discomfort. You will also be familiarised with the subjective scores for *"perception of effort rating" and "pain assessment" before* the race.

- During the three days of registration before the event and immediately after the event, the Stroop test and the concomitant recording of the heart rate variability will be repeated.
- The assessment of the pain threshold level will be repeated immediately before and after the race, together with a recording of the athletes' feelings/mood.
- During the race researchers will be allocated to about 12 stages throughout the race. As you swim, run or cycle past these researchers they will hold up two boards with the scores for *"perception of effort rating"* and *"pain assessment"*. You will be asked to shout out their respective scores as they go pass.

**Potential risks of this component of the study**

- The completion of personal details, racing, training, equipment use, medical, supplement use, fluid use and lifestyle history questionnaires are not associated with any risk. Completion of self-rated behavioral questionnaires has not previously been shown to be associated with risk. A potential risk is that people who have experienced significant past trauma will find questionnaires on this uncomfortable. The questions within the behavioral questionnaires are asking are about temperament and none of the scales are directed at picking up psychopathology. 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 subjects.
- There is no risk associated with the recording of the heart rate variability.
- There is no risk associated with the assessment of the pain threshold with the digital pain probe. As the onset of pain is determined, the discomfort is minimal.
- During the race researchers will be allocated to about 12 stages throughout the race. As the athletes swim, run or cycle past these researchers they will hold up two boards with the scores for *"perception of effort rating"* and *"pain assessment"*. The athletes will be asked to shout out their respective scores as they go past them and these scores will be recorded against the athlete's race number. Data for this component of the study will involve contact with subjects during the race. There is a

potential risk that in the process of data collection, the performance of subjects in the race will interfere with. This risk will be minimal, as the nature of the data collection is such that subjects will only be asked to shout out two numbers as they pass members of the research team at designated points in the race. However, should tri-athletes feel that this affects their performance during the race; they will be free to withdraw from this component of the study. There will be no interference with other race participants during this data collection process.

**Potential benefits of this component of the study**

- The identification of coping strategies in athletes with regards to pain will help to teach similar coping strategies to patients with chronic pain conditions in order to improve their quality of life.

**Component 4: Genetic basis for performance, physiological responses and medical complications during an Ironman Triathlon**

This study will be conducted by the UCT/MRC Research Unit for Exercise Science and Sports Medicine at the University of Cape Town in Cape Town, South Africa, in conjunction with the Molecular Genetics Department B and Laboratory of Forensic Genetics of the Cyprus Institute of Neurology and Genetics in Nicosia, Cyprus.

The study involves donate ten millilitres (2 teaspoons) of venous blood and this will be done at one of the pre-race facilities (either in Cape Town, Port Elisabeth, Durban, Bloemfontein or Johannesburg) or at race registration. The sample will be used for the extraction and analysis of genetic material (DNA).

The DNA will only be used for scientific research purposes relating to the genetic basis of (1) athletic ability, (2) physiological response to and (3) medical complaints during ultra-endurance events. Personal particulars and sporting and medical questionnaires will have to be completed and this information will be treated with the strictest confidentiality and will only be used for scientific research purposes. All data will be analyzed anonymously and DNA samples will be destroyed on completion of the study.

Part of the DNA extracted form the donated blood sample will be sent to the Cyprus Institute of Neurology and Genetics in Cyprus for analysis. DNA samples will be shipped to and analyzed in Cyprus anonymously. DNA will be genotyped (analyzed) for variations (polymorphisms) within genes relating to the genetic basis of athletic ability, physiological response to and (3) medical complaints during ultra-endurance events.

**Potential risks of this component of the study**

- The completion of personal details, racing, training, equipment use, medical, supplement use, fluid use and lifestyle history questionnaires are not associated with any risk. Completion of self-rated behavioral questionnaires has not previously been shown to be associated with risk. A potential risk is that people who have experienced significant past trauma will find questionnaires on this uncomfortable. The questions within the behavioral questionnaires are asking are about temperament and none of the scales are directed at picking up psychopathology. 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 subjects.
- The potential risks to you during blood collection are minimal and are related to 1) blood sample collection technique, and 2) the volume of blood collected prior to racing and the potential risk of a decreased performance in the race. The potential risks associated with blood collection technique from the ante-cubital veins are: infection, delayed healing, haematoma, physical pain, mental discomfort and injury to a nerve or a vessel. These risks are small and will be minimized by the use of trained phlebotomists, use of sterile techniques and the use of disposable, single use materials. The risk of decreased performance as a result of blood collection will be reduced by not subjecting any participant to the collection of a blood volume exceeding 15ml prior to the race.

**Potential benefits of this component of the study**

- There is not direct benefit in participating in this component of the study. The long term anticipated benefits of this component of the research study are to identify genetic factors that may predispose to 1) improved performance or 2) increased risk of medical consequences (such as abnormal electrolyte imbalances). This information will eventually assist tri-athletes in predicting and improving their

performance, and decrease their risk of medical complications during participation in triathlon.

**Component 5: Neural fatigue following an Ironman Triathlon**

The aim of this study is to increase our understanding of the extent of neural processing slowdown/changes and arousal changes that occur in tri-athletes having just completed an exhaustive Ironman Triathlon. Since this component of the study requires completion of a familiarization test 6 weeks prior to the event, in Newlands, Cape Town, only Cape Town based competitors will be considered for this component.

The way we will test for neural processing changes is by way of a repetitive reaction time cognitive test – a computer generated Stroop test – whereby participants have to respond to the color of 4 different color words presented in the centre of the laptop screen. The 4 color words, red, blue, green and yellow will be presented on the screen in a different color to what the word says, e.g. red written in blue ink, or green written in yellow. To ensure that participants read the words, 20% of the 4 color words will be presented in grey – in this case participants have to respond to the word (i.e. not the color).
Arousal changes will be determined from heart rate variability (HRV) and the electroencephalogram (EEG) power spectrum.

A familiarization test will be conducted 6 weeks prior to the Ironman in the EEG room at the MRC/UCT Research Unit for Exercise Science and Sports Medicine, which is located at the Sports Science Institute of South Africa. A further pre-event test will be conducted the day before the Ironman during registration in a separate tent; and finally a post-event test will be done within 30 min of completing the Ironman in the same tent.

We will be using a portable Biopac MP150 W System to record the EEG and HRV data. The measurements are completely non-invasive and harmless and will be collected by way of a neoprene scull cap containing 20 electrodes for the EEG data and 3 electrodes attached to both wrists and the left ankle to record HRV data.

The anticipated benefits of this component of the study are that the results will further our understanding of the deterioration of neural processing in athletes completing extreme endurance exercise. If significant deterioration in brain processing is indeed found, strategies can be implemented to combat this, whether by dietary, training or psychological means.

**Potential risks of this component of the study**

- The completion of a questionnaire is not associated with any risk. Completion of self-rated behavioral questionnaires has not previously been shown to be associated with risk. A potential risk is that people who have experienced significant past trauma will find questionnaires on this uncomfortable. The questions within the behavioral questionnaires are asking are about temperament and none of the scales are directed at picking up psychopathology. 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 subjects.
- There is no risk associated with the recording of the heart rate variability.
- There is no risk associated with the recording of the Stroop test
- There is no risk associated with the recording of an EEG

**Potential benefits of this component of the study**

- There is not direct benefit in participating in this component of the study. The long term anticipated benefits of this component of the research study are to identify genetic factors that may predispose to 1) improved performance or 2) increased risk of medical consequences (such as abnormal electrolyte imbalances). This information will eventually assist tri-athletes in predicting and improving their performance, and decrease their risk of medical complications during participation in triathlon.

**Component 6: Factors associated with gastro-intestinal (GIT) distress in Ironman triathletes**

It is well established that gastrointestinal (GIT) symptoms (nausea, vomiting, abdominal cramps, urge to defecate (passing a stool), diarrhea or blood in the stool) are common

amongst endurance athletes. In a study conducted by our Unit during the 2006 Ironman triathlon about 40% of athletes indicated that they suffered from GIT symptoms. Furthermore, most of the symptoms were lower GIT symptoms (urge to defecate, diarrhea or blood in the stool). However, we do not yet know the precise causes of these symptoms. It is believed that lower GIT symptoms could be related to a decrease in blood flow to the small and large bowel, because blood flow is diverted from the GIT to the working muscle during exercise. Furthermore, dehydration may add to this problem. Other possible mechanisms are dietary (increased fibre intake), psychological stress, mechanical movement of the bowel (mainly during running) and hormonal (increased secretion of hormones affecting gastro-intestinal motility). In this component of the research project, we wish to identify some of the possible mechanism for these symptoms, so that medical care can be improved.

The main aims of this study are to identify possible etiological factors that are associated with GIT complaints experienced by the triathletes. More specifically, the following will be measured:

- To establish an association between the development of GIT symptoms during the race and pre-race dietary habits, pre-race emotional stress factors and other medical conditions (past history of surgery, past history of GIT disease, age, gender, training etc.) (obtained through a pre-race questionnaire)
- To establish whether there is a significant difference in the blood flow to the small and large bowel (celiac artery and superior mesenteric artery blood flow immediately pre- and post-exercise and between triathletes who developed GIT symptoms and those who did not develop any GIT symptoms during the race
- To establish whether the athletes with GIT complaints during the race have a higher risk of blood in a post-race stool sample
- To ascertain whether GIT symptoms are associated with dehydration (as measured by changes in pre- post-race body weight)

This study involves the following. You will be contacted prior to the event via email or will be given information at the time of registration. Once you have volunteered, and have given consent to participate, you will be asked to complete a Medical Questionnaire (Appendix). You will also be contacted again two weeks after the race via email and asked to answer another brief medical questionnaire.

At either a designated research centre, or at registration in Port Elizabeth, you will have a Doppler abdominal ultrasound to determine blood flow in your celiac artery (CA) and superior mesenteric artery (SMA) (prior to the race during the registration). This procedure is similar to the ultrasound done in pregnant women to screen for abnormalities in the baby. You will be asked to lie on an examination couch on your back with the abdomen (rib cage to the pubic bone exposed). A gel will be applied to your skin, and the radiologist will move the scanning probe across the skin. This is not associated with any pain or discomfort and the procedure lasts about 5-10 minutes. Your heart rate and brachial artery blood pressure will be obtained at the same time as the ultrasound.

After the race you will be asked to have a repeat ultrasound, immediately on completing the event. Heart rate and brachial artery blood pressure will again be obtained at the same time as the ultrasound.

Stool samples will be obtained from you (should you agree to this part) after the race. This involves collecting a sample from you after the race, in a designated container, which you can hand to the research staff for analysis for traces of blood.



**Potential risks of this component of the study**

- The completion of the medical questionnaire is not associated with any risk. 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 subjects.
- Abdominal ultrasound: There are no known risks of an abdominal ultrasound in healthy individuals.

**Potential benefits of this component of the study**

- There is not direct benefit in participating in this component of the study. The long term anticipated benefits of this component of the research study are to identify factors that may cause gastrointestinal symptoms in triathletes. This information may lead to 1) lower risk of developing these symptoms and 2) improved medical care of triathletes that develop these symptoms.

# Appendix 5

# INFORMED CONSENT FORM - 2006

## THE PORT ELIZABETH IRONMAN TRIATHLON 2006: MEDICAL CONSEQUENCES FOLLOWING ENDURANCE SPORTS RESEARCH PROJECT

I, _____, agree voluntarily to participate in the UCT/MRC Research Unit for Exercise Science and Sports Medicine's research project with the following components titled:-

- "A study on the management of the collapsed triathlete",
- "A study to determine the cause of Exercise Associated Muscle Cramping (EAMC)",
- "A study to determine the cause of post-exercise upper respiratory tract symptoms",
- "A study to determine the genetic basis for performance and physiological responses during an Ironman Triathlon",
- "A study to determine the genetic risk/s associated with chronic Achilles tendon injuries in triathletes",
- "A study to determine the relationship between training history, perception of effort (RPE) during the race and the subsequent recovery after the race",

performed by the University of Cape Town and the Sports Science Institute of South Africa. I have read the subject information sheets and the following procedures and concepts have been explained to me in full:

1. Completion of a questionnaire: The completion of a questionnaire is not associated with any risk. 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 subjects.

2. Blood sample collection at registration, immediately after the race, and if required in the 14 days after the race: The potential risks to subjects of blood collection are minimal and are related to 1) blood sample collection technique, and 2) the volume of blood collected prior to racing and the potential risk of a decreased performance in the race. The potential risks associated with blood collection technique from the ante-cubital veins are: infection, delayed healing, haematoma, physical pain, mental discomfort and injury to a nerve or a vessel. These risks are small and will be minimized by the use of trained phlebotomists, use of sterile techniques and the use of disposable, single use materials. The risk of decreased performance as a result of blood collection will be reduced by not subjecting any participant to the collection of a blood volume exceeding 25ml prior to the race.

3. Measurement of body weight before and after the race: Body weight will be measured using a standard electronic scale, and there is no risk associated with this procedure.

4. Treatment if I collapse after the race: **(only for the collapsed athlete component)** If I collapse during or after the race I might receive either IV (drip into arm vein) or oral fluids ad libitum (as much fluid as I want). I will be attended to in a separate section of the medical tent under the supervision of a qualified doctor. I will be assessed regularly (every 15 minutes) and I understand that optimum care will be provided to me according to the current standard of care. Treatment will cease when I am alert, oriented, able to walk and when my laboratory tests are normal. I will be transported to the local hospital if my condition requires more urgent medical attention.

5. Treatment if I develop muscle cramps during or after the race: **(only for the cramps component).** If I develop muscle cramps during after the race I will receive treatment in a designated area of the medical facility. Optimum care will be provided to me according to the current standard of care. I will be required to have a rectal temperature measurement taken, blood samples will be collected, body weight will be measured, and I will have surface electrodes attached to my muscle to measure electrical activity. Treatment will cease when my cramps have stopped and I am able to stand up and walk. I will be transported to the local hospital if my condition requires more urgent medical attention.

6. Saliva sample collection at registration, immediately after the race, and if required in the 14 days after the race: **(only for the URT component)** The potential risks associated with saliva sample collection are very small. I may experience transient discomfort as the inner lining of my throat is swabbed with a soft swab. I understand that all the normal precautions will be taken during this procedure, and that it will be undertaken by trained staff.

7. Assessment and treatment of symptoms of the upper respiratory tract in the two weeks after the race: **(only for the URT component)** I understand that should I develop any symptoms of the upper respiratory tract in the 14 days after the race, I will be required to report to a research centre in my home town, to be examined by a doctor, give a blood sample and have a throat swab as well a saliva sample taken. I understand that I will then be treated for my symptoms according to standard medical practice. I understand that I will not receive any financial compensation to attend the centre.

8. Soft tissue diagnostic ultrasound examination: **(only for the Achilles tendon component)** I understand that I will be subjected to a soft tissue diagnostic ultrasound examination of my Achilles tendons during the registration period, on completion of the race, and if possible 6 weeks after the race at a medical facility close to my home. I understand that I will not receive any direct financial compensation to attend this centre for the ultrasound, but that the investigation will be free of charge. I understand that these investigations are not associated with any risk, and will be performed by a trained radiologist.

9. The genetic basis for performance and physiological responses during an Ironman Triathlon as well as to determine the genetic risk/s associated with chronic Achilles tendon injuries in triathletes: **(only for the genetics components)**. These components of the study are been performed in conjunction with the Molecular Genetics Department B and Laboratory of Forensic Genetics of the Cyprus Institute of Neurology and Genetics in Nicosia, Cyprus. At race registration, I have agreed to donate ten ml (2 teaspoon) of venous blood. Half the sample will be used for the extraction and analysis of genetic material (DNA), while the remainder of the sample

will be used to measure serum electrolyte (salt) levels. I also agree to donate an additional five ml (1 teaspoon) of venous blood after the race in the medical tent which will be used to measure post-race serum electrolyte (salt) levels.

The DNA will only be used for scientific research purposes relating to the genetic basis of (1) athletic ability, (2) tendon and ligament overuse injuries and (3) dysnatraemia during ultra-endurance events. I also understand that all data will be analysed anonymously and my DNA sample will be destroyed on completion of the study. I understand that some of the DNA extracted form the donated blood sample will be sent to the Cyprus Institute of Neurology and Genetics in Cyprus for analysis. I understand that the DNA samples will be shipped to and analysed in Cyprus anonymously. I understand that the DNA will be genotyped (analysed) for variations (polymorphisms) within genes relating to the genetic basis of athletic ability, tendon and ligament overuse injuries and dysnatraemia during ultra-endurance events only.

I understand that whilst there is no direct benefit to myself, if a genetic predisposition for (1) athletic ability, (2) tendon and ligament overuse injuries and (3) dysnatraemia during ultra-endurance events can be established, then future generations will be able to establish their risk for this condition. This may allow better prevention and treatment options in the future. I understand that I will receive the overall results of the study.

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, realising that I have the right to request that my DNA sample be destroyed at anytime. I agree that research data provided by me or with my permission during the project 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.

10. Providing information on my rating of effort and fatigue status during the race: **(only for the RPE component)** I understand that I will be required to study and familiarize myself with two scales of perceived effort and fatigue before the race starts. I understand that during the race, at designated stages, I will be required to report (by shouting) my perception of effort and fatigue to members of the research team.

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 triathlete: _____

Signature of triathlete _____

Date: _____

Name of investigator: ___Prof Martin Schwellnus_____

Signature of Investigator: _____

Date: _____ _____

# Appendix 6

# INFORMED CONSENT FORM - 2007

I, _____, agree voluntarily to participate in the following components **(DELETE THOSE COMPONENTS YOU DO NOT AGREE TO PARTICIPATE IN)** of the UCT/MRC Research Unit for Exercise Science and Sports Medicine's, University of Cape Town, research project titled:-

1. "A study on the management of the collapsed tri-athlete",
2. "A study to determine the cause of Exercise Associated Muscle Cramping (EAMC)"
3. "A study on the management of pain in triathlon athletes",
4. "A study to determine the genetic basis for performance, physiological responses and medical complications during an Ironman Triathlon"
5. "A study to determine the extent of neural fatigue in athletes immediately post Ironman triathlon"
6. "Factors associated with gastro-intestinal (GIT) distress in Ironman triathletes"

I understand that my participation in this research project has no direct benefits to me during the Ironman 2007 competition. However, I understand that my participation in the research project will advance the medical and scientific knowledge related to endurance sports. Therefore, information gathered through my participation in this project could advance the future medical care, training advice and performance of endurance athletes.

I have read the subject information sheets and the following procedures and concepts have been explained to me in full:
**(DELETE THOSE COMPONENTS YOU DO NOT AGREE TO PARTICIPATE IN)**

1. **<u>Completion of a questionnaire:</u> (all components)**
   The completion of personal details, racing, training, equipment use, medical, supplement use, fluid use and lifestyle history questionnaires are not associated with any risk. Completion of self-rated behavioral questionnaires has not previously been shown to be associated with risk. A potential risk is that people who have

experienced significant past trauma will find questionnaires on this uncomfortable. The questions within the behavioral questionnaires are asking are about temperament and none of the scales are directed at picking up psychopathology. Any personal identification of subjects (names and surnames), 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 questionnaire information, my performance during the Ironman triathlon, together with all the other data collected from the various components of this trial may be used to answer scientific questions about the medical conditions, physiological responses and measures of performance associated with the participation in and completion of an Ironman triathlon.

2. **Treatment if I collapse after the race: (only for the collapsed athlete component)**

   If I collapse during or after the race I might receive either fluid replacement directly into your vein or oral fluids ad libitum (as much as I want) but according to my post-race blood sodium level. Optimum care will be provided to me according to the current standard of care. Treatment will cease when my laboratory values have returned to normal and I am alert and oriented. I will be transported to the local hospital if my condition requires more urgent medical attention.

3. **Pre- and post-race serum electrolyte (salt) levels and weights (only for the collapsed athlete component)**

   I have agreed to donate 5 milliliters (1 teaspoon) of venous blood during registration and immediately after completing the race in the medical facility. The sample will be used to measure my serum electrolyte (blood salt) levels. The potential risks to subjects of blood collection have been explained and I have agreed to donate ten milliliters (2 teaspoons) of venous blood. The sample will be used for the extraction and analysis of genetic material (DNA). mal and are related to 1) blood sample collection technique, and 2) the volume of blood collected prior to racing and the potential risk of a decreased performance in the race. The potential risks associated with blood collection technique from the ante-cubital veins are: infection, delayed

healing, haematoma, physical pain, mental discomfort and injury to a nerve or a vessel. These risks are small and will be minimized by the use of trained phlebotomists, use of sterile techniques and the use of disposable, single use materials. The risk of decreased performance as a result of blood collection will be reduced by not subjecting any participant to the collection of a blood volume exceeding 15 ml prior to the race.

Body weight will be measured on the morning before the start of the race and immediately after completing the race in the medical facility using a standard electronic scale, and there is no risk associated with this procedure.

4. **Measurement of heart rate data: (only for the cramps component)**
This will be done with the subjects own heart rate monitor used during training and racing. The stored files will be emailed to the researcher at the Sports Science Institute, and will be kept confidential.

5. **Score of perceived exertion during the race: (only for the cramps and the management of pain components)**
During the race researchers will be allocated to about 12 stages throughout the race. As you swim, run or cycle past these researchers they will hold up two boards with the scores for "*perception of effort rating*". You will be asked to shout out your respective scores as you go past them and they will record these scores against your race number. Data for this component of the study will involve contact with subjects during the race. There is a potential risk that in the process of data collection, the performance of subjects in the race will interfere with. This risk will be minimal, as the nature of the data collection is such that subjects will only be asked to shout out two numbers as they pass members of the research team at designated points in the race. However, should tri-athletes feel that this affects their performance during the race; they will be free to withdraw from this component of the study during the race. There will be no interference with other race participants during this data collection process.

6. **<u>Pain during the race:</u> (only for the management of pain components)**
   During the race researchers will be allocated to about 12 stages throughout the race. As you swim, run or cycle past these researchers they will hold up two boards with the scores for "*pain assessment*". You will be asked to shout out your respective scores as you go past them and they will record these scores against your race number. Data for this component of the study will involve contact with subjects during the race. There is a potential risk that in the process of data collection, the performance of subjects in the race will interfere with. This risk will be minimal, as the nature of the data collection is such that subjects will only be asked to shout out two numbers as they pass members of the research team at designated points in the race. However, should tri-athletes feel that this affects their performance during the race; they will be free to withdraw from this component of the study during the race. There will be no interference with other race participants during this data collection process.

7. **<u>Recording of heart rate variability during stroop test:</u> (only for the management of pain components)**
   The stroop test is a simple, computer based test. The mental concentration that is required for the test is relevant for the data collection and not the outcome of the test. There is no risk associated with the recording of the heart rate variability

8. **<u>Pain threshold with a digital pain probe:</u> (only for the management of pain components)**
   There is no risk associated with the assessment of the pain threshold with the digital pain probe. As the onset of pain is determined, the discomfort is minimal.

9. **<u>Brain wave measurements:</u> (only for the neural fatigue)**
   There are no potential risks associated with brain wave measurements, since we are merely recording the underlying electric activity generated by the brain and not stimulating the brain in any way. Similarly, there are also no potential risks associated with measuring the electrical activity generated by the heart. There may be some discomfort experienced by the EEG gel needed to increase the conductivity of the electric signal, but no more so than what would be experienced by applying hair gel to flatten your hair.

10. <u>Blood sample collection for genetic studies:</u> (only for the genetics component)
**At one of the pre-race facilities or at race registration, I have agreed to donate ten milliliters (2 teaspoons) of venous blood. The sample will be used for the extraction and analysis of genetic material (DNA).**

The potential risks to subjects of blood collection are minimal and are related to 1) blood sample collection technique, and 2) the volume of blood collected prior to racing and the potential risk of a decreased performance in the race. The potential risks associated with blood collection technique from the ante-cubital veins are: infection, delayed healing, haematoma, physical pain, mental discomfort and injury to a nerve or a vessel. These risks are small and will be minimized by the use of trained phlebotomists, use of sterile techniques and the use of disposable, single use materials. The risk of decreased performance as a result of blood collection will be reduced by not subjecting any participant to the collection of a blood volume exceeding 15 ml prior to the race.

**The DNA will only be used for scientific research purposes relating to the genetic basis of (1) athletic ability, (2) physiological response to (3) medical complications during ultra-endurance events. I have also agreed to complete personal particulars, training, sporting, measures of behavioral endophenotypes and medical questionnaires and understand that all the information that is collected during the study will be treated with the strictest confidentiality and will only be used for scientific research purposes. 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 reanalyzed without the consent of the individual subjects. I also understand that all data will be analyzed anonymously and my DNA sample will be destroyed on completion of the study.**

**I understand that some of the DNA extracted form the donated blood sample will be sent to the Cyprus Institute of Neurology and Genetics in Cyprus for analysis. I understand that the DNA samples will be shipped to and analyzed in Cyprus**

**anonymously. I understand that the DNA will be genotyped (analyzed) for variations (polymorphisms) within genes relating to the genetic basis of athletic ability, tendon and ligament overuse injuries and dysnatraemia during ultra-endurance events only.**

**I understand that whilst there is no direct benefit to myself, if a genetic predisposition for (1) athletic ability, (2) physiological response to and (3) medical complications during ultra-endurance events can be established, then future generations will be able to establish their risk for this condition. This may allow better prevention and treatment options in the future. I understand that I will receive the overall results of the study.**

**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, realizing that I have the right to request that my DNA sample be destroyed at anytime. I agree that research data provided by me or with my permission during the project 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.**

11. Abdominal ultrasound to determine blood flow to the abdominal organs (only for the GIT component)
    I agree to having a pre-and post-race abdominal ultrasound to measure the blood flow to my abdominal organs.

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 tri-athlete: _____

Signature of tri-athlete _____

Date: _____

Name of investigator: _____Prof Martin Schwellnus____

Signature of Investigator: _____

Date: _____ _____

# Appendix 7


## Department of Human Biology

UCT/MRC Research Unit for Exercise Science & Sports Medicine

Faculty of Health Sciences, University of Cape Town
Private Bag, Rondebosch 7700, South Africa
Tel: + 27 21 650 4561
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## 2006 IRONMAN – MEDICAL AND TRAINING QUESTIONNAIRES

**These questionnaires have been constructed by the Medical Research team, in conjunction with the Medical Director of the Ironman 2006. The information obtained from these questionnaires is essential for the planning of medical care during events such as the Ironman 2006. We acknowledge that the questionnaires are long, but we are asking about 20 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. We suggest that you consider completing this before the event, or at the time of registration.**


**Prof Martin Schwellnus (Chairman, Research Team)**

**Dr Peter Schwartz (Medical Director, Ironman 2006)**




### Instructions

You can either complete the questionnaires electronically using Microsoft word or print the questionnaires and complete them manually. Please answer each question by filling in the details in the allocated space or checking one or more of the option boxes.

If you complete the questionnaire electronically using Microsoft word, please e-mail the completed forms to ironman@sports.uct.ac.za and bring the signed consent form to the research table at race registration.

If you complete the questionnaire manually, please bring the completed forms together with the signed consent form to the research table at race registration.

**Please complete sections A, B, C, D and E**

| Section A: Personal details | | | |
|---|---|---|---|
| 2006 Ironman Race Number | | | |
| Surname | | | |
| First Name | | | |
| Postal Address | | Postal/ Zip Code | |
| E-mail address | | Phone (day time) | code number |
| Date of birth | yyyy-mm-dd | Cell | |
| Height | cm | Gender | Male ☐ Female ☐ |
| Weight | kg | Age | |
| Ethnic group (Only Required and Used for Research Purposes) | Black/African ☐ White ☐ Indian ☐<br>Mixed Ancestry (Coloured) ☐ Asian ☐ Other ☐ | | |
| Ancestry: Tribal or national background (eg Xhosa, Dutch, Zulu, German, Italian) | Father: Unknown ☐ | | |
| | Mother: Unknown ☐ | | |
| Country of Birth | | | |
| Dominant Hand | Left ☐ Right ☐ Both ☐ | Dominant Leg | Left ☐ Right ☐ Both ☐ |
| Occupation | | | |
| What **percentage** of your **working** day is spent in the following activities? | Sitting: ____ %<br>Standing: ____ %<br>Walking (Lower body activity) ____ %<br>Manual Labour (upper and body activity) ____ % | | |

## Section B. Racing and training history

| **Type of triathlon** | **Sprint** | **Standard (1.6, 40, 10)** | **½ Ironman** | **Ironman** |
|---|---|---|---|---|
| Which triathlons have you **ever** participated in? | Yes ☐ No☐ | Yes ☐ No☐ | Yes ☐ No☐ | Yes ☐ No☐ |
| Year of first event | | | | |
| How many events have you **ever** participated in? | | | | |
| How many Olympic (or above) triathlon races have you completed over the **past 2 years**? | | | | |
| Personal best time **ever** | _____ hrs:min | _____ hrs:min | _____ hrs:min | _____ hrs:min |
| What was your time for your last triathlon race during the **past 12 months**? | _____ hrs:min | _____ hrs:min | _____ hrs:min | _____ hrs:min |
| **Type of running event** | **5 km** | **10 km** | **21.1 km** | **42.2 km** |
| Which races have you **ever** participated in? | Yes ☐ No☐ | Yes ☐ No☐ | Yes ☐ No☐ | Yes ☐ No☐ |
| Year of first event | | | | |
| How many events have you **ever** participated in? | | | | |
| Personal best time **ever** | _____ hrs:min | _____ hrs:min | _____ hrs:min | _____ hrs:min |
| What is your best time, in a running race, in the **last 15 weeks**? | _____ hrs:min | _____ hrs:min | _____ hrs:min | _____ hrs:min |

| **Type of event** | **Two Oceans Marathon** | **Comrades Marathon** |
|---|---|---|
| Which races have you **ever** participated in? | Yes ☐ No☐ | Yes ☐ No☐ |
| Year of first event | | |
| How many events have you **ever** participated in? | | |
| Personal best time | _____ hrs:min | _____ hrs:min |

| | | |
|---|---|---|
| What is your best average cycling speed (km/h) in a race over 80 km in the **last 15 weeks**? | Average speed: _____<br>Distance: _____ | km/h;<br>km |
| What is your best swimming performance in the **last 15 weeks**? | Time: _____<br>Distance: _____ | min<br>m |
| What is your predicted time for the entire 2006 Ironman event and each of the three splits? | Entire event: _____<br>Swim: _____<br>Cycle: _____<br>Run: _____ | min<br>min<br>min<br>min |

| Please answer the following questions, with your answers reflecting your average in the **most recent 15 weeks i.e. beginning December 2005 to 18th March, 2006.** | |
|---|---|
| How many days a week did you train during the **last 15 weeks**? | days/week |
| What distances did you train in an average week during the **last 15 weeks**? | Swim: _____ km/week<br>Cycle: _____ km/week<br>Run: _____ km/week |
| How many hours a week did you train in an average week during the **last 15 weeks**? | Swim: _____ hrs/week<br>Cycle: _____ hrs/week<br>Run: _____ hrs/week |
| What **distances** did you train in the week before the race? | Swim: _____ km<br>Cycle: _____ km<br>Run: _____ km |
| How many **hours** did you train in the **week before** the race? | Swim: _____ hours<br>Cycle: _____ hours<br>Run: _____ hours |

| **Flexibility training history** | |
|---|---|
| Do you perform flexibility training (stretching exercises)? | Yes ☐ No ☐ |
| **If YES,** please complete the rest of the flexibility training history section below:-<br>If NO, continue completing the questionnaire from the top of page 5 (Equipment use history). | |
| On average, how many days a week do you perform a stretching session? | days/week |
| On average, how times a day do you perform a stretching session? | times/day |
| Please tick which muscle groups do you include in your stretching session? | ☐ Hamstrings<br>☐ Quadriceps<br>☐ Calf (gastrocnemius)<br>☐ Calf (soleus)<br>☐ Groin (inner thigh)<br>☐ Upper body limbs<br>☐ Other: _____ |
| Please tick when you stretch? (before, during and/or after exercising. You can tick more than one box) | ☐ Before Exercise<br>☐ During Exercise<br>☐ After Exercise |
| When you stretch an individual muscle group, on average, **how long do you hold the stretch** for? | seconds |

| | |
|---|---|
| When you stretch an individual muscle group, on average, **how many times do you stretch the muscle for**? | ☐ Once<br>☐ Twice<br>☐ 3 times<br>☐ 4 times<br>☐ 5 times<br>☐ 6 or more times |

| Equipment use history | |
|---|---|
| Please indicate which type of **bicycle** you use? | ☐ Kuota ☐ Kestrel ☐ Trek<br>☐ Aegis ☐ Litespeed ☐ Softride<br>☐ Felt ☐ Quintana Roo ☐ Javelin<br>☐ Cervelo ☐ Argon 18 ☐ Scott<br>☐ Elite ☐ Specialized ☐ Guru<br>☐ Giant ☐ Other: _____ |
| Please indicate which type of **handle bars** you use? | ☐ Bontrager ☐ HED ☐ Zipp<br>☐ Profile Design ☐ Vision Tech ☐ Oval Concepts<br>☐ Deda ☐ Easton ☐ Syntace<br>☐ Pedalsoft ☐ Kestrel<br>☐ Other: _____ |
| Please indicate which type of **saddle** (Brand - model) you use? | ☐ Selle San Marco- Azoto TriathGel<br>☐ Profile Design- Tri Stryke (with a groove)<br>☐ Selle San Marco- Rever Profil<br>☐ Fizik- Arione Tri<br>☐ Terry<br>☐ Koobi<br>☐ Other: _____ |
| Please indicate which brand of **helmet** you use? | ☐ Trek ☐ Bell ☐ Giro<br>☐ MET ☐ Other: _____ |
| Please indicate which type of **cycling shorts** you use? | ☐ Thin lycra (no padding) ☐ Padded cycling shorts<br>☐ Triathlon shorts with some padding ☐ Swimming costume<br>☐ Other: _____ |
| Do you normally wear **underwear** together with cycling shorts? | ☐ Yes ☐ No |
| Please indicate which type of **cycling shoes** you use? | ☐ Olympic ☐ Nike ☐ Diadora<br>☐ Shimano ☐ Carnac ☐ Sidi<br>☐ Other: _____ |
| Please indicate which type of **kit** you use? | ☐ Anatomic ☐ Nike ☐ Velo<br>☐ Howzit ☐ Adidas ☐ Orca<br>☐ De Soto ☐ Louis Garneau ☐ Quintana Roo<br>☐ Zoot ☐ Other: _____ |
| Please indicate which **brand of running shoe** you use? | ☐ Adidas ☐ Asics ☐ Brooks<br>☐ New Balance ☐ Nike ☐ Mizuno<br>☐ Puma ☐ Reebok ☐ Saucony<br>☐ Other: _____ |

| | |
|---|---|
| Please indicate which **type of running shoe** you use? | ☐ Soft neutral shoe<br>☐ Mild anti-pronation shoe<br>☐ Motion control shoe<br>☐ Light racing shoe<br>☐ Unknown or not sure<br>☐ Other: _____ |

## Section C. History of medication and supplement use

| What medication, if any, are you currently using? (please list) | Name of medication | Years taken |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

| Do you use protective skin sunscreen during training session or when competing? | Yes ☐ No ☐ | ☐ Every session ☐ Most sessions<br>☐ Some sessions ☐ Very occasionally |
|---|---|---|

| 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: _____ | ____ |

| Have you ever used oral corticosteroids (cortisone tablets)? (If **yes**, how long ago?) | Yes ☐ No ☐ | ☐ 3 months ☐ 6 months<br>☐ 12 months ☐ 24 or more months |
|---|---|---|
| Have you ever been given an injection with corticosteroids? (If **yes**, how long ago?) | Yes ☐ No ☐ | ☐ 3 months ☐ 6 months<br>☐ 12 months ☐ 24 or more months |
| Have you ever been given an injection of corticosteroids in or around the **Achilles** tendon? (If **yes**, how many times?) | Yes ☐ No ☐ | ☐ Once ☐ Twice<br>☐ 3 times ☐ >3 times |
| Have you ever used fluoroquinoline antibiotics? (refer to the following list) | Yes ☐ No ☐ | ☐ 3 months ☐ 6 months<br>☐ 12 months ☐ 24 or more months |

**List of some fluoroquinoline antibiotics:**

| | | |
|---|---|---|
| ADCO-CIPRIN | CIPROBAY | SANDOZ CIPROFLOXACIN |
| AVELON | CIPROGEN | TAFLOC |
| BACTIDRON | CPL ALLIANCE CIPROFLOXACIN | TARIVID |
| CIFLOC | DYNAFLOC | TAVANIC |
| CIFRAN | FACTIVE | TEQUIN |
| CIPLA-CIPROFLOXACIN | FLOXIN | UNIQUIN |
| CIPLOXX | MAXAQUIN | UTIN-400 |
| CIPRO-HEXAL | NOROXIN | ZANOCIN |
| | ORPIC | |

| 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<br>_____ glasses wine per week<br>_____ tots of spirits per week | | |

| Fluid Intake | | |
|---|---|---|
| How do you best describe your fluid intake during an ironman triathlon race? | (a) I drink to thirst ☐<br>(b) I drink as much as tolerable ☐<br>(c) I drink according to a predetermined fluid intake schedule ☐<br>(d) I drink to prevent any weight loss during exercise ☐<br>(e) I combine (a) with (c) ☐<br>(f) I combine (b) with (c) ☐<br>(g) Other: _____ ☐ | |
| What percentage of your fluid intake will consist of these beverages? | Water: ☐ 0-25% ☐ 26-50% ☐ 51-75% ☐ 76-100%<br>Sports drink: ☐ 0-25% ☐ 26-50% ☐ 51-75% ☐ 76-100%<br>Coke: ☐ 0-25% ☐ 26-51% ☐ 51-75% ☐ 76-100%<br>Other: ☐ 0-25% ☐ 26-50% ☐ 51-75% ☐ 76-100%<br>Specify other: _____ | |
| What will be your estimated **total** fluid intake be **(if at all)** during the **swim**? | | ml |
| What will be your estimated **total** fluid intake be during the **cycle**? | | ml |
| What will be your estimated **total** fluid intake be during the **run**? | | ml |
| Rank the following sources of information on their importance in formulating your drinking strategy. (1 being most influential and the lowest number being least influential) | _____ Fellow triathletes<br>_____ Coach / trainer<br>_____ Magazines / books<br>_____ Website (please specify: _____)<br>_____ Drinking guidelines from sports associations<br>_____ Adverts<br>_____ Self-experimentation<br>_____ Other: _____ | |

## 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 |
|---|---|---|
| Exercise associated muscle cramps | Yes ☐ No ☐ | ☐ Father ☐ Mother ☐ Brother ☐ Sister ☐ Child ☐ Grandfather ☐ Grandmother |
| Night muscle cramps | Yes ☐ No ☐ | ☐ Father ☐ Mother ☐ Brother ☐ Sister ☐ Child ☐ Grandfather ☐ Grandmother |
| Chronic Achilles tendon injury | Yes ☐ No ☐ | ☐ Father ☐ Mother ☐ Brother ☐ Sister ☐ Child ☐ Grandfather ☐ Grandmother |
| Achilles tendon rupture | Yes ☐ No ☐ | ☐ Father ☐ Mother ☐ Brother ☐ Sister ☐ Child ☐ Grandfather ☐ Grandmother |
| Any ligament injury | Yes ☐ No ☐ | ☐ Father ☐ Mother ☐ Brother ☐ Sister ☐ Child ☐ Grandfather ☐ Grandmother |
| Asthma | Yes ☐ No ☐ | ☐ Father ☐ Mother ☐ Brother ☐ Sister ☐ Child ☐ Grandfather ☐ Grandmother |
| Allergies (in general) | Yes ☐ No ☐ | ☐ Father ☐ Mother ☐ Brother ☐ Sister ☐ Child ☐ Grandfather ☐ Grandmother |
| Heart Disease | Yes ☐ No ☐ | ☐ Father ☐ Mother ☐ Brother ☐ Sister ☐ Child ☐ Grandfather ☐ Grandmother |
| Diabetes | Yes ☐ No ☐ | ☐ Father ☐ Mother ☐ Brother ☐ Sister ☐ Child ☐ Grandfather ☐ Grandmother |

## Section E. Personal general medical history

**In this section, you are asked to read through 14 questions about your personal general medical history. If you answer "yes" to any of questions 1 to 12, please complete the additional questions at the end of the section (section F on page 11).**

| | |
|---|---|
| 1. In the **6 weeks before this race** (from 1st February) did you suffer from any **symptoms of flu** (fever, sore throat, blocked or runny nose, cough, wheeze, muscle aches and pains)? | Yes ☐ No ☐ |
| 2. Have you **ever** in triathlon career suffered from **muscle cramping** during or immediately (within 6 hours) after exercise (in training or competition)? | Yes ☐ No ☐ |
| 3. Have you **ever** in your triathlon career suffered from **a tendon or ligament injury** (pain, swelling, stiffness) in any tendon (including Achilles tendon, knee tendons, and shoulder tendons) or ligaments (partial or complete tear)? | Yes ☐ No ☐ |
| 4. Have you **ever** in your triathlon career **used medicines to treat injuries** in the week **before or during a race** – including anti-inflammatory drugs, cortisone (pills, or injection), or pain killers? | Yes ☐ No ☐ |
| 5. Have you **ever** in your triathlon career suffered **gastrointestinal** symptoms **during exercise** including heartburn, nausea, vomiting, abdominal pain, urge to defecate (pass a stool), diarrhoea, or blood in the stools? | Yes ☐ No ☐ |
| 6. Have you **ever** in your triathlon career suffered from symptoms of the **nervous system** including exercise induced headaches, nerve tingling or loss of sensation? | Yes ☐ No ☐ |
| 7. Have you **ever** in your triathlon or cycling career (in particular with **cycling**) suffered from **injury to the genital area** including genital numbness after cycling, genital pain after cycling, genital swelling or altered sexual function after cycling? | Yes ☐ No ☐ |
| 8. Have you **ever** in your triathlon 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 ☐ |
| 9. 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 ☐ |
| 10. Have you ever **collapsed** (fell down **not because of an accident**, needing medical attention) during, at the finish or after a race or training session? | Yes ☐ No ☐ |
| 11. Do you **currently** suffer from any **symptoms of injury** in the muscles, tendons, bones, ligaments or joints? | Yes ☐ No ☐ |
| 12. Do you **currently**, or did you **in the last year**, suffer from any symptoms of **exercise related skin disease**? | Sunburn: Yes ☐ No ☐<br>Skin cancer: Yes ☐ No ☐<br>Other skin damage resulting sun exposure: Yes ☐ No ☐ |

| | |
|---|---|
| 13. Please tick in which anatomical area you ever had **surgery** performed. | ☐ Head ☐ Neck ☐ Face ☐ Front chest ☐ Back chest ☐ Shoulder ☐ Upper arm ☐ Elbow ☐ Forearm ☐ Wrist ☐ Finger ☐ Lower back ☐ Hip ☐ Thigh ☐ Knee ☐ Lower leg ☐ Achilles ☐ Ankle ☐ Foot ☐ Abdomen ☐ Other (Specify: _____) |

| 14. **Female athletes only:** Please complete the following questions (14a. to 14g.) related to your menstrual cycle and other gynaecological history | |
|---|---|
| 14a. At what age did you start your periods (menstruating)? | (years) |
| 14b. In the last 12 months, how many menstrual cycles did you have? | |
| 14c. Have you ever had irregular menstrual periods in the past? (excluding pregnancy)? | Yes ☐ No ☐ |
| 14d. Have you had a hysterectomy/ovarectomy? | Yes ☐ No ☐ |
| 14e. How many times have you been pregnant? | (times) |
| 14f. What form of contraception are you currently using? | ☐ None ☐ Oral contraceptive pill ☐ Injection ☐ Intra-uterine device ☐ Sterilization (tubes tied) ☐ Other: _____ |
| 14g. If yes to question 14f. above, for oral contraceptive pill, for what reason was the pill prescribed? | ☐ Not applicable ☐ Dermatological ☐ Contraception ☐ Regulate period ☐ Other: _____ |



## THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

If you have answered **YES** to any of the first 11 questions of the Personal General Medical History questionnaollow in section F.

If you have completed the questionnaire manually, please bring the completed forms together with the signed consent form to the research table at race registration.

If you have completed the questionnaire electronically using Microsoft word, please e-mail the completed forms to ironman@sports.uct.ac.za and bring the signed consent form to the research table at race registration.

## Section F. Additional detailed medical history

***(Please complete all the sections to which you answered "Yes" in the Personal general medical history)***

### 1. Flu symptoms in the last 6 weeks

If you answered **YES** to **question 1** in section E, please complete the following two questions related to flu symptoms in the last 6 weeks.

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

### 2. Muscle cramping

If you answered **YES** to **question 2** in section E, please complete the following questions (2a. to 2m.) related to your cramping.

| | |
|---|---|
| (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 exercise** is your cramping associated (You can tick more than one form of exercise)? | ☐ Swimming ☐ Cycling ☐ Running |
| (2d) In the **last 10 races or training sessions**, how many times have you experienced cramping? | Races: _____/10<br>Training sessions: _____/10 |
| (2e) What treatment/s have you had that **successfully relieved** an acute cramp? (can tick more than one) | ☐ Stretching ☐ Resting<br>☐ Drinking fluid ☐ Ice application<br>☐ Massage ☐ Magnesium<br>☐ Salt (tablets or solution)<br>☐ Other (Specify: _____) |
| (2f) At **what point in the race or training run** do you usually first experience cramping? | ☐ First quarter ☐ Second quarter<br>☐ Third quarter ☐ Fourth quarter<br>☐ After the race ☐ 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<br>☐ Quadriceps (thigh) ☐ Foot muscles<br>☐ 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<br>☐ Moderate: 5-15 minutes and you are able to continue exercising<br>☐ Severe: >15 minutes or if you have to STOP exercising | |

## 3. Past Tendon and Ligament Injury History

If you answered **YES** to **question 3** in section E, please complete the following questions (3a. to 3d.) related to your past history of tendon/ligament injury/ies.

| | | **Tendon** | **Longstanding Pain** (Tendionapthy) | **Acute Tear/ Rupture** |
|---|---|---|---|---|
| (3a) Please tick which **tendon/s** you have injured? (next column on the tright)<br><br>Also indicate (tick) if your injured tendon was longsatnding pain (tendinopathy) or an acute tear/rupture | Foot and ankle: | ☐ Achilles tendon<br>☐ Tibialis posterior<br>☐ Plantar fascia | ☐<br>☐<br>☐ | ☐<br>☐<br>☐ |
| | Knee: | ☐ Patellar tendon | ☐ | ☐ |
| | Elbow and wrist: | ☐ Wrist extensor tendon | ☐ | ☐ |
| | Shoulder: | ☐ Rotator cuff | ☐ | ☐ |
| | Other: _____ | | ☐ | ☐ |
| (3b) Please tick which **ligament/s** you have injured? (next column on the tright) | | **Ligament** | **Sprain** | **Complete Tear** |

| | |
|---|---|
| Also indicate if your sprained or completely tore the ligamant. | ☐ Shoulder ligaments<br>☐ Elbow ligaments<br>☐ Wrist ligaments<br>☐ Finger ligaments<br>☐ Knee (ACL)<br>☐ Knee (MCL)<br>☐ Knee (PCL)<br>☐ Knee (LCL)<br>☐ Ankle lateral ligaments<br>☐ Ankle medial ligaments<br>☐ Spinal ligaments<br>☐ Other: _____ |
| (3c) Please tick if you have you ever suffered from any of the following **joint capsule** injuries? | ☐ Acute shoulder dislocation<br>☐ Chronic shoulder instability<br>☐ Other: _____ |
| (3d) Do you suffer from any other **connective tissue or rheumatological diseases** or disorders? (If yes, please specify which one) | Yes ☐ No ☐ (refer to the list on the next page)<br>(If yes, specify: _____) |

| List of some Connective Tissue and/or Rheumatic Diseases and Disorders | | |
|---|---|---|
| Ankylosing Spondylitis | Lipid Storage Diseases | Pseudogout |
| Aspartylglycosaminuria (AGU) | Marfan Syndrome | Reactive Arthritis |
| Behcet's Syndrome | Menkes Kinky Hair Syndrome | Reiter's Syndrome |
| Crohn's Disease | Mucopolysaccharidoses | Relapsing Polychrondritis |
| Discoid Lupus Erythematosus | Myopathies and Dystrophies | Scleroderma |
| Ehlers-Danlos syndrome (EDS) | Ochronosis (Homocystinuria) | Sjogren's Syndrome |
| Eosinophilic Fascitis | Osteogenesis imperfecta (OI) | Systemic Lupus Erythematosus (SLE) |
| Giant Cell (Temporal) Arthritis | Polyarteritis Nodosa | Systemic Sclerosis |
| Gout | Polymyalgia Rheumatica | Wegener's Granulomatosis |
| Hypersentive Vasulatis | Polymyositis & Dermatomyositis | |

## 4. Use of medicines to treat an injury before or during participation

If you answered **YES** to **question 4** in section E, please complete the following two questions related to medicine use for injuries before or during races.

| | |
|---|---|
| (4a) Which of the following medicines have you used in the past to treat an injury **in the week just before** a race? | ☐ Paracetamol (e.g. Panado, Tylenol)<br>☐ Non-steroidal anti-inflammatories (e.g. Voltaren, Cataflam)<br>☐ Cortisone (pills)<br>☐ Cortisone injection<br>☐ Codeine<br>☐ Anti-inflammatory gels/creams/patches<br>☐ Any other pain killers (Specify: _____) |
| (4b) Which of the following medicines have you used in the past to treat an injury **during a race**? | ☐ Paracetamol (e.g. Panado, Tylenol)<br>☐ Non-steroidal anti-inflammatories (e.g. Voltaren, Cataflam)<br>☐ Cortisone (pills)<br>☐ Cortisone injection<br>☐ Codeine<br>☐ Anti-inflammatory gels/creams/patches<br>☐ Any other pain killers (Specify: _____) |

## 5. Gastrointestinal symptoms during exercise

If you answered **YES** to **question 5** in section E, please indicate which gastrointestinal symptoms you have ever suffered from **during exercise** and, how frequently (in the last 12 months and in the last 10 races), and in which type of exercise.

| Symptom | Number of times in the last 12 months **(during exercise)** | Number of times in last 10 races **(during races)** | Tick type of exercise |
|---|---|---|---|
| Nausea | | | ☐ Swimming, ☐ Cycling, ☐ Running |
| Vomiting | | | ☐ Swimming, ☐ Cycling, ☐ Running |
| Heartburn | | | ☐ Swimming, ☐ Cycling, ☐ Running |
| Abdominal pain | | | ☐ Swimming, ☐ Cycling, ☐ Running |
| Urge to pass a stool (defecate) | | | ☐ Swimming, ☐ Cycling, ☐ Running |
| Diarrhoea | | | ☐ Swimming, ☐ Cycling, ☐ Running |
| Passing blood in the stool | | | ☐ Swimming, ☐ Cycling, ☐ Running |

## 6. Diseases of the nervous system

If you answered **YES** to **question 6** in section E, please indicate which nervous disease symptoms you have ever suffered from **during exercise** and, how frequently (in the last 12 months and in the last 10 races), and in which type of exercise.

| Symptom | Number of times in the last 12 months **(during exercise)** | Number of times in last 10 races **(during races)** | Tick type of exercise |
|---|---|---|---|
| Headaches | | | ☐ Swimming, ☐ Cycling, ☐ Running |
| Nerve tingling in the hands | | | ☐ Swimming, ☐ Cycling, ☐ Running |
| Loss of sensation in the hands | | | ☐ Swimming, ☐ Cycling, ☐ Running |

## 7. Genital tract injury during cycling

If you answered **YES** to **question 7** in section E, please indicate which symptoms of genital tract injury have you suffered from **during or after cycling**, how frequently (in the last 10 sessions), how long symptoms last, and what factors prevent or relieve symptoms?

| Symptom | Number of times in the last 10 cycling sessions | Please indicate when the symptoms occur | Please indicate if any of the following reduce or prevent the symptoms (can tick more than one) |
|---|---|---|---|
| Genital numbness | | ☐ Only during cycling<br>☐ During and up to 1 hour after cycling<br>☐ During and 1-24 hours after cycling<br>☐ During and > 24 hours after cycling | ☐ Changing the saddle type<br>☐ Changing the saddle position<br>☐ Using padded cycling shorts<br>☐ Wearing no underwear<br>☐ Wearing additional underwear<br>☐ Other (Specify: _____) |
| Genital pain | | ☐ Only during cycling<br>☐ During and up to 1 hour after cycling<br>☐ During and 1-24 hours after cycling<br>☐ During and > 24 hours after cycling | ☐ Changing the saddle type<br>☐ Changing the saddle position<br>☐ Using padded cycling shorts<br>☐ Wearing no underwear<br>☐ Wearing additional underwear<br>☐ Other (Specify: _____) |
| Genital bruising | | ☐ Only during cycling<br>☐ During and up to 1 hour after cycling<br>☐ During and 1-24 hours after cycling<br>☐ During and > 24 hours after cycling | ☐ Changing the saddle type<br>☐ Changing the saddle position<br>☐ Using padded cycling shorts<br>☐ Wearing no underwear<br>☐ Wearing additional underwear<br>☐ Other (Specify: _____) |
| Altered sexual function following a cycling session | | ☐ Up to 1 hour after cycling<br>☐ 1-24 hours after cycling<br>☐ > 24 hours after cycling | ☐ Changing the saddle type<br>☐ Changing the saddle position<br>☐ Using padded cycling shorts<br>☐ Wearing no underwear<br>☐ Wearing additional underwear<br>☐ Other (Specify: _____) |

## 8. Allergy history

If you answered **YES** to **question 8** in section E, please complete the following questions (8a. to 8e.) related to your current and past history of allergies.

| **(8a) Please indicate how long (years) have you been suffering from allergies?** | | | | | years |
|---|---|---|---|---|---|
| **(8b) Please tick which <u>type of allergy</u> 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 ☐ | Other | |
| **(8c) 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 ☐ | Other | |
| **(8d) 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 ☐ |
| **(8e) 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<br>☐ July ☐ Aug ☐ Sept ☐ Oct ☐ Nov ☐ Dec | | | | |
| **(8f) 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 ☐ | Other | |

## 9. Asthma history

If you answered **YES** to **question 9** in section E, please complete the following questions (9a. to 9k.) related to your current history of asthma

| | |
|---|---|
| (9a) Do you currently suffer from asthma? | Yes ☐ No ☐ |
| (9b) How many years have you suffered from asthma? | (years) |
| (9c) How was your asthma diagnosed? | ☐ A doctor taking a history and performing an examination<br>☐ Lung function test (blow test) but no exercise<br>☐ Lung function test (blow test) before and after exercise<br>☐ Metacholine challenge test<br>☐ Eucapnic hyperventilation test (rebreathing test)<br>☐ Other test (Specify: _____) |
| (9d) Which **type of asthma** do you currently suffer from? | ☐ Asthma that occurs at any time but not during exercise<br>☐ Asthma that occurs at any time including during exercise<br>☐ Asthma that only occurs during exercise |
| (9e) 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)**<br>☐ < 2 / week ☐ 2-4 / week ☐ >4 / week ☐ All the time<br>**Night time symptoms (per month)**<br>☐ < 1 / month ☐ 2-3 / month ☐ ≥4 / month ☐ All the time<br>**Exercise related symptoms (per 10 exercise sessions)**<br>☐ <1 per 10 sessions ☐ 2-3 per 10 sessions ☐ ≥4 per 10 sessions |
| (9f) 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<br>☐ 1-2 hospital admissions for asthma in the last 12 months<br>☐ 3-4 hospital admissions for asthma in the last 12 months<br>☐ >4 hospital admissions for asthma in the last 12 months |
| (9g) Which **symptoms of asthma** do you currently suffer from? | ☐ Wheezing ☐ Dry cough ☐ Shortness of breath<br>☐ Tight chest ☐ Chest pain<br>☐ Other (Specify: _____) |

| | |
|---|---|
| (9h) 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)<br>☐ Salbutamol (bronchodilator) inhaler (e.g. Ventolin, Venteze, Vomax, Airomir, Asthavent etc.)<br>☐ Salmeterol (bronchodilator) inhaler (Serevent)<br>☐ Fenoterol (bronchodilator) inhaler (Berotec)<br>☐ Terbutaline (bronchodilator) inhaler (Bricanyl)<br>☐ Formoterol (bronchodilator) inhaler (e.g. Foradil, Foratec, Oxis)<br>☐ Ipratropium (bronchodilator) inhaler (Atrovent)<br>☐ Tiotropium (bronchodilator) inhaler (Spiriva)<br>☐ Combined cortisone and bronchodilator inhaler (e.g. Atrovent, Berodual, Combivent, Duolin, Duovent, Seretide, Symbicord)<br>☐ Cortisone tablets<br>☐ Bronchodilator tablets<br>☐ Leukotriene receptor antagonist tablets (e.g. Acccolate, Singulair)<br>☐ Other inhaler<br>☐ Other medication (Specify: _____) |
| (9i) **When do you use your medication** for your asthma? | ☐ Daily (irrespective of exercise) ☐ Only before exercise<br>☐ Other (Specify: _____) |
| (9j) **How long before an exercise session** do you use your medication for asthma? | min |
| (9k) Have you obtained **TUE (therapeutic use exemption forms)** for your asthma medication? | Yes ☐ No ☐ |

## 10. History of previous collapse

If you answered **YES** to **question 10** in section E, please complete the following questions (10a. to 10d.) related to your current history of asthma

| | |
|---|---|
| (10a) Have you collapsed during training or racing? | ☐ Training<br>☐ Racing<br>☐ Training and racing |
| (10b) How many times have you collapsed in training session or races during the last **five years**? | _____ training session<br>_____ races |
| (10c) When you collapse, does it mostly occur before of after the finish line / completion of the training session? | ☐ Before the finish<br>☐ After the finish |
| (10d) What is the cause of you collapse? | ☐ Dehydration<br>☐ Heat illness<br>☐ Hyponatremia<br>☐ Low blood pressure<br>☐ Low blood sugar<br>☐ Other condition (Specify: _____) |

## 11. History of any current injury that you suffer from

If you answered **YES** to **question 11** in section E, please complete the following questions (11a. to 11g.) related to each of your current injury/ies (Space is provided for two injuries)

### Injury 1

| | |
|---|---|
| (11a) What was the approximate date when you first became aware of the injury? | Month Year |
| (11b) Please indicate which side of your body is injured (if applicable) | ☐ Right ☐ Left |
| (11c) Please indicate which anatomical area is currently injured | ☐ Head ☐ Neck ☐ Face ☐ Front chest ☐ Back chest ☐ Shoulder ☐ Upper arm ☐ Elbow ☐ Forearm ☐ Wrist ☐ Finger ☐ Lower back ☐ Hip ☐ Thigh ☐ Hamstring ☐ Quadriceps ☐ Knee ☐ Shin ☐ Achilles ☐ Ankle ☐ Foot<br>Other (Specify: _____) |
| (11d) Please indicate the type of structure that was injured | ☐ Muscle ☐ Tendon ☐ Bone ☐ Ligament ☐ Joint<br>Other (Specify: _____) |
| (11e) Please indicate in which sport (discipline) the injury occurred | ☐ Running ☐ Cycling ☐ Swimming<br>Other (Specify: _____) |
| (11f) Please indicate the severity of the injury (tick one box please) | ☐ I only experience symptoms after exercise - Grade 1<br>☐ I experience symptoms during exercise, but it does not interfere with exercise - Grade 2<br>☐ I experience symptoms during exercise that may interfere with my training/ competition - Grade 3<br>☐ I am so painful that I may not be able to train or compete - Grade 4 |
| (11g) Please indicate how your injury was treated to date (you can tick more than one)? | ☐ Rest ☐ Stretches ☐ Physiotherapy ☐ Surgery ☐ Strengthening exercises ☐ Equipment change ☐ Tablets ☐ Cortisone injection ☐ Other injection ☐ Orthotics<br>Other (Specify: _____) |

| Injury 2 | | | |
|---|---|---|---|
| (11a) What was the approximate date when you first became aware of the injury? | Month | Year | |
| (11b) Please indicate which side of your body is injured (if applicable) | ☐ Right | ☐ Left | |
| (11c) Please indicate which anatomical area is currently injured | ☐ Head<br>☐ Neck<br>☐ Face<br>☐ Front chest<br>☐ Back chest<br>☐ Shoulder<br>☐ Upper arm | ☐ Elbow<br>☐ Forearm<br>☐ Wrist<br>☐ Finger<br>☐ Lower back<br>☐ Hip<br>☐ Thigh | ☐ Hamstring<br>☐ Quadriceps<br>☐ Knee<br>☐ Shin<br>☐ Achilles<br>☐ Ankle<br>☐ Foot |
| | Other (Specify: _____) | | |
| (11d) Please indicate the type of structure that was injured | ☐ Muscle<br>☐ Tendon<br>☐ Bone | ☐ Ligament<br>☐ Joint | |
| | Other (Specify: _____) | | |
| (11e) Please indicate in which sport (discipline) the injury occurred | ☐ Running<br>☐ Swimming | ☐ Cycling | |
| | Other (Specify: _____) | | |
| (11f) Please indicate the severity of the injury (tick one box please) | ☐ I only experience symptoms after exercise - Grade 1<br>☐ I experience symptoms during exercise, but it does not interfere with exercise - Grade 2<br>☐ I experience symptoms during exercise that may interfere with my training/ competition - Grade 3<br>☐ I am so painful that I may not be able to train or compete - Grade 4 | | |
| (11g) Please indicate how your injury was treated to date (you can tick more than one)? | ☐ Rest<br>☐ Stretches<br>☐ Physiotherapy<br>☐ Surgery<br>☐ Strengthening exercises<br>☐ Equipment change | ☐ Tablets<br>☐ Cortisone injection<br>☐ Other injection<br>☐ Orthotics | |
| | Other (Specify: _____) | | |

# Appendix 8


## Department of Human Biology

UCT/MRC RESEARCH UNIT FOR EXERCISE SCIENCE & SPORTS MEDICINE

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## 2007 IRONMAN – MEDICAL AND TRAINING QUESTIONNAIRES

**These questionnaires have been constructed by the Medical Research team, in conjunction with the Medical Director of the Ironman 2007. The information obtained from these questionnaires is essential for the planning of medical care during events such as the Ironman. We acknowledge that the questionnaires are long, but we are asking about 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. We suggest that you consider downloading and completing this before the event and handing in the completed questionnaire, at the research area during race registration.**


**Prof Martin Schwellnus (Chairman, Research Team)**

**Dr Peter Schwartz (Medical Director, Ironman 2007)**


### Instructions

Please answer each question by filling in the details in the allocated space or checking one or more of the option boxes.
Please bring the completed forms together with the signed consent form to the research table at race registration.

**Please complete sections A, B, C, D, E and F**

| Section A: Personal details | | | |
|---|---|---|---|
| 2007 Ironman Race Number | | | |
| Surname | | | |
| First Name | | | |
| Postal Address | | Postal/ Zip Code | |
| E-mail address | | Phone (day time) | code number |
| Alternate E-mail address | | | |
| Date of birth | yyyy-mm-dd | Cell (Mobile) | |
| Height | cm | Gender | Male ☐ Female ☐ |
| Weight | kg | Age (on race day) | yrs |
| Ethnic group (Only Required and Used for Research Purposes) | Black/African ☐ White ☐ Indian ☐<br>Mixed Ancestry (Coloured) ☐ Asian ☐ Other ☐ | | |
| Ancestry: Tribal or national background (eg Xhosa, Dutch, Zulu, German, Italian) | Father: Unknown ☐ | | |
| | Mother: Unknown ☐ | | |
| Country of Birth | | | |
| Dominant Hand | Left ☐ Right ☐ Both ☐ | Dominant Leg | Left ☐ Right ☐ Both ☐ |
| Occupation | | | |
| What **percentage** of your **working** day is spent in the following activities? | Sitting: ____ %<br>Standing: ____ %<br>Walking (Lower body activity) ____ %<br>Manual Labour (upper and body activity) ____ % | | |
| Did you participate in the research project conducted at the 2006 Ironman in Port Elizabeth | | | Yes ☐ No ☐ |

## Section B. Racing and training history

| **Type of triathlon** | **Standard (1.6, 40, 10)** | **Ironman** |
|---|---|---|
| Which triathlons have you **ever** participated in? | Yes ☐ No☐ | Yes ☐ No☐ |
| Year of first event | | |
| How many triathlon events have you **ever** participated in? | | |
| How many triathlon races have you completed over the **past 2 years**? | | |
| Personal best time **ever** | _____ hrs:min | _____ hrs:min |
| What was your time for your last triathlon race during the **past 12 months**? | _____ hrs:min | _____ hrs:min |

| **Type of running event** | **10 km** | **21.1 km** | **42.2 km** |
|---|---|---|---|
| Which road running races have you **ever** participated in? | Yes ☐ No☐ | Yes ☐ No☐ | Yes ☐ No☐ |
| Year of first event | | | |
| How many events have you **ever** participated in? | | | |
| Personal best time **ever** | _____ min | _____ min | _____ min |
| What is your best time, in a running race, in the **last 15 weeks**? | _____ min | _____ min | _____ min |

| **Type of event** | **Two Oceans Marathon** | **Comrades Marathon** |
|---|---|---|
| Which races have you **ever** participated in? | Yes ☐ No☐ | Yes ☐ No☐ |
| Year of first event | | |
| How many events have you **ever** participated in? | | |
| Personal best time | _____ hrs:min | _____ hrs:min |

| | |
|---|---|
| What is your personal best cycling time in a race between **80 to 120 km** in the **last 15 weeks**? | Time: _____ min<br>Distance: _____ km |

## South African Ironman Triathlon racing history

Did you enter any of the South African Ironman Triathlons?

| | |
|---|---|
| 2000 (Gordon's Bay) | Yes ☐ No☐ Race No _____ |
| 2001 (Gordon's Bay) | Yes ☐ No☐ Race No _____ |
| 2005 (Port Elizabeth) | Yes ☐ No☐ Race No _____ |
| 2006 (Port Elizabeth) | Yes ☐ No☐ Race No _____ |

| | | | |
|---|---|---|---|
| What is your predicted time for the entire 2007 Ironman event and each of the three splits? | Entire event: | _____ | min |
| | Swim: | _____ | min |
| | Cycle: | _____ | min |
| | Run: | _____ | min |

| Please answer the following questions, with your answers reflecting your average in the **most recent 15 weeks i.e. beginning December 2006 to 18th March, 2007.** | |
|---|---|
| Do you train with a heart rate monitor? | Yes ☐ No ☐ |
| Do you race with a heart rate monitor? | Yes ☐ No ☐ |
| Do you record, download and store your heart rate information? | Yes ☐ No ☐ |
| Would you be willing to make your heart rate data available to the research team? | Yes ☐ No ☐ |
| How many days a week did you train during the **last 15 weeks**? | days/week |
| What distances did you train in an average week during the **last 15 weeks**? | Swim: _____ km/week<br>Cycle: _____ km/week<br>Run: _____ km/week |
| How many hours a week did you **train** in an average week during the **last 15 weeks**? | Swim: _____ hrs/week<br>Cycle: _____ hrs/week<br>Run: _____ hrs/week |
| How many hours a week did you **work** in an average week during the **last 15 weeks**? | _____ hrs/week |
| What **distances** did you train in the week before the race? | Swim: _____ km<br>Cycle: _____ km<br>Run: _____ km |
| How many **hours** did you train in the **week before** the race? | Swim: _____ hours<br>Cycle: _____ hours<br>Run: _____ hours |
| How many fast/ hard sessions did you do per week in the **last 8 weeks**? | Swim: _____<br>Cycle: _____<br>Run: _____ |
| Describe briefly the session, including distance, time and recovery interval (if applicable) e.g. 10 x 400m in 75 sec with 60 sec jog recovery between each | |
| What percentage of your weekly training distance was done at race speed or faster (for each discipline)? | Swim: _____ %<br>Cycle: _____ %<br>Run: _____ % |
| How many hours did you train 3 days before the race | Swim: _____ hours<br>Cycle: _____ hours<br>Run: _____ hours |
| How many hours did you train 2 days before the race | Swim: _____ hours<br>Cycle: _____ hours<br>Run: _____ hours |
| How many hours did you train the day before the race | Swim: _____ hours<br>Cycle: _____ hours<br>Run: _____ hours |

| | |
|---|---|
| How did your training commitment affect your social life? | ☐ Not at all<br>☐ A fair amount<br>☐ A lot |

| **Flexibility training history** | |
|---|---|
| Do you perform flexibility training (regular stretching exercises)? | Yes ☐ No ☐ |
| **If YES,** please complete the rest of the flexibility training history section below:-<br>If NO, continue completing the questionnaire from the top of page 5 (Equipment use history). | |
| On average, how many days a week do you perform a stretching session? | days/week |
| On average, how times a day do you perform a stretching session? | times/day |
| Please tick which muscle groups do you include in your stretching session? | ☐ Hamstrings<br>☐ Quadriceps<br>☐ Calf (gastrocnemius)<br>☐ Calf (soleus)<br>☐ Groin (inner thigh)<br>☐ Upper body limbs<br>☐ Other: _____ |
| Please tick when you stretch? (before, during and/or after exercising. You can tick more than one box) | ☐ Before Exercise<br>☐ During Exercise<br>☐ After Exercise |
| When you stretch an individual muscle group, on average, **how long do you hold the stretch** for? | seconds |
| When you stretch an individual muscle group, on average, **how many times do you stretch the muscle for**? | ☐ Once<br>☐ Twice<br>☐ 3 times<br>☐ 4 times<br>☐ 5 times<br>☐ 6 or more times |

| **Equipment use history** |
|---|

| | | | |
|---|---|---|---|
| Please indicate which type of **bicycle** you use? | ☐ Kuota<br>☐ Aegis<br>☐ Felt<br>☐ Cervelo<br>☐ Elite<br>☐ Giant | ☐ Kestrel<br>☐ Litespeed<br>☐ Quintana Roo<br>☐ Argon 18<br>☐ Specialized<br>☐ Other: _____ | ☐ Trek<br>☐ Softride<br>☐ Javelin<br>☐ Scott<br>☐ Guru |
| Please indicate which type of **handle bars** you use? | ☐ Bontrager<br>☐ Profile Design<br>☐ Deda<br>☐ Pedalsoft<br>☐ Other: _____ | ☐ HED<br>☐ Vision Tech<br>☐ Easton<br>☐ Kestrel | ☐ Zipp<br>☐ Oval Concepts<br>☐ Syntace |
| Please indicate which type of **saddle** (Brand - model) you use? | ☐ Selle San Marco- Azoto TriathGel<br>☐ Profile Design- Tri Stryke (with a groove)<br>☐ Selle San Marco- Rever Profil<br>☐ Fizik- Arione Tri<br>☐ Terry<br>☐ Koobi<br>☐ Other: _____ | | |
| Please indicate which brand of **helmet** you use? | ☐ Trek<br>☐ MET | ☐ Bell<br>☐ Other: _____ | ☐ Giro |
| Please indicate which type of **cycling shorts** you use? | ☐ Thin lycra (no padding)<br>☐ Triathlon shorts with some padding<br>☐ Other: _____ | | ☐ Padded cycling shorts<br>☐ Swimming costume |
| Do you normally wear **underwear** together with cycling shorts? | ☐ Yes | ☐ No | |
| Please indicate which type of **cycling shoes** you use? | ☐ Olympic<br>☐ Shimano<br>☐ Other: _____ | ☐ Nike<br>☐ Carnac | ☐ Diadora<br>☐ Sidi |
| Please indicate which type of **kit** you use? | ☐ Anatomic<br>☐ Howzit<br>☐ De Soto<br>☐ Zoot | ☐ Nike<br>☐ Adidas<br>☐ Louis Garneau<br>☐ Other: _____ | ☐ Velo<br>☐ Orca<br>☐ Quintana Roo |
| Please indicate which **brand of running shoe** you use? | ☐ Adidas<br>☐ New Balance<br>☐ Puma<br>☐ Other: _____ | ☐ Asics<br>☐ Nike<br>☐ Reebok | ☐ Brooks<br>☐ Mizuno<br>☐ Saucony |

| | |
|---|---|
| Please indicate which **type of running shoe** you use? | ☐ Soft neutral shoe<br>☐ Mild anti-pronation shoe<br>☐ Motion control shoe<br>☐ Light racing shoe<br>☐ Unknown or not sure<br>☐ Other: _____ |

## Section C. History of medication and supplement use

| What medication, if any, are you currently using? (please list) | Name of medication | Years taken |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

| Do you use protective skin sunscreen during training session or when competing? | Yes ☐ No ☐ | ☐ Every session ☐ Most sessions ☐ Some sessions ☐ Very occasionally |
|---|---|---|

| 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: _____ | ____ |

| Have you ever used oral corticosteroids (cortisone tablets)? (If **yes**, how long ago?) | Yes ☐ No ☐ | ☐ 3 months ☐ 6 months ☐ 12 months ☐ 24 or more months |
|---|---|---|
| Have you ever been given an injection with corticosteroids? (If **yes**, how long ago?) | Yes ☐ No ☐ | ☐ 3 months ☐ 6 months ☐ 12 months ☐ 24 or more months |
| Have you ever been given an injection of corticosteroids in or around the **Achilles** tendon? (If **yes**, how many times?) | Yes ☐ No ☐ | ☐ Once ☐ Twice ☐ 3 times ☐ >3 times |
| Have you ever used fluoroquinoline antibiotics? (refer to the following list) | Yes ☐ No ☐ | ☐ 3 months ☐ 6 months ☐ 12 months ☐ 24 or more months |

**List of some fluoroquinoline antibiotics:**

| | | |
|---|---|---|
| ADCO-CIPRIN | CIPROBAY | SANDOZ CIPROFLOXACIN |
| AVELON | CIPROGEN | TAFLOC |
| BACTIDRON | CPL ALLIANCE CIPROFLOXACIN | TARIVID |
| CIFLOC | DYNAFLOC | TAVANIC |
| CIFRAN | FACTIVE | TEQUIN |
| CIPLA-CIPROFLOXACIN | FLOXIN | UNIQUIN |
| CIPLOXX | MAXAQUIN | UTIN-400 |
| CIPRO-HEXAL | NOROXIN | ZANOCIN |
| | ORPIC | |

| 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<br>_____ glasses wine per week<br>_____ tots of spirits per week | | |

| Fluid Intake | | |
|---|---|---|
| How do you best describe your fluid intake during an Ironman triathlon race? | (a) I drink to thirst ☐<br>(b) I drink as much as tolerable ☐<br>(c) I drink according to a predetermined fluid intake schedule ☐<br>(d) I drink to prevent any weight loss during exercise ☐<br>(e) I combine (a) with (c) ☐<br>(f) I combine (b) with (c) ☐<br>(g) Other: _____ ☐ | |
| What percentage of your fluid intake will consist of these beverages? | Water: ☐ 0-25% ☐ 26-50% ☐ 51-75% ☐ 76-100%<br>Sports drink: ☐ 0-25% ☐ 26-50% ☐ 51-75% ☐ 76-100%<br>Coke: ☐ 0-25% ☐ 26-51% ☐ 51-75% ☐ 76-100%<br>Other: ☐ 0-25% ☐ 26-50% ☐ 51-75% ☐ 76-100%<br>Specify other: _____ | |
| What will be your estimated **total** fluid intake be **(if at all)** during the **swim**? | | ml |
| What will be your estimated **total** fluid intake be during the **cycle**? | | ml |
| What will be your estimated **total** fluid intake be during the **run**? | | ml |
| Rank the following sources of information on their importance in formulating your drinking strategy. (1 being most influential and the lowest number being least influential) | _____ Fellow triathletes<br>_____ Coach / trainer<br>_____ Magazines / books<br>_____ Website (please specify: _____)<br>_____ Drinking guidelines from sports associations<br>_____ Adverts<br>_____ Self-experimentation<br>_____ Other: _____ | |

## Section D. Psychological and Behavioural

### Connor-Davidson Resilience Scale (CD-RISC)

Please indicate how much you agree with the following statements as they apply to you over the last **month**. If a particular situation has not occurred recently, answer according to how you think you would have felt.

| | not true at all | rarely true | sometimes true | often true | true nearly all the time |
|---|---|---|---|---|---|
| 1. I am able to adapt when changes occur. | | | | | |
| 2. I have at least one close and secure relationship which helps me when I am stressed. | | | | | |
| 3. When there are no clear solutions to my problems, sometimes fate or God can help. | | | | | |
| 4. I can deal with whatever comes my way. | | | | | |
| 5. Past successes give me confidence in dealing with new challenges and difficulties. | | | | | |
| 6. I try to see the humorous side of things when I am faced with problems. | | | | | |
| 7. Having to cope with stress can make me stronger. | | | | | |
| 8. I tend to bounce back after illness, injury, or other hardships. | | | | | |
| 9. Good or bad, I believe that most things happen for a reason. | | | | | |
| 10. I give my best effort, no matter what the outcome may be. | | | | | |
| 11. I believe I can achieve my goals, even if there are obstacles. | | | | | |
| 12. Even when things look hopeless, I don't give up. | | | | | |
| 13. During times of stress/crisis, I know where to turn for help. | | | | | |
| 14. Under pressure, I stay focused and think clearly. | | | | | |
| 15. I prefer to take the lead in solving problems, rather than letting others make all the decisions. | | | | | |
| 16. I am not easily discouraged by failure. | | | | | |
| 17. I think of myself as a strong person when dealing with life's challenges and difficulties. | | | | | |
| 18. I can make unpopular or difficult decisions that affect other people, if it is necessary. | | | | | |
| 19. I am able to handle unpleasant or painful feelings like sadness, fear and anger. | | | | | |
| 20. In dealing with life's problems, sometimes you have to act on a hunch, without knowing why. | | | | | |
| 21. I have a strong sense of purpose in life. | | | | | |
| 22. I feel in control of my life. | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 23. I like challenges. | | | | | |
| 24. I work to attain my goals, no matter what roadblocks I encounter along the way. | | | | | |
| 25. I take pride in my achievements. | | | | | |

**TPQ / TCI (96 shared items)**

| | | |
|---|---|---|
| 1. I usually am confident that everything will go ell, even in situations that worry most people. | True☐ | False ☐ |
| 2. I often try new things just for fun or thrills, even if most people think it is a waste of time. | True☐ | False ☐ |
| 3. I like to discuss my experiences and feelings openly with friends instead of keeping them to myself. | True☐ | False ☐ |
| 4. When nothing new is happening, I usually start looking for something that is thrilling or exciting. | True☐ | False ☐ |
| 5. Usually I am more worried about that most people that something might go wrong in the future. | True☐ | False ☐ |
| 6. I don't mind discussing my personal problems with people whom I have known briefly or slightly. | True☐ | False ☐ |
| 7. I would like to have warm and close friends with me most of the time. | True☐ | False ☐ |
| 8. I nearly always stay relaxed and carefree even when nearly everyone else is fearful. | True☐ | False ☐ |
| 9. I usually demand very good practical reasons before I am willing to change my old ways of doing things. | True☐ | False ☐ |
| 10. I often have to stop what I am doing because I start worrying that something might go wrong. | True☐ | False ☐ |
| 11. I hate to change the way I do things, even if many people tell me there is a new and better way to do it, | True☐ | False ☐ |
| 12. My friends find it hard to know my feelings because I seldom tell them about my private thoughts. | True☐ | False ☐ |
| 13. I like it when people can do exactly what they want without strict rules and regulations. | True☐ | False ☐ |
| 14. I often stop what I am doing because I get worried, even when my friends tell me everything will go well. | True☐ | False ☐ |
| 15. It wouldn't bother me to be alone all the time. | True☐ | False ☐ |
| 16. I like to be very organized and set up rules for people whenever I can. | True☐ | False ☐ |
| 17. I usually do things my own way, rather than giving in to the wishes of other people. | True☐ | False ☐ |
| 18. I usually feel tense and worried when I have to do something new and unfamiliar. | True☐ | False ☐ |
| 19. I often feel tense and worried in familiar situations, even when others feel there is little to worry about. | True☐ | False ☐ |
| 20. Other people often think that I am too independent because I won't so what they want. | True☐ | False ☐ |
| 21. Even when most people feel it is not important, I often insist on things being done in a strict and orderly way, | True☐ | False ☐ |
| 22. I often do things based on how I feel at the moment, without thinking about how they are done in the past. | True☐ | False ☐ |
| 23. I often feel tense and worried in unfamiliar situations, even when others feel there is no danger at all. | True☐ | False ☐ |
| 24. I often brake rules and regulations when I think I can get away with it. | True☐ | False ☐ |
| 25. I don't care very much whether other people like me or the way I do things. | True☐ | False ☐ |

| | | |
|---|---|---|
| 26. I usually stay calm and secure in situations that most people would find physically dangerous. | True☐ | False ☐ |
| 27. I feel it is more important to be sympathetic and understanding of other people than to be practical and tough- minded. | True☐ | False ☐ |
| 28. I lose my temper more quickly than most people. | True☐ | False ☐ |
| 29. I am usually confident that I can easily do things that most people would consider dangerous (sucn as driving as automobile fast on a wet or icy road). | True☐ | False ☐ |
| 30. I often react so strongly to unexpected news that I say or do things that I regret. | True☐ | False ☐ |
| 31. People find it easy to come to me for help, sympathy, and warm understanding. | True☐ | False ☐ |
| 32. I am much more reserved and controlled than most people. | True☐ | False ☐ |
| 33. When I have to meet a group of strangers, I am more shy than most people. | True☐ | False ☐ |
| 34. I am strongly moved by sentimental appeals (like when asked to helped crippled people). | True☐ | False ☐ |
| 35. I almost never get so excited that I lose control of myself. | True☐ | False ☐ |
| 36. I have a reputation as someone who is practical and does not act on emotion. | True☐ | False ☐ |
| 37. I often avoid meeting strangers because I lack confidence with people I do not know. | True☐ | False ☐ |
| 38. I usually stay away from social situations where I would have to meet strangers, even if I am assured that they will be friendly. | True☐ | False ☐ |
| 39. I usually push myself harder than most people do because I want to do as well as I possibly can. | True☐ | False ☐ |
| 40. I often push myself to the point of exhaustion or try to do more than I really can. | True☐ | False ☐ |
| 41. I would probably stay relaxed and outgoing when meeting a group of strangers, even if I were told they were unfriendly. | True☐ | False ☐ |
| 42. It is difficult for me to keep the same interests for a long time because my attention often shifts to something else. | True☐ | False ☐ |
| 43. I think I would stay confident and relaxed when meeting strangers, even if I were told they are angry with me. | True☐ | False ☐ |
| 44. I could probably accomplish more than I do, but I don't see the point of pushing myself harder than is necessary to get by. | True☐ | False ☐ |
| 45. I like to think about things for a long time before I make a decision. | True☐ | False ☐ |
| 46. Most of the time I would prefer to do something a little risky (like riding in an automobile over steep hills and sharp turns), rather than having to stay quiet and inactive for a few hours. | True☐ | False ☐ |
| 47. I often follow my instincts, hunches, or intuition without thinking through all the details. | True☐ | False ☐ |
| 48. I try to do as little work as possible, even when other people expect more of me. | True☐ | False ☐ |
| 49. I often have to change my decisions because I had a wrong hunch or mistaken first impression. | True☐ | False ☐ |
| 50. Most of the time I would prefer to so something risky (like hang-gliding or parachute jumping(, rather than having to stay quiet and inactive for a few hours. | True☐ | False ☐ |
| 51. I am satisfied with my accomplishments and have little desire to do better. | True☐ | False ☐ |
| 52. I see no point in continuing to work on something unless there is a good chance of success. | True☐ | False ☐ |
| 53. I have less energy and get tired more quickly than most people. | True☐ | False ☐ |

| | | |
|---|---|---|
| 54. I usually think about all the facts in detail before I make a decision. | True ☐ | False ☐ |
| 55. I nearly always think about all the facts in detail before I make a decision, even when other people demand a quick decision. | True ☐ | False ☐ |
| 56. I often need naps or extra rest periods because I get tired so easily. | True ☐ | False ☐ |
| 57. I don't go out of my way to please other people. | True ☐ | False ☐ |
| 58. I am more energetic and tire less quickly than most people. | True ☐ | False ☐ |
| 59. I am usually able to get other people to believe me, even when I know that what I am saying is exaggerated or untrue. | True ☐ | False ☐ |
| 60. I can usually do a good job of stretching the truth to tell a funnier story or to play a joke on someone. | True ☐ | False ☐ |
| 61. I usually can stay "on the go" all day without having to push myself. | True ☐ | False ☐ |
| 62. I am usually more upset than most people by the loss of a close friend. | True ☐ | False ☐ |
| 63. I have trouble telling a lie, even when it is meant to spare someone else's feelings. | True ☐ | False ☐ |
| 64. I am better at saving money than most people. | True ☐ | False ☐ |
| 65. Even after there are problems in a friendship, I nearly always try to keep it going anyway. | True ☐ | False ☐ |
| 66. I recover more slowly than most people from minor illnesses or stress. | True ☐ | False ☐ |
| 67. I need much extra rest, support, or reassurance to recover from minor illnesses or stress. | True ☐ | False ☐ |
| 68. I often spend money until I run out of cash or get into debt from using too much credit. | True ☐ | False ☐ |
| 69. Because I so often spend too much money on impulse, it is hard for me to save money, even for special plans like a vacation. | True ☐ | False ☐ |
| 70. It is extremely difficult for me to adjust to changes in my usual way of doing things because I get so tense, tired or worried. | True ☐ | False ☐ |
| 71. If I am feeling upset, I usually feel better around friends than when left alone. | True ☐ | False ☐ |
| 72. I usually feel much more confident and energetic than most people, even after minor illnesses or stress. | True ☐ | False ☐ |
| 73. Some people think I am too stingy or tight with my money. | True ☐ | False ☐ |
| 74. I often keep trying the same thing over and over again, even when I have not had success in a long time. | True ☐ | False ☐ |
| 75. It is hard for me to enjoy spending money on myself, even when I have saved plenty of money. | True ☐ | False ☐ |
| 76. I recover more quickly than most people from minor illnesses or stress. | True ☐ | False ☐ |
| 77. I hate to make decisions based only on my first impressions. | True ☐ | False ☐ |
| 78. I think I will have very good luck in the future. | True ☐ | False ☐ |
| 79. I am most often moved deeply by fine speech or poetry. | True ☐ | False ☐ |
| 80. If I am embarassed or humiliated, I get over it very quickly. | True ☐ | False ☐ |
| 81. I like old "tried and true" ways of doing things according to their priority of importance to me because of lack of time. | True ☐ | False ☐ |
| 82. I like to keep my problems to myself. | True ☐ | False ☐ |
| 83. I enjoy saving money more than spending it on entertainment or thrills. | True ☐ | False ☐ |
| 84. Even when I am with friends, I prefer not to "open up" very much | True ☐ | False ☐ |
| 85. I feel very confident and sure of myself in almost all social situations. | True ☐ | False ☐ |
| 86. I usually like to stay cool and detached from other people. | True ☐ | False ☐ |
| 87. I never worry about terrible things that might happen in the future. | True ☐ | False ☐ |
| 88. I am more hard-working than most people. | True ☐ | False ☐ |

| | | |
|---|---|---|
| 89. In conversations I am much better as a listener than as a talker. | True ☐ | False ☐ |
| 90. I like to please other people as much as I can. | True ☐ | False ☐ |
| 91. Regardless of any temporary problem that I have to overcome, I always think it will turn out well. | True ☐ | False ☐ |
| 92. I like to stay at home better than to travel and explore new places. | True ☐ | False ☐ |
| 93. I am usually so determined that I continue to work long after other people have given up. | True ☐ | False ☐ |
| 94. I usually have good luck in whatever I try to do. | True ☐ | False ☐ |
| 95. I like to pay close attention to details in everything I do. | True ☐ | False ☐ |
| 96. It is easy for me to organize my thoughts while talking to someone. | True ☐ | False ☐ |

| K10 | | | | | |
|---|---|---|---|---|---|
| **Instructions:** The following questions ask about how you have been feeling during the **past four weeks**. For each question, please circle the number that best describes how often you have had this feeling. Your answers will be kept confidential. | | | | | |
| **In the past four weeks:** | **None of the time** | **A little of the time** | **Sometime of the time** | **Most of the time** | **All of the time** |
| 1. About how often did you feel tired of for no good reason? | 1 | 2 | 3 | 4 | 5 |
| 2. About how often did you feel nervous? | 1 | 2 | 3 | 4 | 5 |
| 3.About how often did you feel so nervous that nothing could calm you down? | 1 | 2 | 3 | 4 | 5 |
| 4. About how often did you feel hopeless? | 1 | 2 | 3 | 4 | 5 |
| 5. About how often did you feel restless or fidgety? | 1 | 2 | 3 | 4 | 5 |
| 6. About how often did you feel restless you could not sit still? | 1 | 2 | 3 | 4 | 5 |
| 7. About how often did you feel depressed? | 1 | 2 | 3 | 4 | 5 |
| 8. About how often did you feel that everything is an effort? | 1 | 2 | 3 | 4 | 5 |
| 9. About how often did you feel so sad that nothing could cheer you up? | 1 | 2 | 3 | 4 | 5 |
| 10. About how often did you feel worthless? | 1 | 2 | 3 | 4 | 5 |

## Section E. Family medical history

**Have any of your blood (biological) relatives ever 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 |
|---|---|---|
| Exercise associated muscle cramps | Yes ☐ No ☐ | ☐ Father ☐ Mother ☐ Brother ☐ Sister ☐ Child ☐ Grandfather ☐ Grandmother |
| Night muscle cramps | Yes ☐ No ☐ | ☐ Father ☐ Mother ☐ Brother ☐ Sister ☐ Child ☐ Grandfather ☐ Grandmother |
| Chronic Achilles tendon injury | Yes ☐ No ☐ | ☐ Father ☐ Mother ☐ Brother ☐ Sister ☐ Child ☐ Grandfather ☐ Grandmother |
| Achilles tendon rupture | Yes ☐ No ☐ | ☐ Father ☐ Mother ☐ Brother ☐ Sister ☐ Child ☐ Grandfather ☐ Grandmother |
| Any ligament injury | Yes ☐ No ☐ | ☐ Father ☐ Mother ☐ Brother ☐ Sister ☐ Child ☐ Grandfather ☐ Grandmother |
| Asthma | Yes ☐ No ☐ | ☐ Father ☐ Mother ☐ Brother ☐ Sister ☐ Child ☐ Grandfather ☐ Grandmother |
| Allergies (in general) | Yes ☐ No ☐ | ☐ Father ☐ Mother ☐ Brother ☐ Sister ☐ Child ☐ Grandfather ☐ Grandmother |
| Heart Disease | Yes ☐ No ☐ | ☐ Father ☐ Mother ☐ Brother ☐ Sister ☐ Child ☐ Grandfather ☐ Grandmother |
| Diabetes | Yes ☐ No ☐ | ☐ Father ☐ Mother ☐ Brother ☐ Sister ☐ Child ☐ Grandfather ☐ Grandmother |
| Depression, Anxiety attacks, Personality disorder | Yes ☐ No ☐ | ☐ Father ☐ Mother ☐ Brother ☐ Sister ☐ Child ☐ Grandfather ☐ Grandmother |
| Gastro-intestinal (GIT) disease | Yes ☐ No ☐ | ☐ Father ☐ Mother ☐ Brother ☐ Sister ☐ Child ☐ Grandfather ☐ Grandmother |

## Section F. Personal general medical history

**In this section, you are asked to read through 14 questions about your personal general medical history. If you answer "yes" to any of questions 1 to 12, please complete the additional questions at the end of the section (section G on page 18).**

| | |
|---|---|
| 15. In the **6 weeks before this race** (from 1st February) did you suffer from any **symptoms of flu** (fever, sore throat, blocked or runny nose, cough, wheeze, muscle aches and pains)? | Yes ☐ No ☐ |
| 16. Have you **ever** in triathlon 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 ☐ |
| 17. Have you **ever** in your triathlon career suffered from **a tendon or ligament injury** (pain, swelling, stiffness) in any tendon (including Achilles tendon, knee tendons, and shoulder tendons) or ligaments (partial or complete tear)? | Yes ☐ No ☐ |
| 18. Have you **ever** in your triathlon career **used medicines to treat injuries** in the week **before or during a race** – including anti-inflammatory drugs, cortisone (pills, or injection), or pain killers? | Yes ☐ No ☐ |
| 19. Have you **ever** in your triathlon career suffered **gastrointestinal** symptoms **during exercise** including heartburn, nausea, vomiting, abdominal pain, urge to defecate (pass a stool), diarrhea, or blood in the stools? | Yes ☐ No ☐ |
| 20. Have you **ever** in your triathlon career suffered from symptoms of the **nervous system** including exercise induced headaches, nerve tingling or loss of sensation? | Yes ☐ No ☐ |
| 21. Have you **ever** in your triathlon or cycling career (in particular with **cycling**) suffered from **injury to the genital area** including genital numbness after cycling, genital pain after cycling, genital swelling or altered sexual function after cycling? | Yes ☐ No ☐ |
| 22. Have you **ever** in your triathlon 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 ☐ |
| 23. 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 ☐ |
| 24. Have you ever **collapsed** (fell down **not because of an accident**, needing medical attention) during, at the finish or after a race or training session? | Yes ☐ No ☐ |
| 25. Do you **currently** suffer from any **symptoms of injury** in the muscles, tendons, bones, ligaments or joints? | Yes ☐ No ☐ |
| 26. Do you **currently**, or did you **in the last year**, suffer from any symptoms of **exercise related skin disease**? | Sunburn: Yes ☐ No ☐<br>Skin cancer: Yes ☐ No ☐<br>Other skin damage resulting sun exposure: Yes ☐ No ☐ |

| | |
|---|---|
| 27. Please tick in which anatomical area you ever had **surgery** performed. | ☐ Gastric (stomach) ☐ Oesophageal (swallowing pipe)<br>☐ Small bowel ☐ Large bowel (colon)<br>☐ Rectum ☐ Gallbladder<br>☐ Pancreas ☐ Liver<br>☐ Abdomen (general) ☐ Wrist<br>☐ Head ☐ Finger<br>☐ Neck ☐ Lower back<br>☐ Face ☐ Hip<br>☐ Front chest ☐ Thigh<br>☐ Back chest ☐ Knee<br>☐ Shoulder ☐ Lower leg<br>☐ Upper arm ☐ Achilles<br>☐ Elbow ☐ Ankle<br>☐ Forearm ☐ Foot<br>☐ Other (Specify: _____) |
| 28. Management of pain during the last 3 months | |
| 14a. Did you alter or stop your training schedule due to pain in any part of your body? | Yes ☐ No ☐ |
| If yes: For how long | _____ days |
| Did you adapt your training schedule for a while when your injury/illness was healed? | Yes ☐ No ☐ |
| 14b. How do you feel when you experience pain? (you can tick more than one option) | ☐ It does not bother me much<br>☐ Angry<br>☐ Frustrated<br>☐ Depressed<br>☐ Resentful<br>☐ Overwhelmed |
| 14c. When you experience pain, do you? (you can tick more than one option) | ☐ Adjust your training schedule<br>☐ Stop training<br>☐ Slowly get "back on track" of your training schedule<br>☐ Train harder to make up for the missed training sessions<br>☐ Ignore the pain and continue to train<br>☐ Feel scared to do anything that could aggravate the pain<br>☐ Think that the pain means that you have a severe injury<br>☐ Tell everybody about it |
| 29. **Female athletes only:**<br>Please complete the following questions (14a. to 14g.) related to your menstrual cycle and other gynaecological history | |
| 15a. At what age did you start your periods (menstruating)? | (years) |
| 15b. In the last 12 months, how many menstrual cycles did you have? | |

| | |
|---|---|
| 15c. Have you ever had irregular menstrual periods in the past? (excluding pregnancy)? | Yes ☐ No ☐ |
| 15d. Have you had a hysterectomy/ovarectomy? | Yes ☐ No ☐ |
| 15e. How many times have you been pregnant? | (times) |
| 15f. What form of contraception are you currently using? | ☐ None<br>☐ Oral contraceptive pill<br>☐ Injection<br>☐ Intra-uterine device<br>☐ Sterilization (tubes tied)<br>☐ Other: _____ |
| 15g. If yes to question 15f. above, for <u>oral contraceptive pill</u>, for what reason was the pill prescribed? | ☐ Not applicable<br>☐ Dermatological<br>☐ Contraception<br>☐ Regulate period<br>☐ Other: _____ |

## THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

<u>If you have answered **YES** to any of the first 11 questions of the Personal General Medical History questionnaire (section F) please complete the relevant additional questions that follow in section G.</u>

Please bring the completed forms together with the signed consent form to the pre-race facility or the research table at race registration.

## Section G. Additional detailed medical history

***(Please complete all the sections to which you answered "Yes" in the Personal general medical history)***

### 1. Flu symptoms in the last 6 weeks

If you answered **YES** to **question 1** in section F, please complete the following two questions related to flu symptoms in the last 6 weeks.

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

### 2. Muscle cramping

If you answered **YES** to **question 2** in section F, please complete the following questions (2a. to 2m.) related to your cramping.

| | |
|---|---|
| (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 exercise** is your cramping associated (You can tick more than one form of exercise)? | ☐ Swimming ☐ Cycling ☐ Running |
| (2d) In the **last 10 races or training sessions**, how many times have you experienced cramping? | Races: _____/10<br>Training sessions: _____/10 |
| (2e) What treatment/s have you had that **successfully relieved** an acute cramp? (can tick more than one) | ☐ Stretching ☐ Resting<br>☐ Drinking fluid ☐ Ice application<br>☐ Massage ☐ Magnesium<br>☐ Salt (tablets or solution)<br>☐ Other (Specify: _____) |
| (2f) At **what point in the race or training run** do you usually first experience cramping? | ☐ First quarter ☐ Second quarter<br>☐ Third quarter ☐ Fourth quarter<br>☐ After the race ☐ 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<br>☐ Quadriceps (thigh) ☐ Foot muscles<br>☐ 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<br>☐ Moderate: 5-15 minutes and you are able to continue exercising<br>☐ Severe: >15 minutes or if you have to STOP exercising |

## 3. Past Tendon and Ligament Injury History

If you answered **YES** to **question 3** in section F, please complete the following questions (3a. to 3d.) related to your past history of tendon/ligament injury/ies.

| | Tendon | | Longstanding Pain (Tendinopathy) | Acute Tear/ Rupture |
|---|---|---|---|---|
| (3a) Please tick which **tendon/s** you have injured? (next column on the tright)<br><br>Also indicate (tick) if your injured tendon was longsatnding pain (tendinopathy) or an acute tear/rupture | Foot and ankle: | ☐ Achilles tendon | ☐ | ☐ |
| | | ☐ Tibialis posterior | ☐ | ☐ |
| | | ☐ Plantar fascia | ☐ | ☐ |
| | Knee: | ☐ Patellar tendon | ☐ | ☐ |
| | Elbow and wrist: | ☐ Wrist extensor tendon | ☐ | ☐ |
| | Shoulder: | ☐ Rotator cuff | ☐ | ☐ |
| | Other: _____ | | ☐ | ☐ |

| | Ligament | Sprain | Complete Tear |
|---|---|---|---|
| (3b) Please tick which **ligament/s** you have injured? (next column on the tright)<br><br>Also indicate if your sprained or completely tore the ligamant. | ☐ Shoulder ligaments | | |
| | ☐ Elbow ligaments | | |
| | ☐ Wrist ligaments | ☐ | ☐ |
| | ☐ Finger ligaments | ☐ | ☐ |
| | ☐ Knee (ACL) | ☐ | ☐ |
| | ☐ Knee (MCL) | ☐ | ☐ |
| | ☐ Knee (PCL) | ☐ | ☐ |
| | ☐ Knee (LCL) | ☐ | ☐ |
| | ☐ Ankle lateral ligaments | ☐ | ☐ |
| | ☐ Ankle medial ligaments | ☐ | ☐ |
| | ☐ Spinal ligaments | ☐ | ☐ |
| | ☐ Other: _____ | | |

| | |
|---|---|
| (3c) Please tick if you have you ever suffered from any of the following **joint capsule** injuries? | ☐ Acute shoulder dislocation<br>☐ Chronic shoulder instability<br>☐ Other: _____ |
| (3d) Do you suffer from any other **connective tissue or rheumatological diseases** or disorders? (If yes, please specify which one) | Yes ☐ No ☐ (refer to the list on the next page)<br>(If yes, specify: _____) |

| List of some Connective Tissue and/or Rheumatic Diseases and Disorders | | |
|---|---|---|
| Ankylosing Spondylitis | Lipid Storage Diseases | Pseudogout |
| Aspartylglycosaminuria (AGU) | Marfan Syndrome | Reactive Arthritis |
| Behcet's Syndrome | Menkes Kinky Hair Syndrome | Reiter's Syndrome |
| Crohn's Disease | Mucopolysaccharidoses | Relapsing Polychrondritis |
| Discoid Lupus Erythematosus | Myopathies and Dystrophies | Scleroderma |
| Ehlers-Danlos syndrome (EDS) | Ochronosis (Homocystinuria) | Sjogren's Syndrome |
| Eosinophilic Fascitis | Osteogenesis imperfecta (OI) | Systemic Lupus Erythematosus (SLE) |
| Giant Cell (Temporal) Arthritis | Polyarteritis Nodosa | Systemic Sclerosis |
| Gout | Polymyalgia Rheumatica | Wegener's Granulomatosis |
| Hypersentive Vasulatis | Polymyositis & Dermatomyositis | |

## 4. Use of medicines to treat an injury before or during participation

If you answered **YES** to **question 4** in section F, please complete the following two questions related to medicine use for injuries before or during races.

| | |
|---|---|
| (4a) Which of the following medicines have you used in the past to treat an injury **in the week just before** a race? | ☐ Paracetamol (e.g. Panado, Tylenol)<br>☐ Non-steroidal anti-inflammatories (e.g. Voltaren, Cataflam)<br>☐ Cortisone (pills)<br>☐ Cortisone injection<br>☐ Codeine<br>☐ Anti-inflammatory gels/creams/patches<br>☐ Any other pain killers (Specify: _____) |
| (4b) Which of the following medicines have you used in the past to treat an injury **during a race**? | ☐ Paracetamol (e.g. Panado, Tylenol)<br>☐ Non-steroidal anti-inflammatories (e.g. Voltaren, Cataflam)<br>☐ Cortisone (pills)<br>☐ Cortisone injection<br>☐ Codeine<br>☐ Anti-inflammatory gels/creams/patches<br>☐ Any other pain killers (Specify: _____) |

## 5. Gastrointestinal symptoms during exercise

If you answered **YES** to **question 5** in section F, please indicate which gastrointestinal symptoms you have ever suffered from **during exercise** and, how frequently (in the last 12 months and in the last 10 races), and in which type of exercise.

| Symptom | Number of times you experienced the GIT symptom in the last 12 months **(during exercise)** | Number of times you experienced the GIT symptom in the last 10 races **(during races)** | Please indicate which **type of exercise** is mostly associated with the GIT symptom | Please indicate the **"severity"** of the GIT symptom during exercise |
|---|---|---|---|---|
| Nausea | | | ☐ Swimming<br>☐ Cycling<br>☐ Running | ☐ Does not affect training or racing<br>☐ Affects training/racing (slow down or reduce time)<br>☐ Prevents training/racing |
| Vomiting | | | ☐ Swimming<br>☐ Cycling<br>☐ Running | ☐ Does not affect training or racing<br>☐ Affects training/racing (slow down or reduce time)<br>☐ Prevents training/racing |
| Heartburn | | | ☐ Swimming<br>☐ Cycling<br>☐ Running | ☐ Does not affect training or racing<br>☐ Affects training/racing (slow down or reduce time)<br>☐ Prevents training/racing |
| Abdominal pain | | | ☐ Swimming<br>☐ Cycling<br>☐ Running | ☐ Does not affect training or racing<br>☐ Affects training/racing (slow down or reduce time)<br>☐ Prevents training/racing |
| Urge to pass a stool (defecate) | | | ☐ Swimming<br>☐ Cycling<br>☐ Running | ☐ Does not affect training or racing<br>☐ Affects training/racing (slow down or reduce time)<br>☐ Prevents training/racing |
| Diarrhea | | | ☐ Swimming<br>☐ Cycling<br>☐ Running | ☐ Does not affect training or racing<br>☐ Affects training/racing (slow down or reduce time)<br>☐ Prevents training/racing |
| Passing blood in the stool | | | ☐ Swimming<br>☐ Cycling<br>☐ Running | ☐ Does not affect training or racing<br>☐ Affects training/racing (slow down or reduce time)<br>☐ Prevents training/racing |

| Please indicate if you previously suffered from or had any of the following (you may tick more than one)? | ☐ History of heartburn<br>☐ Gastroscopy<br>☐ Ulcer (gastric, duodenal)<br>☐ Irritable bowel syndrome<br>☐ Allergy to milk products<br>☐ Other past history of GIT disease |
|---|---|

## 6. Diseases of the nervous system

If you answered **YES** to **question 6** in section F, please indicate which nervous disease symptoms you have ever suffered from **during exercise** and, how frequently (in the last 12 months and in the last 10 races), and in which type of exercise.

| Symptom | Number of times in the last 12 months **(during exercise)** | Number of times in last 10 races **(during races)** | Tick type of exercise |
|---|---|---|---|
| Headaches | | | ☐ Swimming, ☐ Cycling, ☐ Running |

| | | | |
|---|---|---|---|
| Nerve tingling in the hands | | | ☐ Swimming, ☐ Cycling, ☐ Running |
| Loss of sensation in the hands | | | ☐ Swimming, ☐ Cycling, ☐ Running |

## 7. Genital tract injury during cycling

If you answered **YES** to **question 7** in section F, please indicate which symptoms of genital tract injury have you suffered from **during or after cycling**, how frequently (in the last 10 sessions), how long symptoms last, and what factors prevent or relieve symptoms?

| Symptom | Number of times in the last 10 cycling sessions | Please indicate when the symptoms occur | Please indicate if any of the following reduce or prevent the symptoms (can tick more than one) |
|---|---|---|---|
| Genital numbness | | ☐ Only during cycling<br>☐ During and up to 1 hour after cycling<br>☐ During and 1-24 hours after cycling<br>☐ During and > 24 hours after cycling | ☐ Changing the saddle type<br>☐ Changing the saddle position<br>☐ Using padded cycling shorts<br>☐ Wearing no underwear<br>☐ Wearing additional underwear<br>☐ Other (Specify: _____) |
| Genital pain | | ☐ Only during cycling<br>☐ During and up to 1 hour after cycling<br>☐ During and 1-24 hours after cycling<br>☐ During and > 24 hours after cycling | ☐ Changing the saddle type<br>☐ Changing the saddle position<br>☐ Using padded cycling shorts<br>☐ Wearing no underwear<br>☐ Wearing additional underwear<br>☐ Other (Specify: _____) |
| Genital bruising | | ☐ Only during cycling<br>☐ During and up to 1 hour after cycling<br>☐ During and 1-24 hours after cycling<br>☐ During and > 24 hours after cycling | ☐ Changing the saddle type<br>☐ Changing the saddle position<br>☐ Using padded cycling shorts<br>☐ Wearing no underwear<br>☐ Wearing additional underwear<br>☐ Other (Specify: _____) |
| Altered sexual function following a cycling session | | ☐ Up to 1 hour after cycling<br>☐ 1-24 hours after cycling<br>☐ > 24 hours after cycling | ☐ Changing the saddle type<br>☐ Changing the saddle position<br>☐ Using padded cycling shorts<br>☐ Wearing no underwear<br>☐ Wearing additional underwear<br>☐ Other (Specify: _____) |

## 8. Allergy history

If you answered **YES** to **question 8** in section F, please complete the following questions (8a. to 8e.) related to your current and past history of allergies.

| **(8a) Please indicate how long (years) have you been suffering from allergies?** | | | | | years |
|---|---|---|---|---|---|
| **(8b) 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 ☐ |
| **(8c) Please tick which type of allergy do you currently take medication 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 ☐ |
| **(8d) Please tick which type of medication do you currently take** | | | | | |
| 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 ☐ |
| **(8e) Please tick which symptoms of allergy do you currently suffer 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 currently have symptoms of allergies? (You tick more than one) | ☐ Jan ☐ Feb ☐ March ☐ April ☐ May ☐ June ☐ July ☐ Aug ☐ Sept ☐ Oct ☐ Nov ☐ Dec | | | | |
| **(8f) Please tick which type of allergy 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 ☐ |

## 9. Asthma history

If you answered **YES** to **question 9** in section F, please complete the following questions (9a. to 9k.) related to your current history of asthma

| | |
|---|---|
| (9a) Do you currently suffer from asthma? | Yes ☐ No ☐ |
| (9b) How many years have you suffered from asthma? | (years) |
| (9c) How was your asthma diagnosed? | ☐ A doctor taking a history and performing an examination<br>☐ Lung function test (blow test) but no exercise<br>☐ Lung function test (blow test) before and after exercise<br>☐ Metacholine challenge test<br>☐ Eucapnic hyperventilation test (rebreathing test)<br>☐ Other test (Specify: _____) |
| (9d) Which **type of asthma** do you currently suffer from? | ☐ Asthma that occurs at any time but not during exercise<br>☐ Asthma that occurs at any time including during exercise<br>☐ Asthma that only occurs during exercise |
| (9e) 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)**<br>☐ < 2 / week ☐ 2-4 / week ☐ >4 / week ☐ All the time<br>**Night time symptoms (per month)**<br>☐ < 1 / month ☐ 2-3 / month ☐ ≥4 / month ☐ All the time<br>**Exercise related symptoms (per 10 exercise sessions)**<br>☐ <1 per 10 sessions ☐ 2-3 per 10 sessions ☐ ≥4 per 10 sessions |
| (9f) 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<br>☐ 1-2 hospital admissions for asthma in the last 12 months<br>☐ 3-4 hospital admissions for asthma in the last 12 months<br>☐ >4 hospital admissions for asthma in the last 12 months |
| (9g) Which **symptoms of asthma** do you currently suffer from? | ☐ Wheezing ☐ Dry cough ☐ Shortness of breath<br>☐ Tight chest ☐ Chest pain<br>☐ Other (Specify: _____) |

| | |
|---|---|
| (9h) 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)<br>☐ Salbutamol (bronchodilator) inhaler (e.g. Ventolin, Venteze, Vomax, Airomir, Asthavent etc.)<br>☐ Salmeterol (bronchodilator) inhaler (Serevent)<br>☐ Fenoterol (bronchodilator) inhaler (Berotec)<br>☐ Terbutaline (bronchodilator) inhaler (Bricanyl)<br>☐ Formoterol (bronchodilator) inhaler (e.g. Foradil, Foratec, Oxis)<br>☐ Ipratropium (bronchodilator) inhaler (Atrovent)<br>☐ Tiotropium (bronchodilator) inhaler (Spiriva)<br>☐ Combined cortisone and bronchodilator inhaler (e.g. Atrovent, Berodual, Combivent, Duolin, Duovent, Seretide, Symbicord)<br>☐ Cortisone tablets<br>☐ Bronchodilator tablets<br>☐ Leukotriene receptor antagonist tablets (e.g. Acccolate, Singulair)<br>☐ Other inhaler<br>☐ Other medication (Specify: _____) |
| (9i) **When do you use your medication** for your asthma? | ☐ Daily (irrespective of exercise) ☐ Only before exercise<br>☐ Other (Specify: _____) |
| (9j) **How long before an exercise session** do you use your medication for asthma? | min |
| (9k) Have you obtained **TUE (therapeutic use exemption forms)** for your asthma medication? | Yes ☐ No ☐ |

| **10. History of previous collapse**<br>If you answered **YES** to **question 10** in section F, please complete the following questions (10a. to 10d.) related to your current history of asthma | |
|---|---|
| (10a) Have you ever collapsed during training or racing? | ☐ Training<br>☐ Racing<br>☐ Training and racing |
| (10b) How many times have you collapsed in training session or races during the last **five years**? | _____ training session<br>_____ races |
| (10c) How many times have you collapsed in training session or races during the last **12 months** (1 year)? | |
| (10d) When you collapse, does it mostly occur before of after the finish line / completion of the training session? | ☐ Before the finish<br>☐ After the finish |
| (10e) What is the cause of you collapse? | ☐ Dehydration<br>☐ Heat illness<br>☐ Hyponatremia<br>☐ Low blood pressure<br>☐ Low blood sugar<br>☐ Other condition (Specify: _____) |

## 11. History of any current injury that you suffer from

If you answered **YES** to **question 11** in section F, please complete the following questions (11a. to 11g.) related to each of your current injury/ies (Space is provided for two injuries)

| Injury 1 | |
|---|---|
| (11a) What was the approximate date when you first became aware of the injury? | Month Year |
| (11b) Please indicate which side of your body is injured (if applicable) | ☐ Right ☐ Left |
| (11c) Please indicate which anatomical area is currently injured | ☐ Head ☐ Neck ☐ Face ☐ Front chest ☐ Back chest ☐ Shoulder ☐ Upper arm ☐ Elbow ☐ Forearm ☐ Wrist ☐ Finger ☐ Lower back ☐ Hip ☐ Thigh ☐ Hamstring ☐ Quadriceps ☐ Knee ☐ Shin ☐ Achilles ☐ Ankle ☐ Foot Other (Specify: _____) |
| (11d) Please indicate the type of structure that was injured | ☐ Muscle ☐ Tendon ☐ Bone ☐ Ligament ☐ Joint Other (Specify: _____) |
| (11e) Please indicate in which sport (discipline) the injury occurred | ☐ Running ☐ Cycling ☐ Swimming Other (Specify: _____) |
| (11f) Please indicate the severity of the injury (tick one box please) | ☐ I only experience symptoms after exercise - Grade 1<br>☐ I experience symptoms during exercise, but it does not interfere with exercise - Grade 2<br>☐ I experience symptoms during exercise that may interfere with my training/ competition - Grade 3<br>☐ I am so painful that I may not be able to train or compete - Grade 4 |
| (11g) Please indicate how your injury was treated to date (you can tick more than one)? | ☐ Rest ☐ Stretches ☐ Physiotherapy ☐ Surgery ☐ Strengthening exercises ☐ Equipment change ☐ Tablets ☐ Cortisone injection ☐ Other injection ☐ Orthotics Other (Specify: _____) |

| Injury 2 | | | |
|---|---|---|---|
| (11a) What was the approximate date when you first became aware of the injury? | Month | Year | |
| (11b) Please indicate which side of your body is injured (if applicable) | ☐ Right | ☐ Left | |
| (11c) Please indicate which anatomical area is currently injured | ☐ Head<br>☐ Neck<br>☐ Face<br>☐ Front chest<br>☐ Back chest<br>☐ Shoulder<br>☐ Upper arm | ☐ Elbow<br>☐ Forearm<br>☐ Wrist<br>☐ Finger<br>☐ Lower back<br>☐ Hip<br>☐ Thigh | ☐ Hamstring<br>☐ Quadriceps<br>☐ Knee<br>☐ Shin<br>☐ Achilles<br>☐ Ankle<br>☐ Foot |
| | Other (Specify: _____) | | |
| (11d) Please indicate the type of structure that was injured | ☐ Muscle<br>☐ Tendon<br>☐ Bone | ☐ Ligament<br>☐ Joint | |
| | Other (Specify: _____) | | |
| (11e) Please indicate in which sport (discipline) the injury occurred | ☐ Running<br>☐ Swimming | ☐ Cycling | |
| | Other (Specify: _____) | | |
| (11f) Please indicate the severity of the injury (tick one box please) | ☐ I only experience symptoms after exercise - Grade 1<br>☐ I experience symptoms during exercise, but it does not interfere with exercise - Grade 2<br>☐ I experience symptoms during exercise that may interfere with my training/ competition - Grade 3<br>☐ I am so painful that I may not be able to train or compete - Grade 4 | | |
| (11g) Please indicate how your injury was treated to date (you can tick more than one)? | ☐ Rest<br>☐ Stretches<br>☐ Physiotherapy<br>☐ Surgery<br>☐ Strengthening exercises<br>☐ Equipment change | ☐ Tablets<br>☐ Cortisone injection<br>☐ Other injection<br>☐ Orthotics | |
| | Other (Specify: _____) | | |

# Appendix 9

UNIVERSITY OF CAPE TOWN

Health Sciences Faculty
Research Ethics Committee
Room E53-24 Groote Schuur Hospital Old Main Building
Observatory 7925
Telephone [021] 406 6338 • Facsimile [021] 406 6411
e-mail: [illegible]

**13 January 2006**

**REC REF: 425/2005**

Assoc Prof MP Schwellnus
Department of Human Biology
UCT/MRC Research Unit for Exercise Science and Sports Medicine
Medical School

Dear Prof Schwellnus

**THE PORT ELIZABETH IRONMAN TRIATHLON 2006: MEDICAL CONSEQUENCES FOLLOWING ENDURANCE SPORTS.**

Thank you for your letter to the Research Ethics Committee dated 14 December 2005, addressing the issues raised by the committee. It is a pleasure to inform you that the Ethics Committee has formally approved the above mentioned study.

**Please quote the REC. REF in all your correspondence.**

Yours sincerely

PROF. T ZABOW
CHAIRPERSON

# Appendix10

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:** preward@curie.uct..ac.za

**09 February 2007**

**REC REF: 002/2007**

Prof M Schwellnus
Human Biology

Dear Prof Schwellnus

**PROJECT TITLE: THE PORT ELIZABETH IRONMAN TRIATHLON 2007: MEDICAL CONSEQUENCES FOLLOWING ENDURANCE SPORTS**

Thank you for your letter to the Research Ethics Committee dated 07 February 2007.

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

Your comments to the queries raised are noted with thanks.

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-SA), Food and Drug Administration (FDA-USA), International Convention on Harmonisation Good Clinical Practice (ICH GCP) and Declaration of Helsinki guidelines.

The Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

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

**Please quote the REC. REF in all your correspondence.**

lcmjedi