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Health status of South African masters swimmers, their medication use and attitudes towards doping

By Annemarie Henriette Dressler

A dissertation submitted in fulfilment of the requirements for the degree

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FACULTY OF HEALTH SCIENCES

Supervisor

Dr K Nolte

Co-supervisor

Prof BJM Steyn

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Declaration

I, the undersigned, declare that the dissertation hereby submitted to the University of Pretoria for the degree MSc Sports Science (Biokinetics) and the work contained therein is my own original work and has not previously, in its entirety or in part, been submitted to any university for a degree. Where the work of other people has been used this has been properly acknowledged and referenced.

Signed:

Date: 30 August 2022

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Ethics statement

I, Annemarie Henriette Dressler (14213657), declare that I have obtained the applicable ethical approval for the research titled *Health status of South African masters swimmers, their medication use and attitudes towards doping* (see Appendix A: Ethical clearance letter). This study was approved on the 11 August 2021, with reference number 193/202, Dr R Sommers Deputy Chair, Faculty of Health Sciences Research Ethics Committee at the University of Pretoria.

Signed: AH Dressler

Date: 30 August 2022

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Dedication

I dedicate this dissertation to my family and the masters swimming community. Without swimming that kept me centred through two occurrences of breast cancer and my partner and swimming friends that provided emotional support, I would not be here today.

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Synopsis

Title: Health status of South African masters swimmers, their medication use and attitudes towards doping

Candidate: Annemarie Henriette Dressler

Supervisor: Dr K Nolte

Co-supervisor: Prof BJM Steyn

Degree: MSc Sports Science (Biokinetics)

Key words: athletes, chronic disease, injury, Performance-Enhancing Substances, PEAS, medication use, quantitative, cross-sectional design.

Physical inactivity is recognised as one of the main causes of the onset of chronic diseases such as diabetes (DM), coronary artery disease (CAD) and cancer.[1] In recognition of this the South African government has started programs like the Let's Play physical education challenge to motivate children to exercise and the Long-term Participant Development Program (LTPD) to motivate athletes to transition from competitive participation to staying active for life.[2] Due to the increased importance attached to exercise and a healthy lifestyle, older adults explore and engage in recreational pursuits to once again compete as athletes in sports that they previously partook in.[3] This has led to increased participation in recreational and competitive sporting events world-wide.[4] This is also evident in South Africa where participation in swimming events has increased in popularity. Open water swims such as the aQuellé Midmar Mile attract large entry numbers. In 2019, the aQuellé Midmar Mile drew over 12 000 swimmers, many of them adult swimmers, making it the largest open water event in the world.[5]

As age increases, adults experience a higher prevalence of chronic diseases.[6-8] Masters athletes with diagnosed chronic disease and injuries train for and take part in swimming events. They use prescribed or over the counter (OTC) medication to treat

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their disease and/or injuries and to alleviate pain.[9, 10] Some of the medication used by masters swimmers may carry health risks in training and competition contexts and may also be prohibited before and during competitions.[11, 12] The main aim of this study was to investigate the health status and associated medication use of South African masters swimmers. Quantifying possible unintentional doping infringements through the use of medication and intentional doping with the sole purpose to enhance performance will provide insight into doping complexities faced by masters swimmers. This study also analysed the doping attitudes and doping knowledge of South African masters swimmers.

The study used a cross-sectional design. A web-based, online survey was used to collect quantitative data based on the aims and objectives of the study. Initial purposive sampling of the swimmers in the South African Masters Swimming (SAMS) database was broadened to snowball sampling to target a sample of both competitive and recreational masters swimmers. Participation in the survey was anonymous and voluntary. To test the self-constructed questionnaires' validity and consistency and to limit survey bias, a pilot study was conducted on 10 randomly selected masters swimmers representative of the population. Their feedback on the survey process, length and question structure was used to improve the online survey structure and questions.

Data curing and analysis of the data was done independently by a statistician using Microsoft Excel and SPSS data analysis software version 28.1. Grouping of medications was done by a registered pharmacist using the EMGuidance application.

The survey resulted in 359 responses with 48.7% male swimmers and 50.7% female swimmers. Results show swimmers taking part in a variety of events namely triathlon and Ironman, pool and open water events. Two participants did not disclose their gender.

The mean age of the participants was 51.3 with a standard deviation of 1.5 years. Given the option of selecting three motivations why they train and compete in swimming the dominant motivation of the swimmers to was to improve health and fitness (85%), followed by the motivations to relieve stress (47.4%) and for enjoyment

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and fun (45.5%). The prevalence of chronic disease in the masters swimmers was 39.1%. The results showed that 22.4% of participants had only one chronic disease and 16.5% reported multi-morbidity. There was a significant ($p<0.001$) weak positive relationship between chronic disease and age showing a Pearson correlation coefficient of $r=0.24$. There was also a significant ($p<0.001$), weak positive relationship ($r=0.26$) between number of chronic diseases and age.

The population percentage for chronic medication use was 33.7% and 11.4% of the participants used medication that is on the World Anti-doping Agency (WADA) prohibited list.

Participants reported an injury prevalence of 26.1% in the five years preceding the survey with injuries in the shoulder region most frequently reported (18.1%) and tendinitis (9.7%) being the most prevalent reported shoulder injury. There was a significant ($p<0.005$) but weak negative correlation ($r=-0.15$) between age and injury prevalence.

Analysis of the prescribed and OTC medication showed that 16.4% of the study participants took medication to treat injury or illness shortly before or during competitions. The most used medication was Nonsteroidal Anti-inflammatory Drugs (NSAIDs) (15%), analgesics (4.5%) and cortisone (2.5%).

In response to the direct life-long and current doping questions only one male swimmer indicated that he had used a banned substance. No participants indicated that they are currently using Prohibited Performance-enhancing Drugs (PEDs). The expressed attitude of the participants on the Performance Enhancement Attitude Scale (PEAS) 8-item instrument showed that masters swimmers do not have a positive or lenient attitude towards doping. Specific questions set to test the swimmers' attitude towards chronic medication use, indicated that they believed that chronic medication helped masters swimmers to perform as healthy individuals and that this medication use should not be construed as doping. Swimmers showed limited knowledge of doping and Therapeutic Use Exemption (TUE) application. This study may assist in steering doping education in the right direction.

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To the researcher's knowledge, no studies have been conducted on masters swimmers in South Africa relating to health status and doping. This study will add to the limited research that has been done on this study population. To make training and competitions safer for masters swimmers, future research could focus on pre-screening to determine the risk factors that may contribute to cardiovascular events and injury.

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List of acronyms

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AST	Asthma
BMD	Bipolar Mood Disorder
CAD	Coronary Artery Disease
CDL	Chronic Disease List
CMY	Cardiomyopathy
CHERRIES	Checklist for Reporting Results of Internet E-Surveys
CI	Confidence Interval
CVD	Cardiovascular Disease
DM	Diabetes Mellitus 1 and 2
DM1	Diabetes Mellitus 1
DM2	Diabetes Mellitus 2
FINA	Fédération Internationale de Natation
HLD	Hyperlipidaemia
HTN	Hypertension
IFs	International Federations
KD	Kidney Disease
LTPD	Long-term Participant Development Program
M	Mean value
MBD	Mental and Behavioural Diseases
N	Number of responses in a question category
N	Study population - total number of participants in the study (359)
NADOs	National Anti-Doping Organizations
NSAIDs	Nonsteroidal Anti-inflammatory Drugs
OA/RA	Osteo- and Rheumatoid Arthritis

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OP	Osteoporosis
OTC	Over the Counter
PEAS	Performance Enhancement Attitude Scale
PEDs	Prohibited Performance-enhancing Drugs
POPIA	Protection of Personal Information Act
R	Correlation coefficient
SAIDS	South African Institute for Drug-Free Sport
SAMS	South African Masters Swimming
SANHANES-1	South African National Health and Nutrition Examination Survey
SD	Standard Deviation
SSA	Swimming South African
TUE	Therapeutic Use Exemption
USA	United States of America
WADA	World Anti-Doping Agency
WHO	World Health Organisation
WMG	World Masters Games

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Chapter 1: Introduction

Background

Physical inactivity is recognised by the World Health Organization (WHO) as one of the main causes of chronic diseases such as DM, Cardiovascular Disease (CVD) and cancer.[1] In recognition of this, the South African government has started programs like the Let's Play physical education challenge to motivate children to exercise and the Long-term Participant Development Program to motivate athletes to transition from competitive participation to staying active for life.[2] Due to the increased importance attached to exercise and a healthy lifestyle, older adults are looking to return to new and former recreational and competitive sports.[3] This has led to increased participation in recreational and competitive sporting events.[4] This is also evident in South Africa where participation in swimming events has increased in popularity.[5]

For the purposes of this study masters athletes are defined as "Individuals who systematically train for and compete in, organised forms of competitive sport specifically designed for older adults."[13] In the South African context masters swimmers are classed as swimmers 18 years and older and constitutes a sub-set of masters athletes as defined above.[14]

As age increases, adults experience a higher prevalence of chronic diseases.[6-8] Masters athletes with diagnosed chronic disease and injuries train for and take part in swimming events such as the World Masters Games (WMG). They use prescribed or OTC medication to treat their disease and/or injuries and to alleviate pain.[9, 10] Some of the medication used by masters swimmers may carry health risks in training and competition contexts and may also be prohibited before and during competitions.[11, 12] To this end an exploration of the concept of doping, doping control and the use of prohibited substances is necessary in the South African masters swimmers context.

Doping can be defined as the collective term used to describe the use of prohibited substances or methods to enhance performance.[15] The use of PEDs before and during sporting competitions is prohibited for all athletes including swimmers. The World Anti-Doping Agency (WADA) implemented policies on anti-doping to make sporting

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competitions fair and equal and to protect the health of athletes.[16] Masters swimmers in South Africa are also subjected to the WADA criteria when they partake in events.[17, 18]

Masters swimmers might commit infringements in a variety of ways. Research shows that masters athletes competing in the various sporting codes at the WMG commit doping offences through the use of prescribed medicine to treat chronic disease.[10] Studies also showed that masters athletes get injured in their preparation for or during competitions and that they take OTC drugs such as pain killers and NSAIDs to treat these injuries.[19, 20] Although NSAIDs are not on the WADA prohibited list, their potential health risks for athletes has been well documented.[21, 22] Purposive doping with the sole motivation to increase performance has been reported mostly in studies on elite athletes.[23-25] A recent study on ultra-marathon runners demonstrated that competitive masters athletes may elect to use PEDs. The same study showed that competitiveness and a positive attitude towards doping was positively correlated to doping behaviour.[26]

Adults enter swimming events for a variety of reasons including increased health and fitness, to delay old age, to socialise and to be competitive and to win.[27-30] In order to understand why masters swimmers would use PEDs the motivation and attitude of masters swimmers towards intentional and unintentional doping was measured.

Necessity and value of the study

The results of this study provided insight into the health status and medication use of masters swimmers. Comparison of the medication used by the swimmers with the WADA prohibited list showed the prevalence of doping infringements. Testing the attitudes of the swimmers towards doping shed light on the intentional and unintentional doping complexities faced by masters athletes. To the researcher's knowledge, no similar studies have been conducted on South African masters swimmers.

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Aim of the study

The aim of this study was to determine the health status, associated medication use, possible doping infringements, doping attitudes and doping knowledge of South African masters swimmers.

Objectives of the study

The primary objectives of this research study were as follows.

1. Establish a demographic profile of South African masters swimmers.
2. Report on the prevalence of chronic disease in South African masters swimmers.
3. Report on the prevalence and nature of injuries in South African masters swimmers.
4. Report on the prescribed medication used by South African masters swimmers to treat their chronic disease.
5. Report on the prescribed or OTC medication used by South African masters swimmers to treat illness and/or injury one month before or during competition.
6. Compare the medication used to the prohibited list and determine the possible infringement percentage.
7. Determine life-long and current prevalence of doping by South African masters swimmers with the sole purpose to enhance performance.
8. Investigate the attitudes of South African masters swimmers towards doping.
9. Determine the relationship between attitudes towards doping and doping behaviour.
10. Investigate the attitudes of South African masters swimmers towards competitors using prescribed medication that enhance performance.
11. Determine the extent of doping knowledge of South African masters swimmers.
12. Determine if South African masters swimmers understand the consequences of doping.

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Research questions

What is the prevalence of chronic disease, injury and related doping infringements due to medication use in South African masters swimmers?

Do South African masters swimmers dope to win and can this be related to a positive attitude towards doping?

Do South African masters swimmers have the doping knowledge to understand the health risks and consequences of doping infringements?

Structure of the dissertation

Chapter 1 consists of the introduction, aim, objectives, research questions and structure of the dissertation.

Chapter 2 provides a short overview of the most recent and relevant literature including sources that contained the key words: swimming, masters swimmers, older adults combined with health status, doping and doping attitudes.

Chapter 3 explains the methodology used in the study.

Chapter 4 delineates the primary findings from the statistical analysis of the data and comparisons with other relevant literature.

Chapter 5 contains the discussion of the findings.

Chapter 6 outlines the strengths, limitations, conclusions and gives recommendations for future research.

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Chapter 2: Literature review

Introduction

A short overview of the most recent and relevant literature on the research topic is included below. Sources include the internet, books, research-based articles in peer-reviewed journals, conference presented papers, dissertations and theses that contained the key words swimming, masters swimmers, older adults combined with health status, doping and doping attitudes.

These sources were selected to develop an overall understanding of who masters swimmers are, why masters swimmers compete, their health status, their medication use, doping implications, doping control in their environment and their attitudes towards doping. The aim of the literature study is to provide a framework for the presentation and discussion of the results and conclusions of this study.

Defining a masters athlete and the context in which they compete

The global body that controls all aquatic sport, FINA governs seven aquatic disciplines namely swimming, open water swimming, diving, high diving, water polo, artistic swimming and the masters programme.[31] FINA regulates recreational and competitive masters swimming events for masters swimmers world-wide.[32]

In South Africa, Swimming South Africa (SSA) is the national body that regulates swimming. SSA acknowledges masters swimming in their constitution and all rules that apply to younger swimmers also apply to masters swimmers.[18] Masters pool swimmers competing in the South African masters championship must be registered with SAMS and SSA.[14] Open water recreational and competitive swimmers do not have to be registered with SAMS or SSA and can enter any open water event in South Africa on an individual basis.

The following definition of a masters athlete was used for this study: “Masters athletes are individuals who systematically train for and compete in, organised forms of competitive sport specifically designed for older adults.”[13] The definition allows for a range of recreational athletes competing for health, fitness and social motivations as

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well as athletes who take part due to competitive motivations.[29] Masters swimmers comprise a sub-set of masters athletes, 18 years and older that compete in organised sporting events such as open water swims, WMG, triathlon, pentathlon and pool events.

FINA group pool and open water masters swimmers into five-year age categories starting from 25 years and upwards.[33] Following the SAMS age categories pre-masters aged 18 - 24 were also included in this study.[14] Age groups for triathlon are also divided into five-year age groups starting from 15 years and upwards.

Why do masters swimmers train and take part in sporting events?

To establish the relationships between motivation, chronic disease, injury and doping in South African masters swimmers it was necessary to first explore why masters swimmers compete.

Recent years have shown an increased participation in sporting events organised specifically for older athletes. Internationally, WMG participation has increased from 8 305 athletes participating in the first 1985 Toronto (Canada) Games to 28 571 athletes participating in the 2017 Auckland (New Zealand) Games.[4]

Open water swims in South Africa such as the aQuellé Midmar Mile attract large entry numbers. In 2019, the aQuellé Midmar Mile drew over 12 000 swimmers, many of them adult swimmers, making it the largest open water event in the world.[5] In 2019, 1 699 amateur triathletes entered to compete in the Ironman South Africa competition.[34] The 36th South African Masters Long Course Swimming Championships held in March 2020 saw 370 masters swimmers compete over five days. In this event in 2020, the youngest swimmer was 19-years old and the oldest swimmer was an 88-year-old male. The South African Masters Open Water Championships during the same week had 101 swimmers competing for the titles.[35]

In the FINA constitution masters programmes are designed with the motto to promote fitness, friendship, understanding and competition.[32] The motivations for masters swimmers to train and take part in events range from the creation of opportunities to

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travel, to compete and win, to improve health and fitness, skills development and companionship.[36]

Previous studies by Adams et al.[27] and Walsh et al.[29] on WMG participants found that the most important motivations for competing was to socialise with other participants, followed by the health considerations to become more physically fit and to improve health. The competing to win motivation was less important to these athletes.

In the South African context, the motivation of open water swimmers seems to align with the above-mentioned findings. It was identified in a survey on 461 swimmers at the 2010 Midmar mile that socialisation and escape, fun and entertainment and intrinsic achievement was seen as motivators to participate in events.[37]

Health status of masters swimmers

The relevant literature on the health status of masters athletes, specifically pertaining to the prevalence of chronic disease and injury, are considered below.

Defining chronic disease

For the purpose of this study chronic disease is defined as a disease that progresses slowly over time and that persists over a long period.[38] An analysis of South African medical scheme beneficiary data by Cairncross et al. for 3 924 901 patients between 2011 and 2016 showed the top nine chronic diseases to be Hypertension (HTN), Hyperlipidaemia (HLD), DM, Asthma (AST), Hypothyroidism, CAD, Cardiomyopathy (CMY), Epilepsy and Bipolar Mood Disorder (BMD).[39]

Although the medical aid Chronic Disease List (CDL) specifies CAD as one of the top nine chronic heart diseases, most research use the broader umbrella term of CVD. CVD includes CAD and all diseases typically involving in narrowing or obstructing blood vessels. The CDL specifies CVD to include CMY, ischaemic heart disease, dysrhythmias and HTN. For the purposes of comparison with other literature the above definition of CVD including CAD is used, unless HTN is specifically excluded as a separate disease. The term heart disease was used in the questionnaire to make it more easily understandable for the participants.

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Hypothyroidism in the CDL was also broadened to thyroid disease in the questionnaire and includes all diseases of the thyroid.

For the purposes of this study multi-morbidity is defined as the simultaneous presence of two or more chronic diseases in one participant.

General population prevalence of chronic diseases

The general population for the purposes of this study is defined as all individuals (not only athletes) that have been included in a sample with selection criteria similar to those used in this study i.e. chronic disease status. This can include country-wide health surveys or medical aid statistics. As concluded by Banerjee et al. inferences between the study population of South African masters swimmers, masters athletes and the general population should be made with caution.[40]

Studies have concluded that participation in physical activity and sport reduces the risk factors that lead to disease development and as such lowers the prevalence of chronic disease.[6, 9, 41] This could be why masters athletes display a lower prevalence of chronic disease when compared to general population statistics.[42, 43]

Internationally, surveys at the WMG in 2008, 2017 and 2018, used an age comparison to compare the prevalence of chronic disease in masters athletes to the Australian Health Survey data. They found that masters athletes have a lower prevalence of health related indices that might lead to chronic disease when compared to that of the general population.[9, 44]

In the 2010 United States of America (USA) National Health Interview Survey, 24.8% of adults 18 years and older had one chronic condition namely HTN, CVD, Stroke, DM, Cancer, Osteo- and Rheumatoid Arthritis (OA/RA), Hepatitis, Kidney disease (KD), Chronic Obstructive Pulmonary Disease, or AST and 26% of the participants had multi-morbidity.[45] The Australian National Health Survey conducted on adults 18 and older in 2017 - 2018, showed that 47% of Australians had one or more chronic conditions. Breaking down the prevalence per condition in this survey showed HTN

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(22.8%), Mental and Behavioural Diseases (MBD) (20.1%), back problems (16.4%), OA/RA (15.0%), AST (11.2%), Diabetes mellites I (DM1) (0.6%), DM2 (4.1%), CVD and stroke (4.8%), osteoporosis (OP) (3.8%), COPD (2.5%), cancer (1.8%) and KD (1.0%).[46]

The South African National Health and Nutrition Examination Survey (SANHANES-1) in 2016 conducted on adults 15 years and older showed the self-reported chronic disease prevalence was HTN (22.9), CVD (3.8%), cancer (1.2%), stroke (1.7%), HLD (4.1%), DM (5.1%), AST (4.1%), COPD (1.7%). More than one condition was reported by 11.9% of the participants.[47]

In another South African study on 710 adults aged 50 years and older, 73% of the participants reported one or more chronic disease. Prevalence was shown as HTN alone (25%), HTN and DM (8%), HTN and arthritis (8%), arthritis alone (8%) and DM alone (5%).[48]

Prevalence of chronic disease in masters athletes

An on-line survey of 7 210 participants in the WMG in Sydney in 2009, found the prevalence of chronic diseases as HTN (9.5%), RA/OA (8.9%), AST (8.7%), HLD (6.4%) and depression (6.3%).[49]

In South Africa, 15 778 runners competing in the Two Oceans Marathon completed a pre-screening health survey showing prevalence of chronic disease as CVD (2.3%), HTN (4.4%), HLD (6.2%), AST (5.9%) and DM (1.0%).[20]

Patelia et al. found that 108 masters athletes aged 50 or above had a lower prevalence of chronic disease (10.2%) when compared to chess-players and inactive or moderately active adults.[43] A similar finding by Batista et al., showed that elite athletes had decreased risk factors for major chronic diseases when compared to that of recreational and non-athletes.[41]

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Relationship between frequency of training and prevalence of chronic disease

A study by McPhillips et al. found that 1 140 older adults between the ages of 50 and 93 did more light exercise and less moderate to heavy exercise as they aged. Sixty percent (60%) of the participants in the study exercised three times per week for a minimum of 20 minutes at a time. Those with a history of chronic disease exercised less frequently than their healthy counterparts.[50]

Relationship between age and prevalence of chronic disease

The statistics of the WHO and South African demographic and health survey in 2016 both show that the prevalence of chronic diseases increased with age.[6-8] A study by Steffler et al. on the general population in Ontario, Canada showed the prevalence of chronic disease and multi-morbidity to increase in five-year age-groups until the age of 89. Thereafter the prevalence decreased slightly.[8]

Prevalence of injuries in masters athletes

As highlighted by Walsh et al. the concern that older athletes might be more prone to injury due to the physiological aging process does exist.[9] Due to the repetitive nature of swimming, shoulder injuries are frequently reported in swimmers.[51-53]

Pain is a good indicator of underlying injuries. Injuries and pain occurrence are often grouped by body region or specific joint. Atilla et al reported the one year prevalence of injured regions in 88 Turkish male masters swimmers as shoulder pain (42.0%), lower back (27.3%), neck (21.6%), back (13.6%), and knee (10.2%).[54]

The following studies concluded that injury in athletes may be sport specific. Climstein et al. investigated 1 418 Australian masters athletes and found no significant difference in injury type between swimming, rowing and soccer. They did find significant differences in injury location between the sports.[55] Ristolainen et al. also found in a retrospective 12-month study on swimmers, cross country skiers, long-distance runners and soccer players that type of sport is related to injury location.[56]

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Relationship between age and prevalence of injury

Research shows ambiguous findings between aging and the prevalence of injury. Opar et al. found in a three-year follow up study that masters track and field athletes have a significantly greater risk of injuries when compared to their younger counterparts.[57] A literature review by Stathokostas et al. indicated that adults 65 years and older who participated in physical activity did not have an increased risk of injury.[58] Masters athletes competing in athletics and football competitions were shown to have a lower risk of injury before and during competition compared to younger elite athletes in the same sporting codes.[59, 60] Ganze et al. studied the prevalence and types of injuries during the 2012 European Veteran Athletics Championships in 3 154 athletes older than 35 years. They reported that injury prevalence did not increase with age or performance.[61] Stocker et al. compared younger collegiate and masters swimmers on shoulder pain lasting three weeks or more and found a pain prevalence of 47% and 48% respectively.[62]

Relationship between cross-training and prevalence of injury

A study by Baker et al. conducted on masters swimmers (55 ± 14 years of age) in the USA found that swim-related injuries were significantly lower if the swimmers reported engagement in cross-training. The injury prevalence in swimmers that cross-trained was inversely related to age ($p<0.05$).[63]

Relationship between volume of training and prevalence of injury

Sein et al. found a significant correlation between volume of training and shoulder impingement in elite swimmers.[64] Atilla et al. found no significant correlation between volume of swimming training and the prevalence of injuries in Turkish masters athletes.[54] Barry et al. concluded in a review of articles that reported the relationship between training load and pain, injury and illness, was unclear.[51] One study found a negative association between training load and musculoskeletal pain.[65] This finding was later explained by the injury prevention paradox, which states that a low training load may make an athlete less prepared for competition and more susceptible to injury.[66]

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Medication used to treat chronic disease and/or injuries

An on-line survey completed by 19 304 masters athletes participating in the 2017 Sydney WMG and the 2018 Pan Pacific masters championship showed that 48.1% had a chronic condition and that 25.3% took medication to treat their condition. Chalmers et al. found the most prevalent conditions treated by medication was AST, CVD, MBD, RA/OA and DM.[10] In a survey by Walsh et al. at the 2009 Sydney WMG, the most common prescribed medication used by masters athletes were HTN medication (7.4%), NSAIDs (6.4%), hypolipidemic medication (4.9%) and bronchodilators (4%).[9]

A pre-race on-line survey of 15 778 endurance runners in the 2012 Two Oceans Marathon in South Africa found that 14.8% of participants used chronic prescription medication. The same study found that 15.6% of the participants used analgesics, NSAIDs and cortisone before or during races.[20] Other international studies showed NSAID and analgesic usage in female recreational runners (34.6%) and NSAID usage in triathletes (84%), in runners (71%) and in cyclists (53%).[19, 67] A study on 1 953 recreational triathletes, aged between 18 - 80, showed the use of PEDs (14.2%) in the year preceding the survey and painkillers (11.1%) during the three months before a competition.[68]

Gorski et al. surveyed 327 triathletes competing at the 2008 Brazil Ironman triathlon and reported 59.9% of the athletes used NSAIDs three months before the competition with 47.4% being consumed the day before or during the race. The predominant reason for taking the medication before the race was to treat injuries and during the race was to prevent pain. Most of the consumption (48.5%) occurred without medical prescription and the athletes were unaware of the negative side effects of the medication.[69]

Relationship between medication used before or during competition and the sporting code

The use of medication shortly before or during competition differ widely between different types of sport. Usage of medication, NSAID's and painkillers to reduce pain and manage musculoskeletal injuries just before and during elite competitions has

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been reported in sports such as football (69%), triathlon (9.2%) and track and field athletics (44%).[70-72] This indicates that medication use might be sport specific.

Doping

Some of the prescribed and OTC medication used by masters swimmers to manage and treat chronic disease and/or injury may harm the athlete's health and can be performance enhancing. The use of some of these substances are prohibited before and during competitions.[11, 12] To this end an understanding of the concept of doping, doping control and the use of prohibited substances are necessary in the South African masters swimmers context.

Definition of doping

Doping was defined by Nolte et al. as 'the collective term used to describe the use of prohibited substances or methods to enhance performance'.[15] The PEDs and methods listed on the WADA prohibited list can enhance adaptation to training and/or directly improve performance in competition.

WADA lists different categories for doping infringements as:

- Substances and Methods Prohibited at All Times (in and out of competition)
- Substances and Methods Prohibited In-Competition
- Substances Prohibited in particular sports[12]

The prohibited list

WADA maintains a list of monitored substances and a list of prohibited substances that is reviewed on an annual basis.[12, 73] A prohibited substance can include a wide variety of substances such as prescribed medication, dietary substances, supplements, stimulants, anabolic agents such as steroids and illicit drugs such as cannabis. It also includes doping methods such as blood and gene manipulation. The substances that WADA list as banned must meet two of three criteria namely: (1) it is potentially performance enhancing, (2) it has the potential to harm the athlete's health and (3) it violates the spirit of the sport.[16]

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Doping infringements by masters swimmers

In terms of the studies reviewed the possible doping infringements committed by South African masters swimmers was divided into: (1) swimmers taking long-term prescribed medication to treat chronic disease, (2) swimmers taking prescribed or OTC medication to treat illness and/or injury shortly before or during competition and (3) swimmers taking lifelong or current PEDs with the sole purpose to improve performance.

(1) Doping infringements through chronic prescribed medication

In the 2017 Sydney WMG and the 2018 Pan Pacific masters championship survey of 817 masters' athletes, researchers found that 25.3% used medication to treat a chronic health condition. The most common medication used were AST medication (26.6%) and CVD medication (23.4%). Of the medication used, 40% were on the prohibited list. These substances were Beta-2 antagonists and glucocorticoids used to treat AST and low blood pressure, Beta-blockers used in the treatment of HTN and other heart conditions, diuretics used to manage fluid retention, hormones, metabolic regulators and stimulants used in the treatment of DM and obesity.[10]

In an international study by Campian et al. on ultra-marathon runners, 19.8% of the runners reported that they had in their lifetime used PEDs prescribed for medical reasons.[26]

(2) Doping infringements before and during competition

A study in 2016 on 136 female amateur runners reported that 34.6% used medication 24 hours before races. The estimated 24-hour doping prevalence for these runners was 8.1%, with pain killers and NSAIDs being the most self-administered drugs.[74]

(3) Prevalence of PEDs used to improve performance

Doping prevalence is mostly estimated by looking at the positive doping statistics accumulated by WADA and by analysing surveys and questionnaires completed by

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elite athletes. WADA only reported 1.42% adverse analytical findings in 2018 in the 344 177 test samples taken globally.[75]

A review of doping prevalence studies in elite athletes in 2014, found that the estimated current doping prevalence ranges between 14 - 39% and the lifetime doping prevalence in the review was estimated to be 3.1%.[23] A later study on Danish athletes in 2017 found that on average 26% of athletes were estimated to have doped in their career.[24] The prevalence of doping in elite athletes was found to be variable depending on the sport, country, training groups and levels of competition.[23]

Lately, the focus of research has shifted from research on elite athletes to the doping practices of amateur or recreational athletes. Two studies by Seifarth et al.[79] and Hellar et al.[87] on recreational Ironman and Half-Ironman athletes (1 076) and triathletes (1 989), found lifelong prevalence of doping to be 13% and the 12-month prevalence to be 14.2%. A study conducted on 609 ultra-marathon runners 18 years and older reported 8.4% use of PEDs during competition and training, the most used PED's being cannabis, narcotics and stimulants.[26] A study on 800 amateur athletes and exercisers reported a lifetime prevalence for doping of 18.3%.[76]

Health implications of doping

In a review by Bird et al., evidence was found that PEDs taken by elite and non-elite athletes carry considerable health risks in training and competition. The researchers identified articles that linked PED use to health risks for chronic diseases such as CVD, DM, cancer and MPD.[77]

Küster et al. surveyed 2010 participants in the Bonn marathon and found that the ingestion of pain medication immediately before the race was linked to serious gastrointestinal adverse events. They reported that 93% of the athletes who took the medication were unaware of the possible side effects.[78]

Relationship between motivation for participation and doping behaviour

Dionigi and O'Flynn showed through performance discourses, that competitive masters swimmers are not only focused on the benefits of swimming such as improved

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health and prolonging of life, but many masters swimmers strive to improve their performance and are highly motivated to excel in competition.[79] Locally this can be seen when looking at the results of the 2020 South African masters long course swimming championships where 30 swimmers achieved South African national colours, placing them in the FINA top ten tabulation for their age group.[35]

Lazuras et al. conducted a study on 800 young amateur athletes and exercisers in five European countries and showed that participants were motivated to use PEDs to achieve results faster, to push themselves to physical limits and to recover faster after training.[80] A study on ultra-marathon runners showed that more competitive runners were using PEDs to gain a competitive edge as winning would lead to increased sponsorships, prize money and/or national recognition.[26] Having a stronger motivation for competition and winning, rather than intrinsic enjoyment and self-improvement can lead to higher doping intentions and behaviour.[81] These studies showed a link between motivation to compete and possible doping intentions.

Other relationships with doping

In the study by Seifarth et al. on recreational triathletes in Germany, researchers linked doping to gender, with females potentially using more PEDs. They also found that athletes with more than 10 years of experience in sport (9.4%), athletes older than 39 years (9.8%) and athletes training more than eight hours per week (8.0%) had an increased prevalence of doping.[68]

Attitudes of athletes towards doping and doping by competitors

A positive attitude towards doping has been correlated with the intention to use PEDs or the actual practice of doping.[82, 83]

Vargo et al. used the PEAS 8-item instrument to measure attitude towards doping in 98 university students (mean age = 24 ± 5.98 years) with different sporting backgrounds and motivations. The athletes average score was 18.473 ± 8.612 (2.309 ± 1.076 average score per question) with females scoring significantly lower (14.242 ± 3.307) than males (21.088 ± 9.869).[84] A meta review by Folkers et al. found five studies that showed a significant correlation between doping attitude and gender.[83]

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To understand why athletes, use PEDs, various models were developed to better understand the social and psychological processes underlying doping. One of these models developed for the sporting environment is the Sport Drug Control Model.[85] The model describes the factors that can influence doping attitudes namely: (1) the threat of being caught or ill health, (2) the benefits such as prize money and/or sponsorships, (3) the opinions of fellow competitors or significant others, (4) the moral belief of the athlete that doping is right or wrong, (5) the ability of regulating bodies to test and regulate according to the law and (6) the personality of the athlete including traits such as optimism and self-esteem.[86] Later research has shown that moral belief, benefit appraisal and threat appraisal have the strongest relationships with attitude towards doping in elite athletes.[87]

Threat appraisal

A study on 250 Australian elite athletes indicated that the Goldman dilemma might no longer be valid for elite athletes. The original Goldman dilemma presented athletes with a choice between the use of PEDs that guarantee performance and glory but caused death in five years' time. In this study, only one athlete was willing to sacrifice longevity for winning through doping.[88] This might also hold true for masters athletes, as they are highly motivated to participate for health and longevity reasons.[27, 89]

Benefit appraisal

There is a correlation between increased doping and increased age in elite swimmers. As athletes get closer to the end of their careers, they weigh up the consequence of being caught doping with economic gain.[90] The main motivators to train and compete for masters athletes is identified as socialisation and to improve health and not extrinsic motivators such as economic gain.[27, 29]

Reference group influences

The decision to dope is highly influenced by the doping attitudes of friends and fellow competitors, as well as perceptions about the prevalence of doping use among competitors. A 2014 meta-analysis of personal and psychosocial predictors of doping use in physical activity found that athletes were more likely to dope if their friends

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doped.[91] It can be theorized that if masters swimmers have a lenient attitude towards their fellow competitors taking PEDs solely to improve performance, it might encourage them to self-use PEDs through the "false consensus effect."[92]

Personal morality

The belief that doping is right or wrong may influence leniency towards doping and can be an accurate predictor for self-use of PEDs.[91, 93, 94] A study in 2012, concluded that participants aged 15 - 60 years hold more negative attitudes towards doping to improve performance, but were positive to drugs for restoring physical functioning conditions. The study found that athletes were lenient towards doping up to the age of 25, but showed decreased leniency at older ages.[95]

Legitimacy

The ability of regulating bodies to test and regulate doping according to the law, plays a role in attitudes towards doping. The regulatory structure for doping control of masters athletes in South Africa is complex. The summary below will highlight the current doping control structures and policies for masters swimmers in South Africa.

Doping structures and control

WADA was formed in 1999 to control and regulate global anti-doping policy through the implementation of several international standards for testing, laboratories, the prohibited list, TUE applications and to protect athletes' rights. One of the purposes of the world anti-doping code is stated as: "To protect the Athletes' fundamental right to participate in doping-free sport and thus promote health, fairness and equality for athletes world-wide."[16]

WADA regulations are enforced by their International Federations (IFs). IFs are tasked with testing in and out of competition, providing education and sanctioning non-compliant athletes. FINA as one of the sports under the Association of Summer Olympic IFs controls doping in swimming. In line with WADA, one of the principle objectives of FINA is to provide fair and drug free sport.[96]

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WADA defines an athlete as any person who competes in sport at an international level (as defined by IFs) or a national level (as defined by each National Anti-Doping Organization (NADO). They give NADOs the right to bring any level of athlete, even recreational athletes, into the definition of an athlete. This gives NADOs the discretion to apply the code and its policies, rules and regulations to any athlete registered with them. South Africa is a registered WADA supported Regional Anti-Doping Organisation (RADO).

The South African Institute for Drug-Free Sport (SAIDS) was created by the South African government under the Department of Sport and Recreation as a national agency to control drug free sport in the country. SAIDS works closely with WADA and the African RADOs. Masters swimmers competing in the South African national championships need to be registered with SSA and thus fall under regulation by the SAIDS through the South African Drug-Free Sport Act. This act is compliant with WADA's international regulations and policies.[97]

Doping control in the masters swimmer context

All FINA rules and regulations, as well as doping controls are valid for masters as one of the FINA disciplines. However, in the specific FINA Rules for masters competitions no mention is made about use of chronic medication, application for TUE and the consequences of using PEDs.[32] FINA places national bodies in this case SSA in charge of ensuring that athletes are in good standing and comply with the FINA regulations.[17] This is carried into the SSA constitution as an objective to provide a drug free sport.[98]

Enforcing doping policies

WADA, FINA and SSA doping regulations apply to both elite and amateur athletes, but states that any event organiser holding an event for masters-level competitors could elect to test but does not have to test for the full menu of PEDs. This might be why masters swimmers have been largely left out of anti-doping efforts.[99]

Another complication for doping control might be the structure in which masters pool swimmers compete. Masters swimmers represent their club even when competing in

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swimming competitions like the world championships. This rule is set out very clearly in the FINA general rules for masters as: "Individual entries shall only be accepted from persons representing clubs. No swimmer or team may be designated as representing a country or federation."[33] It was generated with the masters motto of *fun, fitness and friendship* in mind, but may have conflicting implications for federations like SSA when it comes to doping control. This and the high cost of testing might explain why no drug testing is performed on masters swimmers in swimming competitions from local level to the FINA Masters World Championships.

Doping knowledge

The cornerstone of prevention of doping is education. Doping education is provided by WADA, the IFs and RADOs. They supply athletes with the knowledge to prevent doping. This education can take many forms e.g., doping policies, prohibited substances lists and brochures on doping that are implemented through various platforms such as WADA's Anti-Doping Education and Learning Platform, websites and interactive teaching.[100]

Understanding the more technical components of this education, like the prohibited list, can be challenging to athletes. A survey by Orr et al. on 1 925 elite and sub-elite athletes showed that participants differed in their knowledge of PEDs depending on their age, sex, ethnicity, professional/amateur status and current competition level.[101] Research has shown that RADOs provide sufficient information through the implementation of valuable knowledge-focused programs on their websites.[102]

Studies on younger athletes have found ambiguous results on doping education. A study on elite athletes at Olympic events found that 73.3% of the athletes received anti-doping education.[103] A study conducted by Morente-Sánchez et al. on Spanish football players showed that 95% of participants did not know about WADA and that 97.4% did not know what the prohibited list was.[104]

Houlihan pointed out that one of the limitations of doping education was that it was not aimed at specific stages of sport participation plan where the last stage is aimed at masters participation. Educational context and campaigns should change with the

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athletes as changes happen to their attitude, networks and context and as they progress through the LTPD participation stages. Athletes have a basic right to information in order to make informed choices when it comes to doping.[105]

South African doctors and pharmacists play a role in prescribing and issuing medicine to masters athletes. A study by Starzak et al. found that these South African health professionals were lacking doping-related knowledge and training and could as such not guide or monitor athletes' use of PEDs.[106]

Consequences of doping and application for exemption

Application for TUEs

Athletes suffering from chronic disease, who are taking prescribed medication, can apply for a TUE. The process of applying for a TUE is a long and complicated process that is based on the following criteria: (1) athlete would experience significant impairment of health if the prohibited medication is withheld, (2) no enhancement of performance could result from the administration of the prohibited substance as medically prescribed, (3) the athlete would not be denied the prohibited substance if he/she was not a competing athlete, (4) no available permitted or practical alternative can be substituted for the prohibited substance and (5) retrospective approval would not be granted.[107]

Theoretically, all masters swimmers diagnosed with a chronic disease that require treatment with medication on the prohibited list should apply for a TUE. It is clear from the definition above that some swimmers suffering from chronic diseases would not be allowed a TUE under point (2). This would prevent them from competing and would in effect go against the masters aim of being inclusive.

There are also reasons why masters would be hesitant to apply for TUEs. Studies have reported that using bronchodilators for AST management created a negative stigma towards athletes with AST and the use of inhalers. Masters athletes might be apprehensive of the perception of fellow athletes towards them taking possible PEDs, albeit inadvertently.[108]

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Literature study summary and conclusion

During this literature study, only three age-comparable South African research studies were found. Two studies were done on South African masters swimmers and they reported findings on the motivations of open water swimmers and the prevalence of shoulder injuries and the related risk factors.[37, 65] The other South African study reported on the risk of medical complications and medicine use in marathon runners during the 2012 Two Oceans Marathon. Two similar international studies by Halar et al.[9] and Walsh et al.[55] used a WMG athlete population to report on the prevalence of chronic conditions, treatment strategies and sources of nutritional information, as well as the health, injury and psychological indices of the participants.

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Chapter 3: Methodology

Introduction

This chapter contains an overview of the study design, study setting, study population and sampling, statistical analysis and ethical considerations.

Study design

The study used a cross-sectional design with descriptive, comparative and correlational statistical analysis that is detailed below. Cross-sectional studies survey the population at a single point in time, reflecting a cross-section of the population at the time the participant completes the questionnaire.[109] A non-probability sample was taken through a web-based, online survey based on the inclusion and exclusion criteria.[110] The sampled masters swimmers completed the survey over a period of two months.

The survey was planned using the recommendations of the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) guidelines (Appendix B).[111]

Study setting

The research setting refers to the place or location where the data was collected. The survey was only distributed to masters swimmers in South Africa.

Study population and sampling

The study population consisted of South African competitive and recreational masters swimmers. The sample was taken from the study population as delimited by the inclusion and exclusion criteria listed below.

Inclusion criteria:

- Masters swimmers that are 18 years and older

Exclusion criteria:

- Informed consent not competed

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Sampling method and data collection

A web-based, online questionnaire was used to collect quantitative data based on the aims and objectives of the study. Due to the failure to attain permission to use the aQuellé Midmar Mile database to distribute the questionnaires, the initial purposive sampling of the swimmers in the SAMS database was broadened to snowball sampling to target both competitive and recreational masters swimmers. The SAMS database was selected as the initial distribution channel. Swimmers on the database were asked in the introduction letter to further distribute the survey to known masters swimmers and coaches.

Online survey platform selection

The Google Forms application was used for the survey as it levied no response dependent charge. It allowed participants to use multiple devices such as computers and cellular phones. It also offered structured data delivery via an excel spreadsheet that limited data capture errors.

Data collection process

An introductory email and the survey link were forwarded to SAMS for distribution. The introductory email described the context and purpose of the survey. Participation in the study was anonymous and voluntary.

As the researcher is a well-known coach and masters swimmer, personal telephonic follow-ups with the SAMS regions, clubs and coaches were done throughout the survey period. A reminder to complete the survey was emailed via the platform, one month after the initial survey distribution. The survey was closed two months after distribution started.

Sample size

In 2020, the SAMS database had 556 registered swimmers. The aQuellé Midmar Mile database contained over 15 000 recreational and competitive open-water masters swimmers. It was estimated at the date of proposal that the survey would result in a 4% response rate (max 450 participants) in line with previous and similar research.[10]

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A total of 360 masters swimmers responded to the survey. One swimmer did not agree to the informed consent and was filtered out of the survey.

Design of the questionnaire

In setting the questions care was taken to make the questions concise and easy to understand in swimming related language.[112, 113] Most of the questions were closed-ended with an appropriate answer set that included a non-response option such as "not applicable" or "I would rather not say." Only a limited number of open-ended questions were included to ensure minimum data manipulation.

The survey was divided into 11 sections, with a total of 36 questions. In order to improve the survey completion rate the sections and number of questions were carefully selected to minimise the survey completion time.[114]

The first section focused on obtaining informed consent from the participant to partake in the study as well as POPIA consent for the use of the data.

The second section obtained biographical information about the participant for example, the age group, gender, and medical aid subscription status. Only participants 18 years and older were allowed to complete the questionnaire.

The third section asked questions pertaining to the participants' experience in swimming, for example, the volume of training per week and the number of years the participant has been swimming. Participants were also asked when they last competed in an organised sporting event and to specify the level and type of event.

The fourth section offered a choice of nine reasons for swimming with an open-ended option to list any reasons not included. Swimmers were asked to mark the three predominant reasons why they swim.

The next sections of the questionnaire all included filtering questions. These questions were used to guide participants through the sections and to shorten the questionnaire completion time. For example, if swimmers reported no chronic disease, they were not asked to complete the chronic disease and associated medication section.

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Sections five and six dealt with chronic disease and the associated chronic medicine use. The WHO focusses their global statistics and prevention initiatives mostly around the most prevalent chronic diseases namely CVD, stroke, cancer, chronic respiratory diseases and DM2.[6] Medical schemes in South Africa developed a CDL list that covers 26 chronic conditions (Appendix C).[39] The CDL is used to manage prescription of medication used to treat chronic disease in South Africa. The selection options given were based on the CDL, but included an open-ended option to add any disease not listed.

Section seven focussed on any injuries that were sustained by the participants in the five years preceding the survey. This period was extended from the original time-frame due to limited training and competitions which took place during the COVID-19 pandemic.

Section eight surveyed the medication used to treat injuries or illness shortly before or during competitions. To help participants answer this question the following guidelines were given. “Were you prescribed any injections, medications and/or did you buy any OTC medication, to treat an injury or any illness, suffered SHORTLY BEFORE OR DURING COMPETITIONS? This may include cortisone injections or tablets, NSAIDS, any pain tablets, cold and flu medication, cough syrups or any other medications that you may have used.”

Section nine used the PEAS questionnaire developed by Petróczi to determine the expressed attitude of the masters swimmers towards doping.[115] Nicholls et al. converted the original 17-item PEAS instrument to the 8-item version, suitable to measure doping attitudes in adults.[93, 116] The 8-item version has a better focus on sport drugs and excludes the use of recreational drugs in sporting environments and external factors such as the influence of media attention.[117] This section of the questionnaire also included questions on the swimmers’ attitude towards fellow competitors’ use of medication that may enhance performance.

Section 10 focussed on the life-long and current intentional use of prohibited substances or methods to improve performance. Due to the anonymous online survey process and the stated de-identification of data, it was decided to use direct doping

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questions and not indirect questioning techniques such as Randomized Response Technique (RRT) questions.[118] Participants that indicated use were asked to detail the specific PEDs or methods used to improve performance.

The last section of the questionnaire tested the doping knowledge of the participants by asking questions about the WADA rules and regulations, the prohibited list and TUE application. Swimmers were also asked if they were aware of the consequences of committing doping rule violations.

As a final check, the questionnaire was compared to the objectives of the study to make sure that all the relevant data elements that meet the objectives were included.[113] The survey questionnaire is attached in Appendix D.

Pilot study

To test the questionnaire structure and the question clarity a pilot study was conducted on 10 randomly selected masters swimmers in representative age groups. Their feedback on the structure, length and question design was used to improve the survey.

Data preparation and statistical analysis

Preparation of the data

Data from Google forms were returned to the researcher in an Excel spreadsheet format. No manual input of data was done.

The data were prepared and screened for omissions by the researcher under the guidance of the statistician. Questionnaires that were not fully completed were carefully screened to ensure reliability of the data.

Grouping of medication and comparison with the prohibited list was completed by a registered pharmacist using the EMGuidance application.

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Statistical analysis and tests

Statistical analysis of the data was done using SPSS data analysis software version 28. Analysis of the data variables by type, categories and the statistical calculations performed are set out in Appendix E. The statistical significance for this research was set at 5%.

Descriptive data analysis

Descriptive statistics were used to summarise and describe the biographic data of the participants (age, gender, medical aid), motive and swimming experience (systematic training, number of years training in swimming, competitions attended).

Frequency or number of swimmers that responded to a question category (n) and percentages (%) of the total study population (N) were calculated for the variables. Confidence Intervals (CI) were calculated for means and percentages. The 95% CI is defined as "a range of values for a variable of interest constructed so that this range has a 95% probability of including the true value of the variable".[119] The format used to document the range of possible values in this dissertation was 95% CI (LL,UL) were LL represents the lower limit of the confidence interval and UL represents the upper limit.

For the categorical age variable, the mean age was calculated using mid-point coding. The Standard Deviation (SD) calculated shows the variation of individual reported ages from this mean value.[120]

Volume-load was categorised using low (0 - 4.9 km per week), medium (4.9 - 11.9 km per week) and high volume-load (12 km and more per week) categories as per Kruger et al.[65]

To determine if the participants represented both competitive and recreational swimmers, an analysis of the events entered, as well as an analysis of the competitiveness of the swimmers was done.

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Events were analysed in four categories namely pool swimming, combined events such as triathlons, open water and other events. Events percentages were further analysed according to the event level.

Motivations to train and compete in swimming were compared to other similar studies on swimmers and other athletic populations. Motivation to compete and win was analysed for later comparison to doping attitude and intentional doping.

The calculated prevalence reflects the frequency of disease or injury, expressed as a percentage of the total participants at the time of the survey.[120] Chronic disease prevalence was split for the different age groups to determine if the prevalence differed between the age groups.

Chronic disease prevalence was further analysed for different age sub-sets (all ages, 25 years and older and 50 years and older), for the number of chronic diseases per participant and for type of chronic disease, to make it comparable to the literature. Other chronic diseases, listed under the open-ended question, were described.

The prevalence of injury was analysed by body region, type of shoulder injury and age. Chronic disease and injury prevalence was compared for males and females.

After calculating the frequencies, percentages and prevalence as detailed above, it was compared to relevant studies that were identified in the literature review. Prevalence of injury for age sub-sets (all ages, 25 years and older) were calculated to make the data comparable to similar studies found in the literature.

The prevalence of chronic disease and injury were compared to that of other athletic populations, as well as with the general population. To compare the prevalence of chronic disease in the study with South African medical aid data, the study data were age-adapted. This involved removing the study participants in the age group 18 - 24 from the analysis of chronic data as the Cairncross et al. data contained the age groups 15 - 19 years and 20 - 24 years and as such could not be directly compared.[39]

Medication use was analysed and expressed as a percentage of total participants. The percentage of participants, using prescribed chronic medicine, was calculated for each

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gender, combined genders, and age groups. Medication use was further analysed to determine most prescribed chronic medications. Possible doping infringements were determined by inputting each of the listed medications in the EMGuidance application for comparison with the Prohibited List.

Medication used was then compared to the type of, and percentage of chronic medication use and OTC medication use shortly before or during competition, with what was found in the literature for other athletic populations.

The attitudes of participants towards doping was analysed using the PEAS-8 scale.[82] The PEAS-8 questionnaire is attached in Appendix F. The PEAS instrument is judged by a 6-point Likert-type scale (strongly disagree (1), disagree (2), slightly disagree (3), slightly agree (4), agree (5) to strongly agree (6)), with a range of scores between 8 and 48, setting the theoretical middle-point at 28. The mean scores and SD of the PEAS instrument were calculated. Scale scores larger than 28 (or 3.5 per item on the 6-point scale) were interpreted as a more positive or lenient attitude toward doping.[83]

Swimmers' attitude towards fellow competitors' use of chronic medication and intentional doping for performance enhancement was calculated. The questions were scored by using a 5-point Likert-type scale ((1) strongly disagree; (2) disagree; (3) neither agree nor disagree; (4) agree; and (5) strongly agree) with a range of scores between one and five. The mean scores and SD for the questions were determined and evaluated against the midpoint of three. Scale scores larger than three per item were interpreted as a more positive or lenient attitude toward fellow competitors use of chronic medication and intentional doping. The mean scores for attitude towards doping and attitude towards fellow competitors doping were compared to studies found in the literature.

Both the previous and current prevalence of doping were calculated as a percentage of total participants.

Doping knowledge about WADA, the Prohibited List, sources of doping information and TUE application was analysed and described. The percentage of swimmers that was aware of the consequences of doping was calculated.

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Comparative data analysis

To compare different sub-sets of data, independent samples T-tests were used. A T-test is a statistical test that is used to compare the means of two data sub-sets in order to see if they differ from one another.[121] Parametric and non-parametric T-tests were conducted depending on how the data were distributed.[122, 123]

The independent sub-sets of data that were compared are listed below:

- Swimmers with and without chronic disease were tested against each of the motivations
- Swimmers with and without chronic disease were tested against gender
- Swimmers with and without injury were tested against each of the motivations
- Swimmers with and without injury were tested against gender
- Swimmers with a competitive motivation and swimmers with a non-competitive motivation were tested against types of injury
- Swimmers that competed in triathlons (regularly cross-trained by cycling and running) and swimmers that only competed in swimming events were tested for differences in injury status
- Males and females were tested for different PEAS mean scores
- Swimmers with a competitive motivation and swimmers with non-competitive motivation were tested for different PEAS mean scores

Correlation between variables

As defined by Schober et al. “Correlation coefficients quantify the strength of a linear (Pearson correlation) or monotonic (Spearman correlation) relationship between two continuous variables”.[124] The correlation coefficient (*r)* determines the significance or strength of the correlations and was interpreted as: 0.00–0.10 negligible correlation, 0.10–0.39 weak correlation, 0.40–0.69 moderate correlation, 0.70–0.89 strong correlation, 0.90–1.00 very strong correlation.[125]

Pearson’s correlation calculations were done between the following variables:

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- Age and chronic disease
- Age and number of chronic diseases
- Chronic disease, number of years swimming, volume-load, and the distance per session
- Volume-load and injury
- Injury location and injury

Research process, permissions and ethical considerations

Flow diagram of the research process

The flow diagram of the research process is shown in figure 1 below.

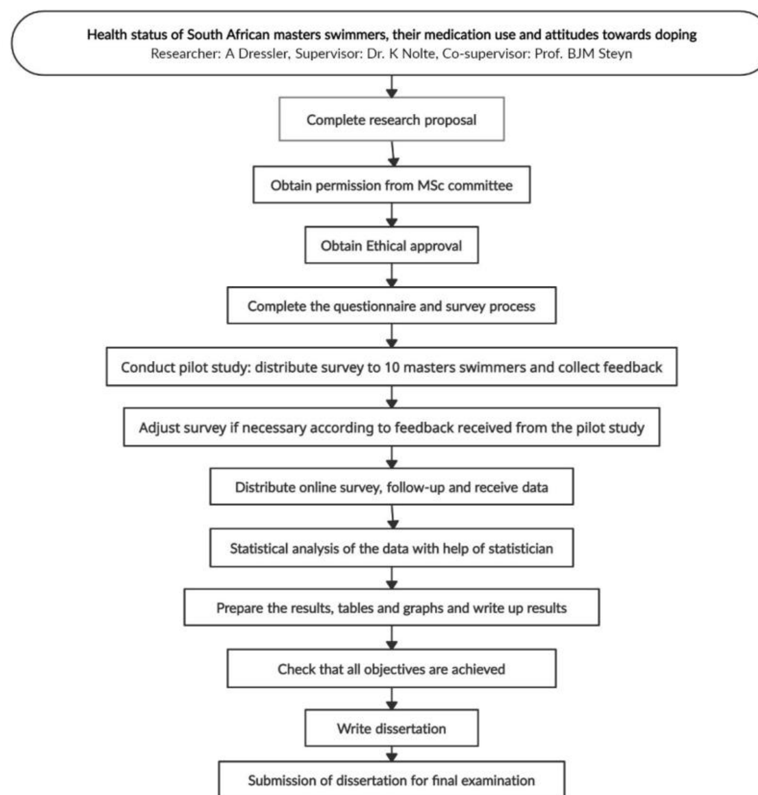

Figure 1: Flow diagram of the research process

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Approval of the study

On completion of the study proposal, permission to proceed with the study was obtained from the Faculty of Health Sciences' MSc Committee (Appendix G).

Permission was obtained from the governing body of masters swimming in South Africa, SAMS, to distribute the survey to their members (Appendix H). A secondary request was sent to the organiser of the aQuellé Midmar Mile swim, Mr W Ridden, to distribute the survey to all participants 18 years and older, who had previously competed in the open water swim. This request for distribution was unfortunately denied.

Ethical considerations

Great care was taken to adhere to ethical requirements and specifically in making the survey Protection of Personal Information Act (POPIA) compliant. POPIA came into effect on 1 July 2021 and had implications on all research activities that involved the collection, processing and storage of personal information. Actions taken to adhere to the act, included making data collection anonymous and voluntary, attaining consent from participants to share their data and adding a declaration by the researcher in the questionnaire. Only participants that provided informed consent were allowed to compete the survey.

Ethical clearance (193/2021) was granted by the Faculty of Health Sciences Research Ethics Committee. The study was carried out following the ethical standards laid down in the 1964 declaration of Helsinki and its later amendments (Appendix A).

Data protection

The data collected contained personal and other sensitive information on health status and doping practice. For this reason, the data will be kept confidential. The electronic metadata will be uploaded to the University of Pretoria Research Data Repository system at the end of the study for the prescribed minimum period. The declaration of data storage is included in Appendix I. Data collected in the online survey will be used in this study only and will not be made available for any other research.

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Chapter 4: Findings

Demographic data analysis

Age distribution

The 359 masters swimmers that completed the survey selected five-year age categories as defined in the previous section on age range of swimmers included in the survey. The age range was 18 - 89 years. The mean age of 51.3 years, 95% CI (49.8, 52.7) for the participants was determined using mid-point coding. Figure 2 below shows the age distribution of the participants.

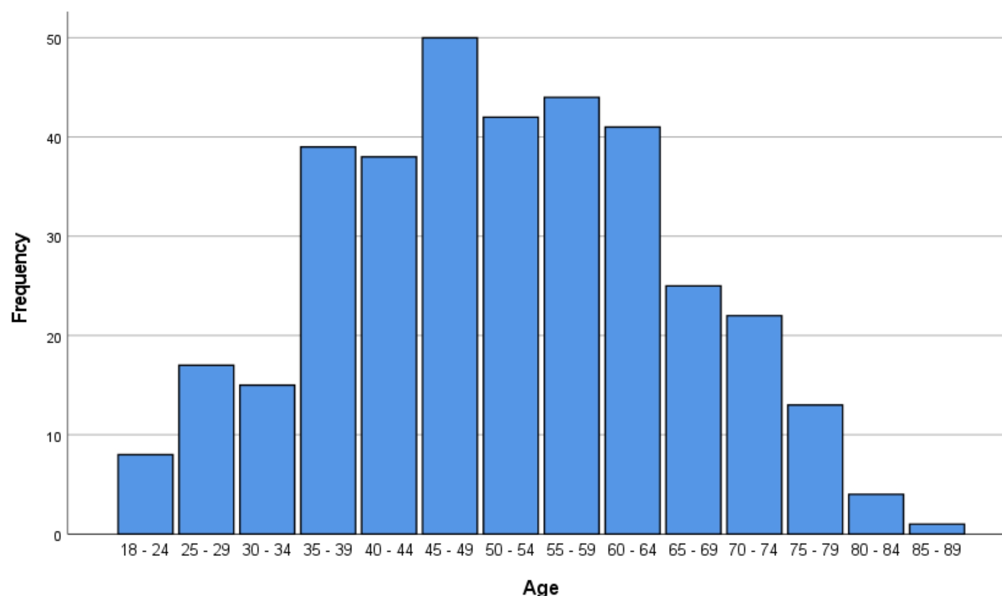

Figure 2: Age distribution of participants

Gender

The gender distribution showed that 50.7% (n=182) of the participants were female and 48.7% (n=175) were male. Two participants did not disclose their gender. A study population pyramid showing an overview of the age and gender distribution of the participants is shown in Figure 3.

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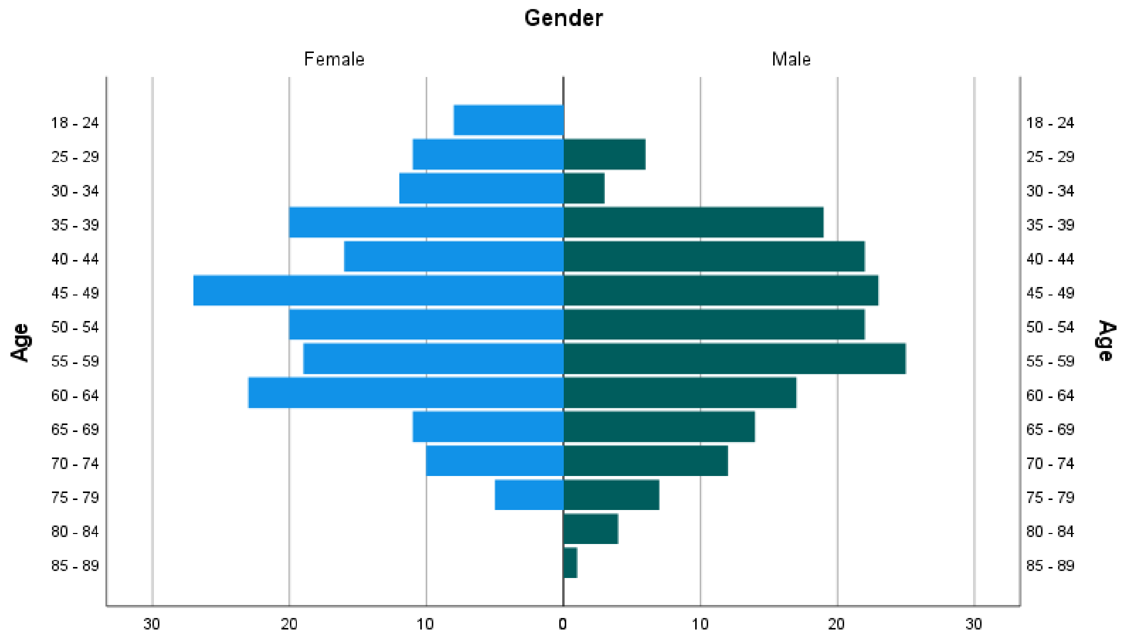

Figure 3: Population pyramid displaying age and gender distribution

Medical aid

The percentage of participants that subscribed to a medical aid was 96.1%, 95% CI (94.1, 98.1). This question was included for possible comparison of participants health status with that reported in medical aid statistics. Medical aid data on chronic diseases were available to the researcher and adaptation of age groupings of the statistics made comparisons possible.[39]

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Frequency of training

The responses to the question 'How many times in a week do you swim?' are listed below in Table 1. One participant did not respond to this question.

Table 1: Number of training sessions per week

Number of training sessions per week	n	Percentage (%)
Less than once per week	29	8.1%
Once per week	16	4.5%
Twice per week	84	23.4%
Three times or more per week	229	63.8%

The results showed that 63.8% of the swimmers train three or more times per week.

Distance of training per session

The responses to the question 'What distance do you swim per training session?' are listed below in Table 2. One swimmer did not respond to this question.

Table 2: Training distance per session in meters (m)

Training distance per session (m)	n	Percentage (%)
Less than 500 m per session	9	2.5%
500 - 2000 m per session	174	48.5%
2000 - 3000 m per session	151	42.1%
More than 3000 m per session	24	6.7%

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Swim training volume-load per week

Two participants did not respond to this question. To compare the results of this study to previous research, it was necessary to calculate the training volume-load for the participants. Although most articles that use swimming-related training load used the hours per week that swimmers train to determine training load, two surveys conducted on adult swimmers by De Almeida et al.[63] and Kruger et al.[76] calculated training load by multiplying the number of training sessions done per week by the average distance that swimmers trained during a session. Kruger et al. also categorised training load per week in masters swimmers into low (0 - 4.9 km per week), medium (4.9 - 11.9 km per week) and high volume-load (12 km and more per week) categories.[65] Similar categories were used to determine swimming volume-load for the participants and the results are summarised in Table 3 below.

Table 3: Volume-load per week

Volume-load category	n	Percentage (%)
Low (0 - 4.9 km/w)	106	29.5
Medium (4.9 - 11.9 km/w)	227	63.2
High (11.9 + km/w)	24	6.7

The calculated training-volume showed that most swimmers followed a medium regime of training, swimming between five and 12 km per week.

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Figure 4 shows the % of swimmers against the training-volume.

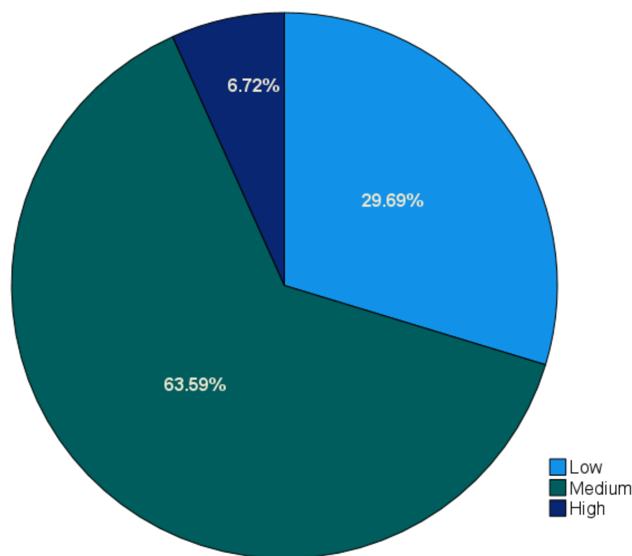

Figure 4: Pie chart showing number of swimmers against training-volume per week

Years of swimming

Swimming experience or life-time exposure was defined by Feijen et al. as the number of years swimmers participated competitively.[126] To be inclusive for recreational swimmers this definition was adapted for this study by not referring to competitiveness. The responses to the question 'How many years have you been swimming?' are listed in Table 4. Table 4: Number of years swimming

Number of years swimming	n	Percentage (%)
0 - 1 years	28	7.8%
1 - 2 years	36	10.0%
3 - 5 years	39	10.9%
5 - 10 years	36	10.0%
More than 10 years	220	61.3%

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Competitions attended

In this section the participants were asked three questions.

Question 1: ‘Have you competed in an organised sporting event that included swimming in the last five years? This includes social, non-competitive, and fun events for example the Polar Bear swim.’

The relatively long reporting interval of five years was chosen due to the COVID-19 pandemic restrictions that limited events in the two years preceding the study. For this question 89.1%, 95% CI (86.0, 92.2) of participants indicated that they competed in an event in the last five years.

Question 2: ‘Please specify the event(s). You can choose more than one option.’

Participants were given four categories of events to choose from namely triathlon, Ironman, open water swimming, pool and an option to specify other events. Participants could choose more than one category of event i.e. one participant could indicate participation in triathlon, Ironman competitions and open water swimming. The results for triathlon and Ironman competition were combined as they include the same sporting codes at different distances, with Ironman being a specific type of triathlon. Participants then had to indicate the level at which they competed namely local, regional, national and/or international. They could indicate more than one level of competition. It was clear that this question confused specifically the open water swimmers as they did not know how to categorise events as local, regional and national.

Question 3: ‘Please specify the event or events that you train for. Separate your events with a comma (,).’ One hundred and two participants indicated that they competed in other events. Analysis of the open-ended question where swimmers could indicate what events they took part in resulted in most swimmers indicating that they train for the SAMS nationals championships, triathlon/Ironman and the Midmar Mile open water swim.

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Several other events were specified namely cold-water swimming (18), fun events (6), lifesaving (3), religious events (2), and combination events (10). Combination events included biathle, biathlon and duathlon. Although the combination events could theoretically be combined with triathlon it was decided not to do so. The reason being that the question could be interpreted as events participants aspire to compete in and not necessarily events in which they have already competed in. Twelve participants replied that they trained for health and fitness only. Table 5 shows the analysis of the number of swimmers that competed in triathlon, pool, open water swimming and other events against the competition level selected.

Table 5: Analysis of events

Event	Percentage (%)	Event level			
		Local (%)	Regional (%)	National (%)	International (%)
Triathlon / Ironman	27.5	37.4	10.1	27.3	25.3
Pool swimming	56.7	11.3	9.3	67.2	12.3
Open water swimming	66.9	31.5	24.1	39.0	5.4
Other events	28.3	-	-	-	-

Analysis of the events showed that 27.5% of swimmers take part in triathlon and Ironman events, 56.7% in pool events and 66.9% in open water events.

Motivation to train and compete in swimming

Every swimmer could choose three motivations for why they swim. No ranking was performed for the motivations selected. The motivations selected by the participants are shown as a percentage of total participants in Table 6. Although two participants selected other motivations, they did not specify what these motivations were.

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Table 6: Motivation to swim

Motivation	Percentage (%)
To improve my health and fitness	85
To relieve stress and feel better	47
To enjoy myself and have fun	45
To challenge myself and master new skills	34
For social interaction and being with friends	23
To compete and win	16
To delay the effects of aging	16
To be part of a team	8
To travel and gain new experiences	7
Other motivations	2

The results showed that most participants trained and competed to improve health and fitness. This was followed by the motivations to relieve stress and to have fun.

Chronic disease prevalence

In the first question of this section on chronic disease participants were asked to indicate if they have ever been diagnosed with chronic disease by a health care provider. The options given were 'yes, no, I am not sure, and I do not wish to disclose any chronic disease information'. Four participants indicated that they were not sure if they had a chronic disease, they did however specify an actual chronic disease under the open question. These participants were added to the number of participants that answered 'yes' to this question. One participant did not want to disclose disease status and was excluded from the percentage calculations. The prevalence of chronic disease reported by the 358 participants that completed the question on chronic disease prevalence was calculated as 39.1%, 95% CI (34.0, 44.2). The prevalence of chronic disease for the 350 participants 25 years and older was calculated as 38.7%, 95% CI (33.6, 43.9). The prevalence of chronic disease for the 192 participants 50 years and older was calculated as 50.0%, 95% CI (42.9, 57.1).

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Analysis of prevalence of chronic disease split by gender

The gender split for the 356 participants (two participants did not want to disclose their gender, one participant did not want to disclose chronic disease information) shows that 34.9%, (n=61) of the male participants were diagnosed with a chronic disease compared to 43.1%, (n=78) of the females.

Relationship between age and chronic disease

An analysis of the relationship between age and the prevalence of chronic disease in an age group is shown in Table 7 below. One participant did not want to disclose disease status and was excluded from the percentage calculations.

Table 7: Relationship between age and chronic disease

Age group	n with chronic disease	n per age group	Age group prevalence (%)	Population prevalence (%)
18 - 24	4	7	57.1	1.1
25 - 29	4	17	23.5	1.1
30 - 34	6	15	40.0	1.7
34 - 39	7	39	17.9	2.0
40 - 44	10	38	26.3	2.8
45 - 49	13	50	26.0	3.6
50 - 54	14	42	33.3	3.9
55 - 59	21	44	47.7	5.9
60 - 64	19	41	46.3	5.3
65 - 69	20	25	80.0	5.6
70 - 74	13	22	59.1	3.6
75 - 79	6	13	46.2	1.7
80 - 84	2	4	50.0	0.6
85 - 89	1	1	100.0	0.3
Total	140	358		39.1

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There is a high prevalence of chronic disease in the younger age groups 18 - 24 years (57.1%) and 30 - 34 years (40.0%). From the age group of 34 - 39 years the prevalence of chronic disease gradually increases up to the age group of 65 - 69 years, after which the older age groups shows a decline in chronic disease prevalence.

Analysis of type of chronic disease

In this section of the questionnaire participants were given a selection of nine chronic diseases to select from. They could pick more than one disease as well as specify any other diseases not on the list under an open-ended option. The diseases they could select were HTN, HLD, DM, AST, thyroid disease, CAD, heart disease, epilepsy and BMD. One participant did not want to disclose disease status and was excluded from the percentage calculations. One participant indicated a chronic disease in question 1, but did not specify type of disease and medication and was excluded from the data analysis in question 2. The data were evaluated by the medication specified and the participant was added to the MBD type.

An analysis of the selected and open-ended listed chronic diseases for different age groupings is given in Table 8 below.

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Table 8: Type of Chronic disease prevalence for different age groupings

Chronic disease	n 18+	18+ (n=357) (%)	n 25+	25+ Population (n=350) (%)	n 50+	50+ Population (n=192) (%)
Arthritis*	8	2.2	8	2.3	6	3.1
AST	24	6.7	21	6.0	12	6.3
BMD	7	2.0	6	1.7	4	2.1
Cancer	5	1.4	5	1.4	4	2.1
Heart disease*	12	3.4	12	3.4	9	4.7
Chronic pain*	7	2.0	7	2.0	4	2.1
DM	9	2.5	9	2.6	7	3.6
Epilepsy	0	-	-	-	-	-
HTN	48	13.4	47	13.4	42	21.9
HLD	43	12.0	43	12.3	37	19.3
MBD*	16	4.5	16	4.6	7	3.6
OP	5	1.4	5	1.4	5	2.6
Thyroid disease	25	7.0	25	7.1	19	9.9
Other	17	4.8	16	4.6	9	4.7

*Heart disease excludes HTN, MBD includes BMD, schizophrenia, depression and anxiety conditions and arthritis includes OA/RA, ankylosing spondylitis, and gout. Chronic pain conditions include chronic back and neck pain, fibromyalgia, non-specific polyarthralgia and unspecified neuropathy.

Other chronic diseases listed by participants included Addison`s disease, unspecified auto-immune disorder, Barrett's islands disease, prostate hypertrophy, haemophilia, Cushing's syndrome, endometriosis, glaucoma, graves' disease, hypogonadism, KD, optic neuritis, narcolepsy and ulcerative colitis.

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Number of chronic diseases per participant

Participants could select an unlimited number of chronic diseases from the CDL of the ten most prevalent chronic diseases in South Africa. They could also specify any diseases not listed in an open-ended option. Table 9 below summarizes the number of chronic diseases listed by swimmer as a percentage of the total number of participants (n=358).

Table 9: Number of chronic diseases per swimmer

Number of chronic diseases per swimmer	n	Percentage (%)
No chronic conditions	218	61.1
One or more chronic conditions	140	39.1
More than one chronic condition (multi-morbidity)	59	16.5
Only one chronic condition	80	22.4
Two chronic conditions	39	10.9
Three chronic conditions	13	3.6
Four chronic conditions	6	1.7
Five chronic conditions	1	0.3

The results showed that 22.4% of participants had only one chronic disease and that 16.5% reported multi-morbidity. The maximum number of reported co-existing chronic diseases was five in the same individual. Multi-morbidity prevalence reported in males was 14.9% (n=26) and in females 18.1% (n=33).

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The figure below is a summary of the reported number of chronic diseases per swimmer.

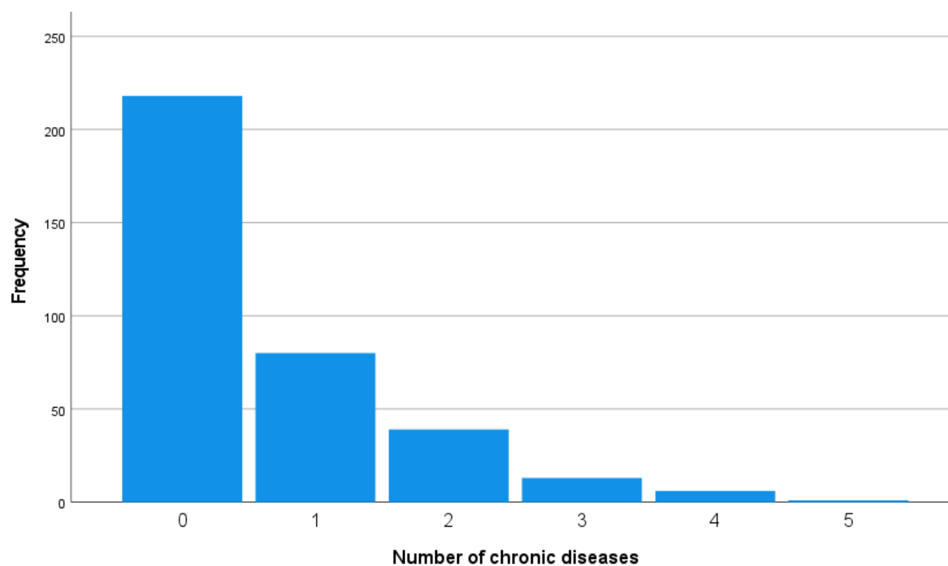

Figure 5: Number of chronic diseases per participant

Prescribed chronic medication for chronic disease

In this section participants were asked 'Do you use any prescribed medication on a daily, weekly or monthly basis to treat your chronic disease? On answering yes, they were directed to an open-ended question where they could specify the medication used with the instruction 'Please list the medication(s) that you are taking for your chronic disease(s). Please just enter the name of the medication. No need to give the dosage. Separate your medication names with a comma (,)'.

Analysis of the prescribed chronic disease medication showed that 84.6% of the masters swimmers with a chronic condition took medication to treat their condition. In total 121 swimmers indicated that they used chronic medication. This makes the total population prevalence of chronic medication use 33.7%, 95% CI (28.8, 38.6). Table 10 below shows the number of swimmers taking medication per type of chronic condition.

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Table 10: Most prescribed medication

Type of medication	n	Percentage (%)
HTN	48	13.4
Hypolipidemic	39	10.9
NSAIDs	27	7.5
Cardiac	15	4.2
Bronchodilators	15	4.2
Mental health	11	3.1
DM	11	3.1
Glucocorticoid	2	0.6
Analgesic	2	0.6
Arthritis	2	0.6
For other chronic diseases	44	12.3

The results showed that the most prescribed chronic medications are HTN and hypolipidemic medications. This is followed by NSAIDs, cardiac medication and bronchodilators.

Possible doping infringements through the use of chronic medication

Of the 121 swimmers that used medication to treat their chronic disease 34.7%, (n=42) were committing a possible doping offence. This makes the total population percentage of possible doping offences through the use of prescribed medication to treat chronic disease 11.4%. Table 11 below gives a breakdown of the type of infringement.

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Table 11: Type of doping infringement through use of chronic medication

Type of PED	n	Percentage (%)
Stimulants	4	1.1
Beta-2-antagonists	5	1.4
Diuretics and masking agents	27	7.5
Glucocorticoids	1	0.3
Metabolic and hormone modulators	4	1.1
Total infringements	41	11.4

Diuretics and masking agents that are mostly used for the treatment of hypertension were the most prescribed medication found on the prohibited list. This was followed by beta-2-antagonists used mostly to treat AST. Although one participant used a beta-blocker, swimming is not one of the specified sports on the prohibited list and was excluded from the infringement calculations.

Prevalence of injury

In this section of the questionnaire participants were asked if they suffered any injury due to swimming that required treatment e.g., use of medication or required them to seek medical advice from a health professional in the last five years. The prevalence of injury split between the genders is summarised in Table 12 below.

Table 12: Prevalence of injury split by gender

	n Males	n Females	Male (%)	Female (%)	Population (%)
Injury	45	48	12.6	13.5	26.1

The prevalence of injuries in the five years preceding the survey was 26.1% with males reporting slightly less injuries (12.6%) than females (13.5%).

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Injury by body region

An analysis of the selected injured regions ranked by location or joint is given in Table 13 below. Seven swimmers indicated that they suffered an injury due to swimming in a body region that was not listed as an option. They did not specify which body region the injury occurred in.

Table 13: Prevalence of injury by body region

Injury location	n	Prevalence (%)	95% CI
Shoulder	65	18.1	(14.1 – 22.1)
Back and/or neck	13	3.6	(1.7 – 5.6)
Knee	6	1.7	(0.3- 3.0)
Ear	3	0.8	(0.0 – 1.8)
Other	7	1.9	(0.5 – 3.4)

The most injured region was the shoulder followed by the back and/or neck and knee regions. Injuries to other regions were not specified by the participants and could not be analysed.

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Relationship between age and injury

Table 14 below gives a summary of the prevalence of the swimmer's injuries per age group.

Table 14: Age group and injury prevalence analysis

Age group	Number of Injuries	n in age group	Injury % per age group
18 - 24	4	8	50
25 - 29	6	17	35
30 - 34	2	15	13
34 - 39	13	39	33
40 - 44	13	38	34
45 - 49	16	50	32
50 - 54	12	42	29
55 - 59	10	44	23
60 - 64	8	41	20
65 - 69	4	25	16
70 - 74	3	22	14
75 - 79	3	13	23
80 - 84	0	4	0
85 - 89	0	1	0

The prevalence of injuries in the 18 - 24 age group was the highest. The results show that prevalence of injuries mostly decrease with increased age.

Shoulder injuries

In this section swimmers were asked if they suffered any of the following injuries to their shoulders? The options given were swimmer's shoulder and /or impingement, inflammation of tendons in shoulder or arm (tendinitis), rotator-cuff tear, OA and shoulder pain. Swimmers were allowed to choose more than one option or could specify an injury not listed. The other shoulder injuries swimmers specified were AC

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ligament injury (1), calcification of tendon (1), dislocation (2), trapezius tear (1) and a labrum tear (1). The results of the analysis for shoulder injuries are shown in Table 15 below.

Table 15: Type of shoulder injuries reported

Type of injury	n	Percentage (%)
Inflammation of tendons in	35	9.7
Swimmer's shoulder and /or	34	9.5
Rotator-cuff tear	23	5.8
Shoulder pain	19	5.3
Osteo-arthritis	3	0.8
Other:	6	1.4

Analysis by type of shoulder injury showed that tendinitis and impingement are the most reported shoulder injuries.

Prescribed and OTC medication used shortly before and during competitions

This section included two questions on medication used to treat injuries or illness shortly before or during competitions. The first being 'Were you prescribed any injections, medications and/or did you buy any OTC medication, to treat an injury or any illness, suffered SHORTLY BEFORE OR DURING COMPETITIONS? This may include cortisone injections or tablets, NSAIDS, any pain tablets, cold and flu medication, cough syrups or any other medications that you may have used.' Analysis of the prescribed and OTC medication showed that 16.4% of the participants took medication to treat injury or illness shortly before or during competitions. Table 16 shows the percentages of the most prescribed and OTC medication types used by the swimmers to treat injury or illness shortly before or during competitions.

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Table 16: Prescribed and OTC medication used shortly before or during competition

Type of medication	n	Prevalence (%)
NSAIDs	48	13.4
Analgesic	10	2.8
Cortisone	9	2.5
Muscle relaxant	6	1.7
NSAID and analgesic	6	1.7
Bronchodilator	2	0.6
Antibiotic	2	0.6

The medications used to treat injuries or illness shortly before or during competitions were NSAIDs, analgesics and cortisone.

Possible doping infringements through use of prescribed or OTC medication shortly before or during competition

Of the 59 swimmers that used medication shortly before or during competition 34.7%, (n=10) were committing a possible doping offence. The percentage of possible doping infringements for the total population is 2.8%. Table 17 gives a breakdown of the type of infringement.

Table 17: Type of doping infringement through use of prescribed or OTC medication shortly before or during competition

Type of PED used	n	Percentage (%)
Beta-2-antagonists	1	0.3
Glucocorticoids	9	2.5
Total infringements	10	2.8

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Attitudes towards doping

In this question swimmers were asked to express their attitude towards the intentional use of PEDs. They were asked to rate their answers as strongly disagree (1), disagree (2), slightly disagree (3), slightly agree (4), agree (5) to strongly agree (6). The mid-point or mean score for each of the PEAS items is 3.5 and for the total of 8-items is 28. Values reported below these scores signify a negative or non-lenient attitude towards doping. The mean scores and SD of the PEAS instrument are listed in Table 18.

Table 18: Results of the PEAS instrument

PEAS items	Mean score ± SD
1. Legalizing performance enhancements would be beneficial for sport.	1.416 ± 1.0
2. Doping is necessary to be competitive.	1.340 ± 1.0
3. The risks related to doping are exaggerated.	1.801 ± 1.4
4. Athletes should not feel guilty about breaking the rules and taking performance-enhancing drugs.	1.248 ± 0.9
5. Doping is an unavoidable part of the competitive sport.	1.885 ± 1.4
6. Doping is not cheating since everyone does it.	1.228 ± 0.8
7. Only the quality of performance should matter, not the way athletes achieve it.	1.465 ± 1.2
8. There is no difference between drugs and speedy swimsuits that are all used to enhance performance.	1.616 ± 1.2
PEAS total	11.99 ± 4.8

The participants scored well below the item and total mean scores, showing a non-lenient attitude towards doping.

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Possible gender differences in the scores between males and females were investigated. Table 19 below summarises the PEAS scores separately for males and females.

Table 19: PEAS scores for genders

Gender	n	Mean score ± SD
Males	172	12.49 ± 5.1
Females	180	11.53 ± 4.5

The mean PEAS scores split per gender above shows that the male scores were slightly higher than that of females.

Swimmers' attitude towards fellow competitors doping

In this section participants were asked to rate their attitude towards fellow competitor use of medication and PEDs. The five questions were scored by using a 5-point Likert-type scale with a range of scores between one and five. They were asked to rate their answers as (1) strongly disagree; (2) disagree; (3) neither agree nor disagree; (4) agree; and (5) strongly agree. The mean score for the questions was 3. The mean scores and SD for the questions are listed in Table 20.

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Table 20: Swimmers' attitude towards fellow competitors doping

Attitude questions	Mean score ± SD
Swimmers taking medication to treat chronic disease, illness or injury have an unfair advantage in competitions.	2.18 ± 1.0
I do not care if my competitors take medication even if it gives them an unfair advantage in competitions.	2.85 ± 1.4
I do not care if my competitors INTENTIONALLY use prohibited substances other than chronic medication or methods to give them an unfair advantage in competitions.	1.52 ± 1.8
Intentionally taking performance enhancing drugs with the sole purpose of improving performance has long-term health implications.	4.27 ± 1.1
The use of chronic medication helps masters swimmers to perform as healthy individuals.	3.45 ± 1.3
In your opinion does advancing age make swimmers more vulnerable to (intentional and unintentional) doping?	2.78 ± 1.2

Intentional doping to improve performance

This section included three questions on doping.

Question 1: Have you ever intentionally used banned substances or methods to enhance your swimming performance? It further specified that 'This excludes the use of prescribed chronic medication or the unintentional use of performance enhancing medication to treat injury or illness. Remember that the questionnaire is anonymous and your identity is protected. Please be honest.' One male swimmer answer indicated the intentional use of a PED in this question.

Question 2: Do you currently use a banned substance(s) or method(s) to enhance your sporting performance? All participants answered 'no' to this question.

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Question 3: Please specify the drug or method that you use to improve your performance. This was an open-ended question. No swimmers completed this question.

Knowledge about doping

In this section participants were asked several questions pertaining to doping knowledge and where they attained the knowledge.

The first question asked if participants were familiar with the WADA website, anti-doping rules, regulations and policies. In response to this question 37.9%, (n=136) of the masters swimmers answered 'yes'.

In the second question participants could then indicate where they found doping information in a selection table with an open-ended option where they could further specify sources. The selection and sources specified under the open question were categorised into Table 21.

Table 21: Sources of doping information

Sources	n	Percentage (%)
WADA and SAIDS websites	92	25.6
SSA	69	19.2
Social and news media	137	38.2
Family/friends	97	27.0
Medical professionals	2	0.6
Own research/Internet searches	8	2.2
Expert lectures and journal articles	6	1.7
My profession	4	1.1
Swim coach	4	1.1
Other sport	6	1.7

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In the third question swimmers were asked if they have ever heard about the WADA prohibited list and to this question 57.4% (n=206) of the participants indicated 'yes'.

To the fourth question 'Have you ever asked your doctor if the medication he prescribed is legal to use when taking part in sporting events?', 24.5%, (n=88) of the participants indicated that they had asked.

The next two questions tested the participants knowledge about TUEs and the application process for exemption. Question 1: Have you ever applied for a Therapeutic Use Exemption (TUE) for YOURSELF in any sport? This question resulted in 1.9% (n=7) of the participants indicating that they have applied for TUEs. Question 2: Have you ever applied for a Therapeutic Use Exemption (TUE) for a family member in any sport? Only three swimmers (0.8%) answered yes to this question.

In the last question participants were asked if they were aware of the consequences of committing anti-doping rule violations. To this question 70.2%, (n=252) answered that they were aware of the consequences of doping.

Results summary

The survey resulted in 359 responses with 48.7% male and 50.7% female swimmers completing the gender question. Two swimmers did not declare their gender. The mean age of the participants was 51.27 ± 1.5 years. The study population showed a representative sample of masters swimmers, with swimmers taking part in a variety of events namely triathlon and Ironman (27.5%), pool events (56.7%) and open water events (66.9%). Most of the participants (61.3%) have been swimming for more than 10 years, but a surprisingly high number of swimmers (17.8%) indicated that they have only recently (< 2 years) taken up swimming as a sport.

The dominant motivation of the swimmers to train and compete in swimming was to improve health and fitness (85%), followed by the motivations to relieve stress (47.4%) and for enjoyment and to have fun (45.5%). In line with previous studies the swimmer's motivation to compete and win (16.2%) was a less dominant motivation.[29, 37]

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The prevalence of chronic disease in the masters swimmers was 39.1% with females (43.1%) having a higher prevalence than male participants (34.9%). The total population prevalence of prescribed chronic medication use was 33.7% with 11.4% committing a possible doping offence.

Twenty-six percent of the participants reported injuries in the five years preceding the survey with injuries in the shoulder region most frequently reported and tendinitis being the most prevalent reported shoulder injury.

Analysis of the prescribed and OTC medication showed that 16.4% took medication to treat injury or illness shortly before or during competitions, leading to 2.8% of the participants committing possible doping offences. The most used medication were NSAIDs, analgesics and cortisone.

In the section on intentional doping by PEDs or methods only one male swimmer indicated previous use of a banned substance.

The expressed attitude of the participants on the PEAS 8-item version showed scores considerably lower than the 3.5 midpoint score per question indicating that masters swimmers do not have a positive or lenient attitude toward doping. Specific questions set to test the swimmers' attitude towards chronic medication use, indicated that they believed that chronic medication helped masters swimmers to perform as healthy individuals and that this medication use should not be construed as doping.

Participants showed limited knowledge (37.9%) of the WADA website, anti-doping rules, regulations and policies. The most listed sources of doping information were social and news media (38.2%), family/friends (27.0%) and the WADA and SAIDS websites (25.6). Only 24.5% of the participants indicated that they have ever asked their medical doctor if the medication they prescribed is legal to use when taking part in sporting events and only 1.9% showed knowledge of TUEs. Counter to the limited doping knowledge displayed by the swimmers 70.2% indicated that they were aware of the consequences of doping.

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Chapter 5: Discussion

Response rate

In the original planning the estimated number of responses using purposive sampling on both the SAMS and Midmar databases, calculated at a 4% response rate, indicated that the estimated number of participants would be 450. It was theorised that in using the two databases the survey would reach a mix of South African recreational and competitive masters swimmers competing in a variety of combination, pool, open-water and recreational events. Due to the failure to attain permission to distribute the survey to masters swimmers on the aQuellé Midmar Mile database, the study was adapted to use snowball sampling. The snowball sampling technique was used to further distribute the questionnaire to an unknown number of masters coaches and masters swimmers resulted in 359 responses to the survey. Due to the use of this sampling method the response rate cannot be determined.

Representative sample

Although the survey was initially distributed to the SAMS database only, which mostly targeted pool swimmers, the snowball sampling resulted in a more representative sample with swimmers taking part in a variety of events namely triathlon and Ironman (27.5%), pool events (56.7%) and open water events (66.9%). Masters swimmers participation in events showed representation at all event levels from recreation or fun events to international events.

Most of the participants (61.3%) have been swimming for more than 10 years, this is similar to the results in a study by Potdevin et al. conducted on masters swimmers in France (21 years ± 13.5) that also showed long term engagement with the sport. A surprisingly high number of swimmers (17.8%) indicated that they have only recently (< 2 years) taken up swimming as a sport.[127]

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Comparison of motivation to swim with other studies

The dominant motivation to train and compete in swimming was to improve health and fitness (85%), followed by the motivations to relieve stress (47.4%) and to enjoy myself and have fun (45.4%). Only 23% of swimmers were motivated by social interaction and being with friends. These findings differ from studies by Adams on WMG participants that found that the motives to socialise and compete with other participants were slightly more important than to improve my health.[27] Walsh et al. found that the main motivation for females was to socialise and that of males was to increase fitness and health.[29] Kruger et al. found that the motivation of swimmers differs depending on the event they partook in.[37] They also found that competitors at the Midmar Mile were motivated for three main reasons namely socialisation and escape, fun and entertainment and intrinsic achievement. In line with all these studies the motivation to compete and win (16.2%) was a less dominant reason.

Number of chronic diseases compared to the general population

Table 22 compares the number of diseases per participant with the general population statistics for adults 18 years and older in the USA and Australian health surveys. The prevalence of chronic disease in the South African masters swimmers (39.1%) is lower than of the general population found in other studies in the USA (50.8%) and Australia (47.0%).[45, 46]

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Table 22: Comparison of prevalence of chronic diseases with general population statistics

Author	One chronic disease	Two or more chronic diseases	One or more chronic diseases
Dressler et al.	22.4	16.5	39.1
2010 USA National Health Interview Survey in Ward et al.[45]	24.8	26.0	50.8
2017 - 2018 Australian national health survey[46]	-	-	47.0

The prevalence of chronic disease in participants 50 years and older in this study compared with the Westaway study on 710 randomly selected adults from diverse ethnic backgrounds shows a multi-morbidity prevalence of 39.1% in swimmers compared to 73.0%.[128]

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Chronic diseases prevalence compared to the general population

Table 23 below compares the prevalence of different chronic diseases with the general population statistics that was found in relevant studies.

Table 23: Comparison of prevalence of chronic disease with the general population

Author	**Dressler et al.**	**Australian national health survey in Walsh et al.[9]**	**SANHANES-1 in Shisana et al.[7]**
Age group	18+ years	18+ years	15+ years
Arthritis	2.2	15.0	-
AST	6.7	11.2	4.1
Cancer	1.4	1.8	1.2
CVD	3.4	-	3.8
DM	2.5	4.7	5.1
HTN	13.2	22.8	22.9
HLD	12.0	-	4.1
MBD	4.5	20.1	-
OP	1.4	3.8	-

* MBD includes diseases BMD, schizophrenia, depression and anxiety conditions. Arthritis conditions included OA/RA, ankylosing spondylitis, and gout. CVD includes CAD and heart diseases (CMY, ischaemic heart disease, dysrhythmias), but excludes HTN which is shown separately.

The comparison shows that South African masters swimmers have a better prevalence of specific chronic diseases when compared to the general population statistics found to the Australian national health survey. Chronic disease prevalence in the South African SANHANES-1 survey could not be compared to this study as it included participants from 15 years and older.

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Chronic diseases prevalence compared to South African medical aid data

With 96.1% of the participants subscribed to a medical aid, chronic disease prevalence reported in the study was compared to medical aid data in Table 24. Cairncross et al. used different definitions to sample the medical aid data. The prevalence data using the more relaxed definition of chronic disease prevalence namely the count of beneficiaries who have had at-least one claim for a specified CDL condition during the year was used for comparison with this study.[39]

Table 24: Comparison of study chronic disease prevalence with South African medical aid chronic diseases data

Author	**Dressler et al.**	**Medical aid chronic disease data 2016 in Cairncross et al.[39]**
Age group	18+ years	All ages
Arthritis*	2.2	0.8
AST	6.7	16.0
BMD	2.0	1.1
CAD	1.4	2.3
CVD	3.4	3.5
DM	2.5	6.2
HTN	13.2	15.6
HLD	12.0	7.6
MBD	4.5	2.3

* Study MBD includes diseases BMD, schizophrenia, depression and anxiety conditions while medical aid data only includes SCZ and BMD. Study arthritis conditions included OA/RA, ankylosing spondylitis, and gout while medical aid data only includes RA. Study CVD includes CAD and heart disease, while medical aid data includes CAD, CMY, ischaemic heart disease, dysrhythmias. Both excludes HTN as a separate disease.

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Comparison of the study results with the diseases prevalence for all ages in Cairncross et al., show considerably better chronic disease prevalence for AST, CVD, DM, and HTN in the study population.[39, 128] The values for arthritis could not be compared as the Cairncross et al. statistics only included RA as a chronic disease. This study combined all arthritis conditions namely RA, OA, ankylosing spondylitis and gout. MBD for this study included BMD, schizophrenia, depression and anxiety conditions. Cairncross et al. only included BPD and schizophrenia. The prevalence for BMD and HLD are higher for the study. This may be due to age discrepancies between the compared data.

To better compare the study data with the medical aid data in Cairncross et al., the data was age-adapted to only include the age-groups of 25 years and older. The age-adapted chronic disease prevalence is compared in Table 25.

Table 25: Comparison of age-adapted study chronic disease prevalence with medical aid chronic disease data

Author	**Dressler et al. 25+ (%)**	**Cairncross et al.[39] 25+ (%)**	**Dressler et al. 50+ (%)**	**Cairncross et al. [39] 50+ (%)**	**Westaway [128]50+ (%)**
Arthritis*	2.3	1.87 (RA)	3.1	2.4	8.0
AST	6.0	5.7	6.3	6.6	-
BMD	1.7	1.3	2.1	1.0	-
Heart	3.4	16.54	4.7	23.4	-
CAD	1.4	7.8	2.1	10.9	-
DM	2.6	13.4	3.6	17.1	5.0
Epilepsy	0.0	1.9	0.0	2.4	-
HTN	13.4	40.3	21.9	52.88	25.0
HLD	12.3	21.1	19.3	28.8	-
MBD	4.6	1.47	3.6	1.18	-
Thyroid	7.1	7.3	9.9	9.7	-

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Comparison of the study results with the diseases prevalence in the different age groups reported to that of Cairncross et al.[39] and Westaway[128], show considerably better chronic disease prevalence for CAD, DM, epilepsy, HTN, HLD and thyroid disease (25+ age group) in the study population. Hypothyroidism in the CDL was broadened to thyroid disease in the study to include all diseases of the thyroid. This may be why the 50+ age group in the study shows higher prevalence of thyroid disease.

The values for arthritis could not be compared as the Cairncross et al. statistics only included RA as a chronic disease. This study combined all arthritis conditions namely RA, OA, ankylosing spondylitis and gout. Heart disease in the study could be under reported as the options given in the questionnaire were not clear. The Cairncross et al. value was derived by adding the prevalence of CAD, CMY, ischaemic heart disease and dysrhythmias (excluding HTN). MBD for this study included BMD, schizophrenia, depression and anxiety conditions. Cairncross et al. only included BPD and schizophrenia. MBD prevalence was higher in the study. Chronic disease prevalence for the study was higher than the medical aid prevalence's for the conditions AST (ages 25+) and BMD.[39]

The prevalence of chronic disease in participants 50 years and older in this study compared with the Westaway study shows lower prevalence of chronic diseases for arthritis, DM and HTN.[128]

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Chronic disease prevalence compared to other athletic populations

To compare this study results with other studies on masters athletes, pre-masters (18 - 24) were excluded from the statistics. The results of the masters athlete comparison of specific types of chronic diseases are show in Table 26 below.

Table 26: Comparison of chronic disease prevalence with other athletic populations

Author	Dressler et al.	Walsh et al.[9]	Schwabe et al.[20]
Age group	25 - 85	25 - 91	Older than 16 years
Population	Masters swimmers	Masters athletes	Runners
n	358	8072	15778
Mean age (years)	50.27	51.6	-
HTN	13.4	9.5	4.4
HLD	12.3	6.2	5.8
AST	6.0	8.7	5.9
MBD	4.3	6.3	-
CVD	3.4	-	2.3
DM	2.6	-	1.0
Arthritis	2.3	8.9	-
Cancer	1.4	-	1.9

Comparing the chronic disease prevalence of the participants to masters athletes at the WMG as reported by Walsh et al. showed higher prevalence in HTN (13.4 vs 9.5) and HLD (12.3 vs 6.2) and lower prevalence in AST (6.0 vs 8.7), MBD (4.3 vs 6.3) and arthritis (2.3 vs 8.9) for the masters swimmers.[9]

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Relationship between age and chronic disease

The chronic disease prevalence per age group is shown in Figure 6.

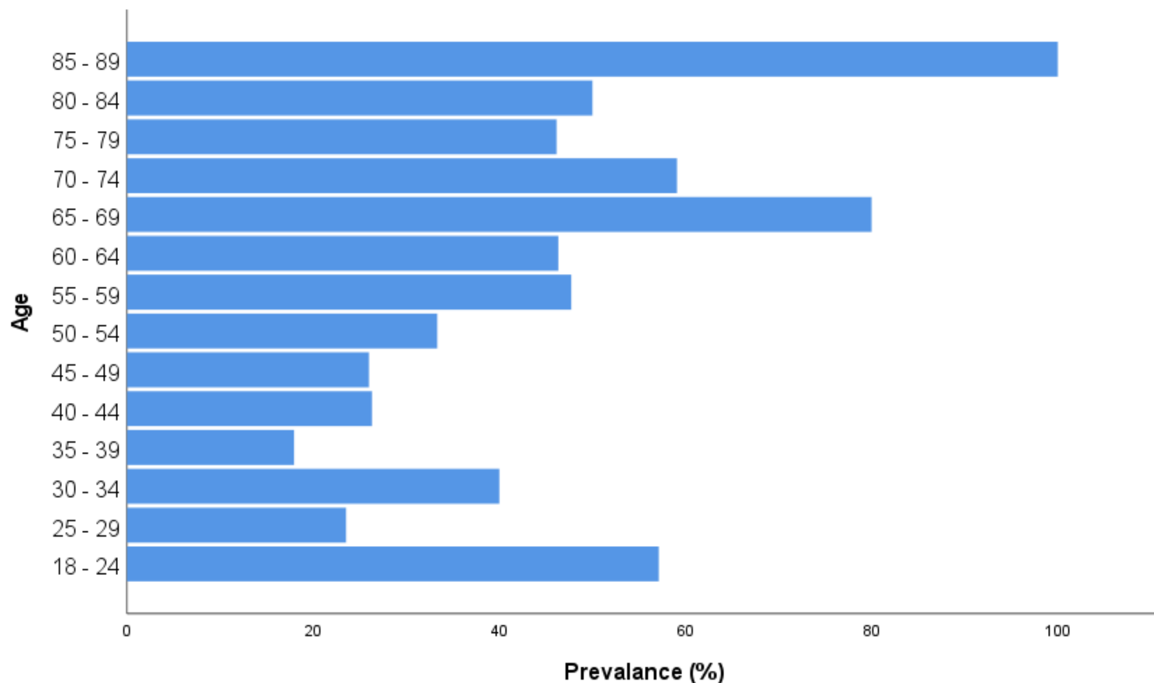

Figure 6: Chronic disease prevalence per age group

There was a significant weak positive relationship r=0.24, (p<0.001) between chronic disease and increased age in the masters swimmers. There was also a significant weak positive relationship between age and number of chronic diseases r=0.26, (p<0.001). This finding is similar to a review by Marengoni et al. on multi-morbidity that found older age and female gender were factors associated with multiple chronic conditions.[129]

Relationship between other parameters and chronic disease

Comparing swimmers that were diagnosed with chronic disease and those without, the independent samples T-test for equality of means showed no significant difference between swimmers training and competing with different motivations.

No correlation was found between chronic disease and the number of years swimming, volume-load or the distance per session. This finding shows that adult

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swimmers with chronic disease train with the same volume-load as their healthy counterparts. This is different from the finding in a study by McPhillips et al. that found that 1140 older adults between the ages of 50 and 93 with a history of chronic disease exercised less frequently than their healthy counterparts.[50]

Medication used for the treatment of chronic disease

In order to compare the study results to the literature, only the chronic medication use for participants 25 years and older were analysed. The percentage of participants that used prescribed chronic disease medication to treat their disease (33.3%, 95% CI (28.4, 38.3)) was higher than the 25.3% reported by masters athletes competing in the 2017 Sydney WMG and the 2018 Pan Pacific masters championships and that of the runners (14.8%) competing in the 2012 Two Oceans Marathon in South Africa.

The most prevalent medication prescribed was HTN medication (13.7%), Hypolipidemic medication (11.1%), CVD medication (4.3%) and Bronchodilators (3.7%). The most treated chronic conditions were HTN, HLD and AST.

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Most prescribed medications to treat chronic disease

The most prescribed chronic medications to treat the types of chronic disease as selected by the participants are summarised in Table 27.

Table 27: Most prescribed chronic medication compared with other athletic populations

Authors	Dressler et al.	Walsh et al.[9]	Potdevin et al.[127]
Age	25+ (n=351)	25+	25 - 95
Type of athlete	Masters swimmers	Masters athletes	Masters swimmers
HTN medication %	13.7	7.4	-
Hypolipidemic medication %	11.1	4.9	-
NSAIDs %	7.4	6.4	-
Bronchodilator %	3.7	4	4*
Cardiac medication %	4.3	-	3.5
Mental health medication %	3.1	-	2.0

(*Includes ear, nose and throat medication)

In line with the higher prevalence of HTN, HLD and CVD in the study population, they were also prescribed more HTN and hypolipidemic medication as well as cardiac medication when compared to masters athletes and swimmers in other studies. The use of bronchodilators were similar in all the studies.[9, 127]

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Possible doping infringements through the use of chronic medication

To compare with previous research doping infringements through the use of prescribed chronic medication in participants 25-years and older are shown in Table 28. For this sub-population 33.3%, 95% CI (28.3, 38.4) used chronic medication of which 10.8% is on the prohibited list. This is lower than the prevalence found in Campian et al. (19.8%) and slightly higher than that by Chalmers et al (10.1%).[10, 26] The most used chronic medication that were on the prohibited list were diuretics used to treat HTN (7.7%), beta-antagonists to treat AST (1.1%) and metabolic and hormone modulators (1.1%) used to treat various chronic diseases.

Five swimmers used PEDs to treat AST that contained beta-2-antagonists. One swimmer used a beta-blocker to treat a heart condition. As beta-blockers are only prohibited for specific sports that do not include swimming it was not considered as an infringement. Four swimmers used metabolic and hormone modulators to treat DM. The most used PEDs were diuretics and masking agents mainly used to down regulate HTN.

Table 28: Doping infringements through the use of prescribed chronic medication

Type of PEDs	n taking PEDs	Percentage of swimmers
Diuretics and masking agents	27	7.7
Beta-2-antagonists	4	1.1
Metabolic and hormone modulators	4	1.1
Stimulants	3	0.9
Glucocorticoids	1	0.3
Total infringements	39*	10.8

*One participant had two infringements

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Injury prevalence compared to other athletic populations

To compare the results on injury prevalence with other studies on masters swimmers and athletes, pre-masters (18 - 24) were excluded from the statistics. Table 29 compares the results for injury suffered in the last five years due to swimming in the sample to other athletic populations.

Table 29: Prevalence of injuries in the masters swimmers compared to other athletic populations

Author	**Dressler et al.**	**Atilla et al.[54]**	**Stocker et al.[62]**	**Kruger et al.[65]**	**Walsh et al.[9]**
Age group	25 - 89 M=51.3	26 - 89 m=47.1	25+	25 - 94	25+ m=51.6
Population	Masters swimmers	Male masters swimmers	Masters swimmers	Masters swimmers	Masters athletes
Period	Five years	One year	-	Three years	-
Shoulder injury %	18.1	42.0	48.0	62.4	3.1
Knee injury %	1.7	10.2	-	-	4.9

The Walsh et al. study analysed statistics collected from all 28 sporting codes in the WMG. As previous research has proven that injuries and specifically injury locations are sport specific, no injury comparisons between the WMG study and this study can be made.[55, 56, 130] Injuries to the shoulder in the participants (18.1%) was much lower than previous prevalence reports on masters swimmers.[54, 62, 65] This might be due to the two-year COVID-19 lockdown restrictions on facilities and events that limited training and competitions in South Africa. Knee injury prevalence in the study (1.7%) was lower than that reported by Atilla et al. in male masters swimmers (10.2%).[54]

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Relationships between motivation, volume-load and prevalence of injury

Comparing the participants with a motivation to win and those that chose other motivations such as health and enjoyment using an independent samples T-test for equality of means, there was no significant difference (p=0.25) between those that reported an injury (m=0.25, SD=0.4) and those without (m=0.33, SD=0.5).

A negligible correlation (*r*=0.1, p=0.048) was found between volume-load and injury. This finding is similar to findings by Atilla et al.[62] and Barry et al.[65] that concluded that correlation between the parameters was insignificant and unclear. A negligible correlation was found between any specific injury location and volume-load.

Relationship between age and prevalence of injury

The Pearson's correlation showed that there was a negligible correlation (*r*=-0.15, p<0.005) between age and injury prevalence. Similar to the result in this study, Heazelwood et al. found no significant correlation between injury incidence and age in football players in preparation for the WMG.[60] Most studies that investigated the relationship between age and injury prevalence compared masters athletes and their younger counterparts or age and injury prevalence during a specific event.[57, 61, 62] This made comparisons to previous findings in the literature difficult.

Relationship between cross-training and injury prevalence and location

Using T-test for equality of means, injury prevalence for swimmers that competed in triathlon (m=0.21, SD=0.4) and regularly cross-trained by cycling and running were compared to swimmers that only indicated competition in pool events (m=0.28, SD=0.5). This test showed no significant difference (p=0.19) between the injury prevalence or injury location for pool swimmers and triathletes.

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Prescribed and OTC medication used shortly before and during competitions

Analysis of the prescribed and OTC medication for participants 25-years and older showed that 16.4% of the swimmers took medication to treat injury or illness shortly before or during competitions. The most used medication were NSAIDs (13.1%) analgesics (2.6%) and cortisone (2.5%). The prevalence of analgesic use is lower than that reported by Seifarth et al.[79] and Dietz et al.[82] for competitive (9.2%) and recreational triathletes (11.1%). The use of NSAIDs was higher than that reported by Walsh et al. for masters athletes (6.4%) in the WMG. Combined analgesic and NSAIDs used by the swimmers (17.4%) was lower than that reported by Locquet et al. for female runners (34.6%).[74] The comparisons of the medication used with other literature studies done on athletes shortly before or during competition is shown in Table 30.

Table 30: Percentage of medication used before or during competition comparisons

Author	**Dressler et al.**	**Dietz et al.[71]**	**Walsh et al.[9]**	**Schwabe et al.[20]**	**Locquet et al.[74]**	**Seifarth et al.[68]**
Population	Masters swimmers	Competitive triathletes	Masters athletes	Endurance runners	Female recreational runners	Recreational triathletes
Age group	25+		25+			
Term of use	Before and during	12 months before	At time of entry		Before and during	Three months before
Analgesics %	2.6	9.2	-	-	-	11.1
NSAIDS %	13.1	-	6.4	-	-	-
Bronchodilators %	0.6	-	4	-	-	-
Analgesics, NSAIDS and cortisone %	19.9	-	-	15.6	-	-
Analgesics and NSAIDS %	17.4	-	-	-	34.6	-

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Possible doping infringements through use of pre and in competition medication

Analysis of the medication that constitute possible doping infringements shows that one participant used an AST pump and nine swimmers used cortisone shortly before or during competition. The 10 swimmers that committed possible doping infringement were 2.8% of the participants. This doping prevalence for the masters swimmers is lower than the estimated 24-hour estimated doping prevalence reported in female runners (8.1%) and ultramarathon runners (8.4%) during competition or training.[68, 74]

Attitudes towards doping

The expressed attitude of the swimmers on the PEAS 8-item version showed scores considerably lower than the 3.5-midpoint score per question. The total score for males (12.49 ± 5.1, p<0.001) and females (11.53 ± 4.5, p<0.001) as well as the combined score (11.99 ± 4.8, p<0.001) is also lower than the 28-midpoint score for the instrument. This showed that masters swimmers do not have a positive or lenient attitude toward doping.

Although male swimmers showed a slightly more lenient but negative doping attitude when compared to female swimmers, the difference between the genders was not significant (p=0.064). The three questions that scored closer to the midpoint was question three (The risks related to doping are exaggerated, m=1.8), question five (Doping is an unavoidable part of the competitive sport, m=1.9) and question eight (There is no difference between drugs and speedy swimsuits that are all used to enhance performance, m=1.6).

Using an independent samples T-test to compare the two gender sub-sets for questions three, five and eight showed the following differences. For question three (p=0.291) females scored higher than the male swimmers possibly showing according to the categories assigned to the questions by Folkers et al., that females have a slightly better knowledge about doping as well as the health risks involved. Males scored higher than female swimmers on questions five (p=0.057) and eight (p<0.001) possibly showing that they believe that hypocrisy exist regarding doping and swimsuits.[117]

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Comparing the study results with the Vargo et al. study on university student athletes (mean age 24 ± 5.98 years), shows that the masters swimmers (mean age 51.27 + 1.5 years) have a lower average mean PEAS score (11.99±4.8) than the student athletes (18.473 ± 8.612). In the Vargo et al. study, females scored significantly lower (14.242 ± 3.307) than males (21.088 ± 9.869).[84]

Attitude differences between competitive and non-competitive motivations

An independent sample T-test between swimmers with a competitive motivation (m=12.02) and swimmers with non-competitive motivations (m=11.99) showed no significant difference (p=0.962) in the mean scores for the PEAS instrument. This shows no significant difference in the attitude towards doping between swimmers motivated to win and swimmers training and competing with a health or fun and enjoyment motivation.

Swimmers' attitude towards fellow competitors doping

It was hypothesised that the attitude of masters swimmers towards doping will differ between two possible doping scenarios namely: (1) the attitude towards competitors taking PEDs with the sole purpose of improving performance and (2) the attitude towards prescribed medication use by competitors to treat chronic disease that can lead to unfair advantage in competition.

The PEAS 8-item instrument in the section above was used to test the attitude of swimmers for scenario 1 (intentional doping to increase performance). The specific questions below were set to test the swimmers' attitude towards medication use. The specific questions relating to the masters swimmers' attitude towards fellow competitors using medication vs intentional doping are analysed below.

Question 1: Swimmers taking medication to treat chronic disease, illness or injury have an unfair advantage in competitions. The below the midpoint score ± SD for this question (m=2.18 ± 1.1) indicated that swimmers do not believe that taking medication to treat chronic disease should be construed as doping.

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Question 2: I do not care if my competitors take medication even if it gives them an unfair advantage in competitions. An above the midpoint score ± SD in this question would indicate that swimmers are not lenient to intentional doping. The score of m=2.85 ± 1.4 indicates that masters swimmers are ambivalent towards the use of medicine even if it gives an unfair advantage in competition.

Question 3: I do not care if my competitors INTENTIONALLY use prohibited substances other than chronic medication or methods to give them an unfair advantage in competitions. The below midpoint score ± SD in this question (m=1.52 ± 1.1) indicates that swimmers are not lenient towards intentional doping. This reiterates the results of the PEAS score in scenario 1.

Question 4: Intentionally taking performance enhancing drugs with the sole purpose of improving performance has long term health implications. Participants strongly agreed with this statement (m=4.29 ± 1.3). This again underscores the negative attitude of masters swimmers towards intentional doping.

Question 5: The use of chronic medication helps masters swimmers to perform as healthy individuals. Participants strongly agreed with this statement (m=3.45 ± 1.3).

In summary the five questions on participants attitude towards fellow competitors' use of PEDs showed that masters swimmers are lenient towards the use of chronic medication used to treat disease but non-lenient towards intentional doping.

Intentional doping

Only one male swimmer indicated to that he had used a banned substance. No swimmers indicated that they were currently using PEDs. It is possible that even though the question design reassured participants that the survey was anonymous, participants might have been hesitant to reveal the truth about their doping. Elbe and Barkoukis describes doping as 'a behaviour that may have significant legal and health consequences for the user and individuals asked about doping might intentionally deny their involvement.'[85]

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Discussion summary

Comparisons with population data in the USA and Australia as well as South African medical aid data shows that South African masters swimmers have a lower prevalence of specific chronic diseases when compared to general population statistics found in the literature.[9, 44] The comparisons show higher HTN, HLD and DM prevalence's for the South African masters swimmers compared to masters athletes and runners from other countries. A significant weak positive relationship $r=0.24$, ($p<0.001$) was found between chronic disease and age and between age and number of chronic diseases $r=0.26$, ($p<0.001$).

The prescribed chronic disease medication use prevalence of 33.7% in the study is higher than the 25.3% reported by masters athletes and that of the runners (14.8%), but the use of bronchodilators were similar.[9, 127] Further analysis of the chronic medication used showed that 11.4% of the participants used medication that is on the prohibited list. This is lower than the prevalence found in Campian et al.[10] (19.8%) and slightly higher than that by Chalmers et al. (10.1%).[26]

Injuries to the shoulder (18.1%) and the knee (1.7%) in the participants was much lower than previous prevalence reported on masters swimmers.[54, 62, 65] This might be due to the two-year COVID-19 lockdown restrictions on facilities and events that limited training and competitions in South Africa. Statistical analysis showed a negligible correlation between volume-load and injury. This finding is similar to findings by Atilla et al.[62] and Barry et al.[65] that concluded that correlation between the parameters was insignificant and unclear. There was a significant ($p<0.005$) but weak negative correlation ($r=-0.15$) between age and injury prevalence. Similar to the result in this study, Heazlewood et al. found no significant correlation between injury incidence and age in football players in preparation for the WMG.[60]

Analysis of the prescribed and OTC medication showed that 16.4% of the swimmers took medication to treat injury or illness shortly before or during competitions with 2.8% of swimmers committing possible doping infringements. This was mostly due to the use of cortisone shortly before or during competition. This doping prevalence for the masters swimmers is lower than the estimated 24-hour estimated doping prevalence

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reported in female runners (8.1%) and ultramarathon runners (8.4%) during competition or training.[68, 74]

The expressed attitude of the swimmers on the PEAS 8-item version showed that masters swimmers do not have a positive or lenient attitude toward doping. Although male swimmers showed a slightly more lenient but still negative attitude towards doping when compared to female swimmers, the difference between the genders was not significant ($p=0.064$).

Specific questions were set to test the swimmers' attitude towards fellow competitors use of PEDs. The findings showed that swimmers believed that swimmers taking medication to treat disease or injury to allow them to compete as healthy individuals did not have an unfair advantage in competitions and that taking medication should not be construed as doping. The participants were not lenient towards intentional doping. This reiterates the results of the PEAS score.

In response to the direct doping questions, only one male swimmer indicated having used a banned substance. No swimmers indicated that they were currently using PEDs.

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Chapter 6: Limitations, strengths, conclusion and recommendations

Limitations of the study

The definitions of heart disease and CVD was not clearly defined in the planning stage of the study. This made comparisons with other CVD prevalence research in the general population and athletic populations difficult.

In the reporting of medication use participants could take multiple medications and might have grown tired of listing, resulting in incomplete answers.

Due to the COVID-19 pandemic that limited training and competition due to the lockdown in South Africa the original term of 24 months for injury reporting was extended to five years. This extended reporting period could have led to recall bias in the injury reporting.

On the intentional doping questions, it was decided not to use the random response techniques. This could have resulted in participants not answering truthfully as they mistrusted the anonymity of the survey. Not using random response techniques in this question might have led to under reporting and is a limitation to this study.

Strengths of the study

In setting the questionnaire care was taken to choose multiple choice questions with a non-response option. A limited number of open-ended questions were worded carefully and were mostly used when a closed question answer was not selected. This ensured consistent reliability of answers between participants. To ensure face, content and internal validity, questions and data elements was linked back to specific research objectives. No completion incentives were offered to limit sample bias. Due to the online collection and tabulation of data by Google forms, systematic data errors were prevented.

The use of a pilot study and the feedback received from the participants helped to clarify the survey questions and to improve question validity.

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Despite the failure to distribute the survey to competitors on the aQuellé Midmar Mile database the response rate on the SAMS database and subsequent snowball distribution led to a sample that included both competitive and recreational masters swimmers. Results showed a mix of swimmers that competed in combined events such as triathlon, pool and open water events.

In the initial planning it was estimated that the survey would result in a 4% response rate (maximum 450 participants) in line with similar previous research.[10] The survey resulted in an actual number of 359 responses. Even though the response rate cannot be determined due to the snowball sampling the resulted response was enough to result in several significant findings.

Analysis of the gender responses showed 48.7% male and 50.7% female swimmers completed the survey.

This is the first study to the researchers knowledge, conducted on masters swimmers in South Africa relating to health status, medication use and doping. This study will add to the limited amount of research that has been done on this study population.

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Conclusions

The analysis of the study data showed a balanced demographic profile of South African masters swimmers with almost equal participation of male (48.7%) and female (50.7%) swimmers. The study population showed a representative sample of masters swimmers competing at different levels and at a variety of events, thereby thus fully achieving the first objective of this study.

As one of the common causes of chronic disease is inactivity and studies have concluded that participation in physical activity and sport reduces the risk factors that lead to disease development and as such lowers the prevalence of chronic disease.[6, 9, 41] Although comparisons with the general population proved difficult due to different definitions and grouping of chronic diseases and the differences in study parameters such as age categories, the prevalence of chronic disease in this sample of masters swimmers was lower than that of the general population. Comparison of the data to other athletic populations showed higher HTN, HLD and DM prevalence's for the South African masters swimmers.

Injuries reported in the five years preceding the survey were lower than that reported in previous studies on masters swimmers and might be due to the two-year COVID-19 lockdown restrictions on facilities and events that limited training and competitions in South Africa. Injuries to the shoulder region followed by knee injuries were the most frequently reported injuries. Reporting on the health status of masters swimmers achieved the second and third objectives of the study.

Analysis of the medication used to treat chronic disease and the prescribed and OTC medication to treat injury or illness shortly before or during competitions, showed respectively that 11.4% and 2.8% of the swimmers took PEDs and were possibly committing unintentional doping infringements. These findings achieved the fourth, fifth and sixth objectives of the study.

Adults enter swimming events for a variety of reasons including health and fitness, social and more competitive motivations.[27-30] The increased focus on health and fitness and the benefits of exercise in prolonging life has led to the well-known masters

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catchphrase of "*The last one alive wins*." With this dominant motivation, the intentional use of PEDs may not be a problem in masters competitions and in this study only one swimmer indicated previous use of PEDs. Answers to this section on life-long and current intentional doping practices might have been underreported due to the direct questioning that was used. Due to this objective seven was only partially achieved.

Using the PEAS 8-item instrument to report on the attitude towards doping showed that masters swimmers are not lenient toward intentional doping. However, specific questions set to test the swimmers' attitude towards chronic medication use, indicated that they believed that chronic medication helped masters swimmers to perform as healthy individuals and that this medication use should not be construed as doping. These findings achieved the ninth and 10th objectives of the study. Objective eight namely establishing a relationship between attitudes towards doping and doping behaviour could not be achieved due to the limited response to the intentional doping section.

To eliminate the intentional dopers, it might be necessary to start drug testing in masters competitions to determine the true prevalence of doping in masters swimming. Some of WADA's IFs have implemented anti-doping policies and testing specifically for masters athletes. The International Weightlifting Federation and USA Masters Track and Field athletes are educated on TUE procedures. Testing on randomly selected athletes within age groups also takes place at competitions.[131, 132] In the 2017 - 2018 season, SAIDS only tested 60 urine samples, 30 blood samples and conducted two erythropoietin blood doping tests on South African elite swimmers. The results only showed one infringement for testosterone use.[133] Due to the complexity of sifting out legal medication use as specified in TUEs and will create an additional financial burden for developing countries like South Africa.[134]

To make medication use 'legal' during competition, masters swimmers can apply for TUEs. Participants in this study showed limited knowledge of doping and TUEs. The testing and TUE application processes are wrought with complexities and might lead to masters swimmers being prevented from competing in a sport that they love. This would be particularly negative if the swimmers are non-competitive and only compete for motivations such as health, social companionship and fun. Many swimmers using

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prescribed medication may be victimised just to identify the few that intentionally use PEDs to improve their performance.[99] Counter to the limited doping knowledge displayed by the swimmers 70.2% indicated that they were aware of the consequences of doping. These findings achieved the 11th and 12th objectives of the study.

The doping dilemma of many masters athletes cannot be better expressed than in the exact words of Jeff Hammond a 58-year-old USA cyclist: ''They're treating us like 20-year-old Olympians. Something that is considered a performance-enhancing drug for an 18-year-old may be a necessary life-saving medication for a senior athlete. I think it's very unfair.'' He was diagnosed with hypogonadism and takes supplemental testosterone to raise his levels to average for his age, as well as medication to combat low bone density. His functional deficiency does not meet the WADA criteria for application for a TUE and he was banned from competing in USA sanctioned bike races until he received his TUE exemption from the U.S. Anti-Doping Agency after a long fight in 2016.[135]

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Recommendations

Chronic disease usually requires medical treatment and may limit activities of daily living and athletic performance. FINA must be aware of the increased incidence of chronic disease with increased age and the associated risk in competition for older athletes as they state in their general rules for masters competitions: “Masters competitors must be aware of the need of being well prepared and medically fit before entering into masters competitions.” Even though this statement clearly indicates some form of medical screening, no pre-participation health screening guidelines are provided for masters swimmers.[32] As 39.1% of swimmers in this study have been diagnosed with chronic disease and used chronic medication, they should get medical clearance before competing and they should be educated on the risks of taking chronic medication while exercising and competing.[11, 136] This substantiates the need for further studies to set parameters for pre-screening of swimmers before taking up training and entering competitions.

In line with the aim of the South African government to motivate adults to stay active for life, masters swimmers with chronic disease, using chronic medication that are prohibited, should be allowed to train for and participate in swimming events. Currently no testing is done on masters swimmers in South Africa. Due to the complexity of testing and the high cost involved in weaning out medications and applying for TUEs, it is recommended that the status quo be maintained.

Masters swimmers in this study displayed limited knowledge about the doping implications of medication use. They also did not enquire about the legality of prescribed medication use for athletes from their health care providers. The high prevalence of chronic disease and the associated medication use in this study, combined with the limited knowledge about doping, indicate that information campaigns about doping and medication use could be beneficial to the masters swimmers and for medical professionals that prescribe and issue medication to them.

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Table 31: Study recommendations

Study recommendations
• Further studies should research and set parameters for pre-screening of masters swimmers
• Studies on masters athletes examining the use of dietary substances, supplements, and vitamins
• Swimming bodies, coaches and masters swimmers should receive education on the risks of participation in masters swimming
• Health care providers should receive guidelines in the athletic prescription of medication and doping implications for masters swimmers
• Doping education programs should be developed for masters swimmers
• No further action is advised regarding application of TUEs or testing of masters swimmers

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Appendices

Appendix A: Ethical clearance letter and Declaration of Helsinki

Appendix B: Checklist for Reporting Results of Internet E-Surveys

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Appendix A: Ethical clearance letter and Declaration of Helsinki

Faculty of Health Sciences

Institution: The Research Ethics Committee, Faculty Health Sciences, University of Pretoria complies with ICH-GCP guidelines and has US Federal wide Assurance.

- FWA 00002567, Approved dd 22 May 2002 and Expires 03/20/2022.
- IORG #: IORG0001762 OMB No. 0990-0279 Approved for use through February 28, 2022 and Expires: 03/04/2023.

Faculty of Health Sciences **Research Ethics Committee**

13 August 2021

Approval Certificate
New Application

Dear Mrs AH Dressler

Ethics Reference No.: 193/2021
Title: Health status of South African masters swimmers, their medication use and attitudes towards doping

The **New Application** as supported by documents received between 2021-04-20 and 2021-08-11 for your research, was approved by the Faculty of Health Sciences Research Ethics Committee on 2021-08-11 as resolved by its quorate meeting.

Please note the following about your ethics approval:

- Ethics Approval is valid for 1 year and needs to be renewed annually by 2022-08-13.
- Please remember to use your protocol number (193/2021) on any documents or correspondence with the Research Ethics Committee regarding your research.
- Please note that the Research Ethics Committee may ask further questions, seek additional information, require further modification, monitor the conduct of your research, or suspend or withdraw ethics approval.

Ethics approval is subject to the following:

- The ethics approval is conditional on the research being conducted as stipulated by the details of all documents submitted to the Committee. In the event that a further need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.

We wish you the best with your research.

Yours sincerely

On behalf of the FHS REC, Dr R Sommers
MBChB, MMed (Int), MPharmMed, PhD
Deputy Chairperson *of the Faculty of Health Sciences Research Ethics Committee, University of Pretoria*

The Faculty of Health Sciences Research Ethics Committee complies with the SA National Act 61 of 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 and 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes, Second Edition 2015 (Department of Health)

Research Ethics Committee
Room 4-60, Level 4, Tswelopele Building
University of Pretoria, Private Bag x323
Gezina 0031, South Africa
Tel +27 (0)12 356 3084
Email: deepeka.behari@up.ac.za
www.up.ac.za

Fakulteit Gesondheidswetenskappe
Lefapha la Disaense tša Maphelo

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Special Communication

World Medical Association Declaration of Helsinki
Ethical Principles for Medical Research Involving Human Subjects

World Medical Association

Adopted by the 18th WMA General Assembly, Helsinki, Finland, June 1964, and amended by the:
29th WMA General Assembly, Tokyo, Japan, October 1975
35th WMA General Assembly, Venice, Italy, October 1983
41st WMA General Assembly, Hong Kong, September 1989
48th WMA General Assembly, Somerset West, Republic of South Africa, October 1996
52nd WMA General Assembly, Edinburgh, Scotland, October 2000
53rd WMA General Assembly, Washington, DC, USA, October 2002 (Note of Clarification added)
55th WMA General Assembly, Tokyo, Japan, October 2004 (Note of Clarification added)
59th WMA General Assembly, Seoul, Republic of Korea, October 2008
64th WMA General Assembly, Fortaleza, Brazil, October 2013

Preamble

1. The World Medical Association (WMA) has developed the Declaration of Helsinki as a statement of ethical principles for medical research involving human subjects, including research on identifiable human material and data.

   The Declaration is intended to be read as a whole and each of its constituent paragraphs should be applied with consideration of all other relevant paragraphs.

2. Consistent with the mandate of the WMA, the Declaration is addressed primarily to physicians. The WMA encourages others who are involved in medical research involving human subjects to adopt these principles.

General Principles

3. The Declaration of Geneva of the WMA binds the physician with the words, "The health of my patient will be my first consideration," and the International Code of Medical Ethics declares that, "A physician shall act in the patient's best interest when providing medical care."

4. It is the duty of the physician to promote and safeguard the health, well-being and rights of patients, including those who are involved in medical research. The physician's knowledge and conscience are dedicated to the fulfilment of this duty.

5. Medical progress is based on research that ultimately must include studies involving human subjects.

6. The primary purpose of medical research involving human subjects is to understand the causes, development and effects of diseases and improve preventive, diagnostic and therapeutic interventions (methods, procedures and treatments). Even the best proven interventions must be evaluated continually through research for their safety, effectiveness, efficiency, accessibility and quality.

7. Medical research is subject to ethical standards that promote and ensure respect for all human subjects and protect their health and rights.

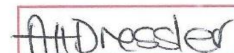
8. While the primary purpose of medical research is to generate new knowledge, this goal can never take precedence over the rights and interests of individual research subjects.

9. It is the duty of physicians who are involved in medical research to protect the life, health, dignity, integrity, right to self-determination, privacy, and confidentiality of personal information of research subjects. The responsibility for the protection of research subjects must always rest with the physician or other health care professionals and never with the research subjects, even though they have given consent.

10. Physicians must consider the ethical, legal and regulatory norms and standards for research involving human subjects in their own countries as well as applicable international norms and standards. No national or international ethical, legal or regulatory requirement should reduce or eliminate any of the protections for research subjects set forth in this Declaration.

11. Medical research should be conducted in a manner that minimises possible harm to the environment.

12. Medical research involving human subjects must be conducted only by individuals with the appropriate ethics and scientific education, training and qualifications. Research on patients or healthy volunteers requires the supervision of a competent and appropriately qualified physician or other health care professional.



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Appendix B: Checklist for Reporting Results of Internet E-Surveys

Checklist Item	***Explanation***	***Page Number***
Describe survey design	Describe target population, sample frame. Is the sample a convenience sample? (In “open” surveys this is most likely.)	p13
IRB approval	Mention whether the study has been approved by an IRB.	p20-21
Informed consent	Describe the informed consent process. Where were the participants told the length of time of the survey, which data were stored and where and for how long, who the investigator was and the purpose of the study?	p16, Ann C and E
Data protection	If any personal information was collected or stored, describe what mechanisms were used to protect unauthorized access.	p21
Development and testing	State how the survey was developed, including whether the usability and technical functionality of the electronic questionnaire had been tested before fielding the questionnaire.	p15-17
Open survey versus closed survey	An “open survey” is a survey open for each visitor of a site, while a closed survey is only open to a sample which the investigator knows (password-protected survey).	Closed
Contact mode	Indicate whether the initial contact with the potential participants was made on the Internet. (Investigators may also send out questionnaires by mail and allow for Web-based data entry.)	Through registered bodies SAMS
Advertising the survey	How/where was the survey announced or advertised? Some examples are offline media (newspapers), or online (mailing lists – If yes, which ones?) or banner ads (Where were these banner ads posted and what did they look like?). It is important to know the wording of the announcement as it will heavily influence who chooses to participate. Ideally the survey announcement should be published as an appendix.	Mailing list, App E, p18
Web/E-mail	State the type of e-survey (e.g., one posted on a Web site, or one sent out through e-mail). If it is an e-mail survey, were the responses entered manually into a database, or was there an automatic method for capturing responses?	Email, p15, p18
Context	Describe the Web site (for mailing list/newsgroup) in which the survey was posted. What is the Web site about, who is visiting it, what are visitors normally looking for? Discuss to what degree the content of the Web site could pre-select the sample or influence the results. For example, a survey about vaccination on an anti-immunization Web site will have different results from a Web survey conducted on a government Web site	N/A
Mandatory/voluntary	Was it a mandatory survey to be filled in by every visitor who wanted to enter the Web site, or was it a voluntary survey?	Voluntary, p21
Incentives	Were any incentives offered (e.g., monetary, prizes, or non-monetary incentives such as an offer to provide the survey results)?	None, p32
Time/Date	In what timeframe was the data collected?	P18, p22
Randomization of items or questionnaires	To prevent biases items can be randomized or alternated.	Done in Google forms

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Adaptive questioning	Use adaptive questioning (certain items, or only conditionally displayed based on responses to other items) to reduce number and complexity of the questions.	Done
Number of Items	What was the number of questionnaire items per page? The number of items is an important factor for the completion rate.	Ave 2/section. Max 5
Number of screens (pages)	Over how many pages was the questionnaire distributed? The number of items is an important factor for the completion rate.	16 sections /screens
Completeness check	It is technically possible to do consistency or completeness checks before the questionnaire is submitted. Was this done and if "yes", how (usually JavaScript)? An alternative is to check for completeness after the questionnaire has been submitted (and highlight mandatory items). If this has been done, it should be reported. All items should provide a non-response option such as "not applicable" or "rather not say" and selection of one response option should be enforced.	In data Cleanup Included Done
Review step	State whether participants were able to review and change their answers (e.g., through a Back button or a Review step which displays a summary of the responses and asks the participants if they are correct).	No
Unique site visitor	If you provide view rates or participation rates, you need to define how you determined a unique visitor. There are different techniques available, based on IP addresses or cookies or both.	No done to protect anonymity
View rate (Ratio of unique survey visitors/unique site visitors)	Requires counting unique visitors to the first page of the survey, divided by the number of unique site visitors (not page views!). It is not unusual to have view rates of less than 0.1 % if the survey is voluntary.	No done to protect anonymity
Participation rate (Ratio of unique visitors who agreed to participate/unique first survey page visitors)	Count the unique number of people who filled in the first survey page (or agreed to participate, for example by checking a checkbox), divided by visitors who visit the first page of the survey (or the informed consents page, if present). This can also be called "recruitment" rate.	Part of stats analysis
Completion rate (Ratio of users who finished the survey/users who agreed to participate)	The number of people submitting the last questionnaire page, divided by the number of people who agreed to participate (or submitted the first survey page). This is only relevant if there is a separate "informed consent" page or if the survey goes over several pages. This is a measure for attrition. Note that "completion" can involve leaving questionnaire items blank. This is not a measure for how completely questionnaires were filled in. (If you need a measure for this, use the word "completeness rate".)	Part of stats analysis
Cookies used	Indicate whether cookies were used to assign a unique user identifier to each client computer. If so, mention the page on which the cookie was set and read and how long the cookie was valid. Were duplicate entries avoided by preventing users access to the survey twice; or were duplicate database entries having the same user ID eliminated before analysis? In the latter case, which entries were kept for analysis (e.g., the first entry or the most recent)?	Cookies will be disabled

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	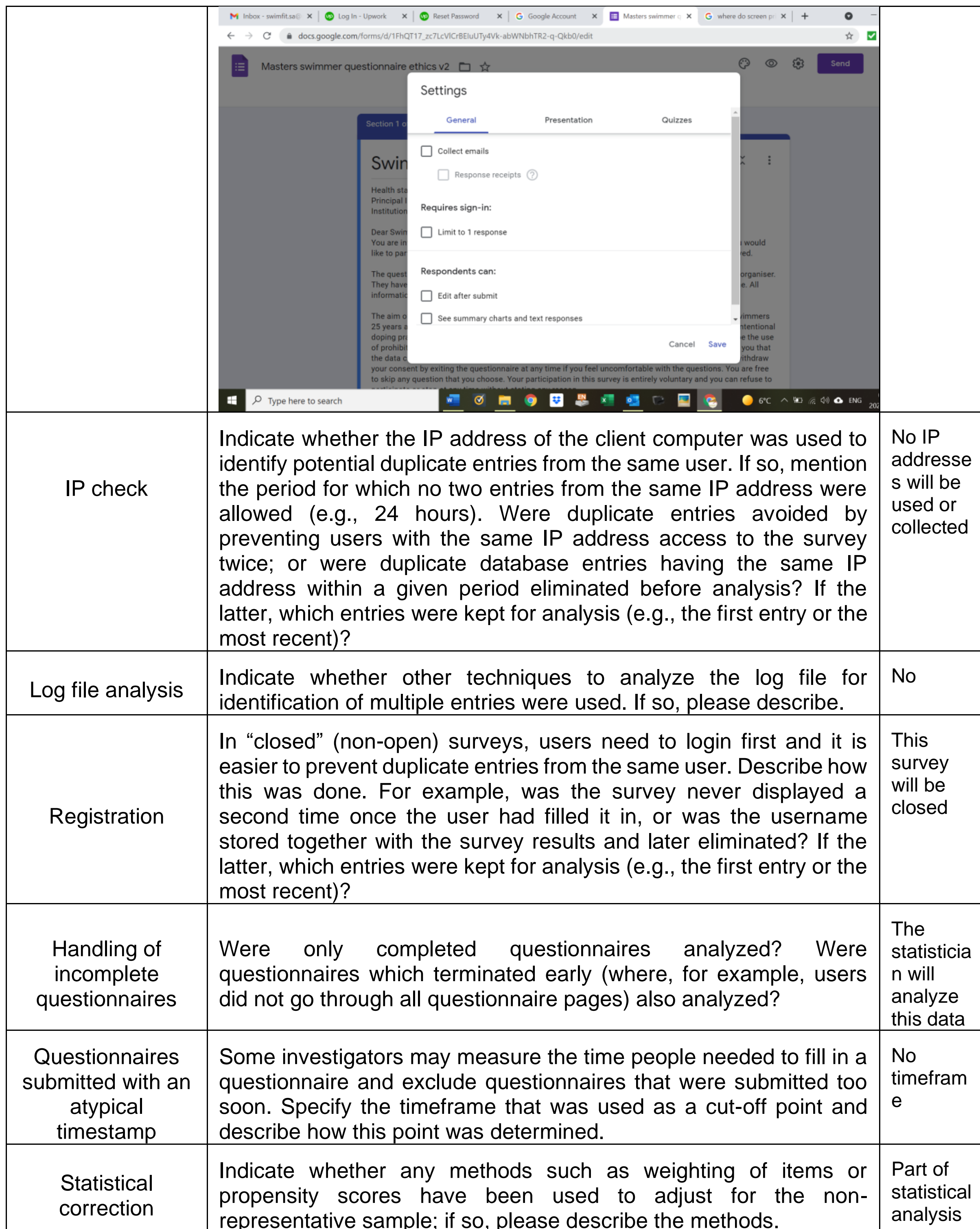	
IP check	Indicate whether the IP address of the client computer was used to identify potential duplicate entries from the same user. If so, mention the period for which no two entries from the same IP address were allowed (e.g., 24 hours). Were duplicate entries avoided by preventing users with the same IP address access to the survey twice; or were duplicate database entries having the same IP address within a given period eliminated before analysis? If the latter, which entries were kept for analysis (e.g., the first entry or the most recent)?	No IP addresses will be used or collected
Log file analysis	Indicate whether other techniques to analyze the log file for identification of multiple entries were used. If so, please describe.	No
Registration	In “closed” (non-open) surveys, users need to login first and it is easier to prevent duplicate entries from the same user. Describe how this was done. For example, was the survey never displayed a second time once the user had filled it in, or was the username stored together with the survey results and later eliminated? If the latter, which entries were kept for analysis (e.g., the first entry or the most recent)?	This survey will be closed
Handling of incomplete questionnaires	Were only completed questionnaires analyzed? Were questionnaires which terminated early (where, for example, users did not go through all questionnaire pages) also analyzed?	The statistician will analyze this data
Questionnaires submitted with an atypical timestamp	Some investigators may measure the time people needed to fill in a questionnaire and exclude questionnaires that were submitted too soon. Specify the timeframe that was used as a cut-off point and describe how this point was determined.	No timeframe
Statistical correction	Indicate whether any methods such as weighting of items or propensity scores have been used to adjust for the non-representative sample; if so, please describe the methods.	Part of statistical analysis

This checklist has been modified from Eysenbach G. Improving the quality of Web surveys: The Checklist for Reporting Results of Internet E-Surveys (CHERRIES). J Med Internet Res. 2004 Sep 29;6(3): e34. Article available at https://www.jmir.org/2004/3/e34/; erratum available https://www.jmir.org/2012/1/e8/. Copyright ©Gunther Eysenbach. Originally published in the Journal of Medical Internet Research, 29.9.2004 and 04.01.2012. This is an open-access article distributed under the terms of the Creative Commons Attribution License (https://creativecommons.org/licenses/by/2.0/), which permits unrestricted use, distribution and reproduction in any medium, provided the original work, first published in the Journal of Medical Internet Research, is properly cited.

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Appendix C: Chronic disease list

Chronic Disease Code	Full Description
ADS	Addison's Disease
AST	Asthma
BCE	Bronchiectasis
BMD	Bipolar Mood Disorder
CHF	Cardiac failure[1]
CMY	Cardiomyopathy
COPD	Chronic Obs. Pulmonary Disease
CRF	Chronic Renal Disease
CSD	Crohn's Disease
DBI	Diabetes Insipidus
DM1	Diabetes Mellitus 1
DM2	Diabetes Mellitus 2
DYS	Dysrhythmias
EPL	Epilepsy
GLC	Glaucoma
HAE	Haemophilia
HYL	Hyperlipidaemia
HYP	Hypertension
IBD	Ulcerative Colitis
IHD	Coronary Artery Disease
MSS	Multiple Sclerosis
PAR	Parkinson's Disease
RHA	Rheumatoid Arthritis
SCZ	Schizophrenia
SLE	Systemic Lupus Erythematosus
TDH	Hypothyroidism
HIV/AIDS	HIV/AIDS[2]

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Appendix D: Swimmer questionnaire

Swimmer questionnaire

Health status of South African masters swimmers, their medication use and attitudes towards doping
Principal Investigators: Annemarie Dressler, Dr. Kim Nolte
Institution: University of Pretoria

Dear Swimmer,
You are hereby invited to take part in this research study. The accompanying mail and the information below will help you decide if you would like to participate. Before you agree to take part in this study you should fully understand what it entails.

Doping is a collective term that is used to describe the use of prohibited substances or methods to enhance performance. The aim of this study is to evaluate the health status and associated medicine use in swimmers 18 years and older. Certain medications that masters swimmers take to treat chronic disease and injury may enhance performance and qualify as unintentional doping.

Please keep all the packaging for any medication you currently use handy, so that you can list them when asked to do so.

Masters swimmers can also intentionally take performance enhancing substances to improve their performance. This questionnaire will explore doping attitudes and any possible unintentional and intentional doping practices. Although you may not directly benefit from taking part, the results of this study may help us pave the way to better doping education for South African adult swimmers. You will not be paid to take part in the study and there are no costs involved. There are no known risks associated with the study.

This questionnaire was forwarded to you via your national or regional body, the Midmar organiser, your club or your coach. They have not shared any of your information such as email addresses or any other personal data with me. The survey was set up in such a way that no contact information (i.e. email addresses) are recorded and the data items collected are generic. As the researcher I would like to assure you that the data collected during this study cannot be linked back to you. All information you wish to share during this study will be anonymous.

You are also welcome to withdraw your consent by exiting the questionnaire at any time you feel uncomfortable with any of the questions. You are free to skip any questions of your choosing. Your participation in this survey is entirely voluntary and you can refuse to participate or stop at any time without stating the reason.

If you have any further questions, or require further explanation, do not hesitate to contact me, Annemarie Dressler directly.
email: annemarie.dressler1@gmail.com or cell: 0828013531

This study was submitted to the Faculty of the Health Sciences Research Ethics Committee, University of Pretoria, telephone numbers (012) 356 3084 / (012) 356 3085 and written approval to proceed has been granted. The study has been structured in accordance with the Declaration of Helsinki (last update: October 2013). A copy of the Declaration may be obtained from me if you wish to review it. Data collected during this

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survey will be protected in accordance with the data security protocols of the University of Pretoria.

Please print a copy of this consent for your records.

*Required

Declaration by the Researcher

I, Annemarie Henriette Dressler hereby declare that the data collected by this questionnaire has been de-identified in terms of the POPI Act. Data collected is anonymous and cannot be linked back to respondents.

Annemarie H Dressler

1. By clicking "I agree" below you are indicating that you are at least 18 years old, have read and understood what the study involves and want to participate in this research study. *

Mark only one oval.

- I agree
- I disagree *Skip to section 19 (Thank you for completing the questionnaire)*

Demographic information

2. What gender do you identify as?

Mark only one oval.

- Female
- Male
- Other: ____________

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3. What is your age?

Mark only one oval.

- Less than 18 years
  Skip to section 19 (Thank you for completing the questionnaire)
- 18-24
- 25-29 year
- 30-34
- 34-39
- 40-44
- 45-49
- 50-54
- 55-59
- 60-64
- 65-69
- 70-74
- 75-79
- 80-84
- 85-89
- Other: ____________________

4. Do you subscribe to a medical aid?

Mark only one oval.

- Yes
- No

Swimming experience

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5. How many times in a week do you swim?

Mark only one oval.

- Less than once per week
- Once
- Twice
- Three times or more

6. What distance do you on average swim per training session?

Mark only one oval.

- Less than 500m
- 500m-2000m
- 2000-3000m
- More than 3000m

7. How many years have you been swimming?

Mark only one oval.

- 0-1 year
- 1-3 years
- 3-5 years
- 5-10 years
- More than 10 years

8. Have you competed in an organised sporting event that included swimming in the last 5 years? This includes social, non-competitive and fun events for example the Polar Bear swim.

Mark only one oval.

- No *Skip to question 11*
- Yes

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9. Please specify the event(s). You can choose more than one option.

Tick all that apply.

	Local event	Regional	National event	International event
Triathlon	☐	☐	☐	☐
Ironman	☐	☐	☐	☐
Masters pool gala	☐	☐	☐	☐
Open water swim	☐	☐	☐	☐
Other swimming events	☐	☐	☐	☐

10. Please specify the event or events that you train for. Separate your events with a comma (,).

____

____

____

____

____

Motivation for swimming

You can select only three reasons, so please carefully consider why you swim. If you swim for any reason other than those listed below please select the other option and specify your reason.

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11. Please indicate the three predominant reasons why you swim?

Tick all that apply.

- [ ] To enjoy myself and have fun
- [ ] For social interaction and being with friends
- [ ] To improve my health and fitness
- [ ] To relieve stress and feel better
- [ ] To be part of a team
- [ ] To travel and gain new experiences
- [ ] To delay the effects of aging
- [ ] To challenge myself and master new skills
- [ ] To compete and win
- [ ] Other....

Chronic disease status

12. Have you ever been diagnosed with a chronic disease(s) by a health care provider?

Mark only one oval.

- ( ) Yes
- ( ) No *Skip to question 16*
- ( ) I am not sure
- ( ) I do not wish to disclose any chronic disease information *Skip to question 16*

Chronic disease selection

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13. Please pick the chronic disease(s) that you suffer from. You can pick more than one disease or specify a disease in the text box (Other) if not on the list.

Tick all that apply.

- [ ] High blood pressure
- [ ] High cholesterol or blood fat
- [ ] HIV/AIDS
- [ ] Diabetes (type 1 or 2)
- [ ] Asthma
- [ ] Thyroid disease
- [ ] Coronary artery disease
- [ ] Heart disease
- [ ] Epilepsy
- [ ] Bipolar mood disorder
- [ ] Other: ______________________

Medication used for chronic disease

Please keep all the packaging for the medication you use handy so that you can quickly list them.

14. Do you use any prescribed medication on a daily, weekly or monthly basis to treat your chronic disease?

Mark only one oval.

- ( ) Yes
- ( ) No *Skip to question 16*

Details of medication usage

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15. Please list the medication(s) that you are taking for your chronic disease(s).

Please just enter the name of the medication. No need to give the dosage. Separate your medication names with a comma (,).

____
____
____
____
____

Injury status

16. Did you suffer any injury due to swimming that required treatment, e.g. use of medication, or required you to seek medical advice from a health professional in the last five years?

Mark only one oval.

- Yes
- No *Skip to question 20*

Injury identification

If you suffered injury or pain to any region of your body not listed below, please select other and specify.

17. Please indicate the region(s) of your body in which you sustained the injury or experienced the pain.

Mark only one oval.

- Shoulder
- Knee *Skip to question 19*
- Back and/or neck *Skip to question 19*
- Ear *Skip to question 19*
- Other *Skip to question 19*

Specify shoulder injuries

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18. Did you suffer any of the following injuries to your shoulder? You can pick more than one option or specify an injury not listed by selecting Other.

Tick all that apply.

- [ ] Swimmers shoulder and /or Impingement
- [ ] Inflammation of tendons in shoulder or arm (tendinitis)
- [ ] Rotator-cuff tear
- [ ] Osteo-arthritis
- [ ] Shoulder pain
- [ ] Other: ____________________

Medication used to treat injuries or illness up to one month before or during competitions

Were you prescribed any injections, medications and/or did you buy any over the counter medication, to treat an injury or any illness, suffered up to ONE MONTH BEFORE OR DURING COMPETITIONS?
This may include cortisone injections or tablets, anti inflammatory medications (NSAIDS) , any pain tablets, cold and flu medication, cough syrups or any other medications that you may have used.

19. Please write down any medications that you used to treat your illness or injury. Please separate the medications with a comma.

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Attitude towards intentional use of performance enhancing drugs (doping)

Please rate the questions below as strongly disagree (1), disagree (2), slightly disagree (3), slightly agree (4), agree (5) to strongly agree (6)

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20. Legalizing performance enhancements would be beneficial for sport.

Mark only one oval.

	1	2	3	4	5	6	
Strongly disagree	◯	◯	◯	◯	◯	◯	Strongly agree

21. Doping is necessary to be competitive.

Mark only one oval.

	1	2	3	4	5	6	
Strongly disagree	◯	◯	◯	◯	◯	◯	Strongly agree

22. The risks related to doping are exaggerated.

Mark only one oval.

	1	2	3	4	5	6	
Strongly disagree	◯	◯	◯	◯	◯	◯	Strongly agree

23. Athletes should not feel guilty about breaking the rules and taking performance-enhancing drugs.

Mark only one oval.

	1	2	3	4	5	6	
Strongly disagree	◯	◯	◯	◯	◯	◯	Strongly agree

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24. Doping is an unavoidable part of the competitive sport.

Mark only one oval.

	1	2	3	4	5	6	
Strongly disagree	◯	◯	◯	◯	◯	◯	Strongly agree

25. Doping is not cheating since everyone does it.

Mark only one oval.

	1	2	3	4	5	6	
Strongly disagree	◯	◯	◯	◯	◯	◯	Strongly agree

26. Only the quality of performance should matter, not the way athletes achieve it.

Mark only one oval.

	1	2	3	4	5	6	
Strongly disagree	◯	◯	◯	◯	◯	◯	Strongly agree

27. There is no difference between drugs and speedy swimsuits that are used to enhance performance.

Mark only one oval.

	1	2	3	4	5	6	
Strongly disagree	◯	◯	◯	◯	◯	◯	Strongly agree

Attitude towards fellow competitor use of medication and performance enhancing drugs

Please rate the questions below as (1) Strongly disagree; (2) Disagree; (3) Neither agree nor disagree; (4) Agree; (5) Strongly agree.

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28. Swimmers taking medication to treat chronic disease, illness or injury have an unfair advantage in competitions.

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

29. I do not care if my competitors take MEDICATION even if it gives them an unfair advantage in competitions.

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

30. I do not care if my competitors INTENTIONALLY use prohibited substances other than chronic medication or methods to give them an unfair advantage in competitions.

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

31. Intentionally taking performance enhancing drugs with the sole purpose of improving performance has long term health implications.

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

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32. The use of chronic medication helps masters swimmers to perform as healthy individuals.

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

33. In your opinion does advancing age make swimmers more vulnerable to (intentional and unintentional) doping?

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

Intentional use of prohibited substances or methods to improve performance

This excludes the use of prescribed chronic medication or the unintentional use of performance enhancing medication to treat injury or illness. Remember that the questionnaire is anonymous and your identity is protected. Please be honest.

34. Have you ever intentionally used banned substances or methods in order to enhance your swimming performance?

Mark only one oval.

◯ Yes
◯ No
◯ I do not want to answer this question

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35. Do you currently use a banned substance(s) or method(s) to enhance your sporting performance?

Mark only one oval.

- ◯ Yes
- ◯ No *Skip to question 37*
- ◯ I do not want to answer this question *Skip to question 37*

Performance enhancing drug use

No drug testing is currently being conducted on South African masters swimmers.

36. Please specify the drug or method that you use to improve your performance.

____

____

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____

____

Doping knowledge

37. Are you familiar with the World Anti-Doping Agency (WADA) web-site, anti-doping rules, regulations and policies?

Mark only one oval.

- ◯ Yes
- ◯ No

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38. Please indicate below where you found anti-doping information? You can select more than one answer.

Tick all that apply.

- [ ] Social media
- [ ] WADA website
- [ ] SAIDS website
- [ ] Swimming South Africa
- [ ] Family/friends
- [ ] Other: ____________________

39. Have you ever heard about the WADA Prohibited list?

Mark only one oval.

- ( ) Yes
- ( ) No

40. Have you ever asked your doctor if the medication he prescribed is legal to use when taking part in sporting events?

Mark only one oval.

- ( ) Yes
- ( ) No

41. Have you ever applied for a Therapeutic Use Exemption (TUE) for YOURSELF in any sport?

Mark only one oval.

- ( ) Yes
- ( ) No
- ( ) I do not know what a TUE is

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42. Have you ever applied for a Therapeutic Use Exemption (TUE) for a family member in any sport?

Mark only one oval.

- Yes
- No
- I do not know what a TUE is

43. Are you aware of the consequences of committing anti-doping rule violations?

Mark only one oval.

- Yes
- No

Thank you for completing the questionnaire

If you have any questions about the research, please contact Annemarie Dressler
email: annemarie.dressler1@gmail.com
Cell: 0828013531

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Appendix E: Data variables

Variable name	Question/Calculation	Variable type	Categories	Statistical calculation	Compared to literature
Informed consent	By clicking "I agree" below you are indicating that you are at least 18 years old, have read and understood what the study involves and want to participate in this research study.	Categorical: Nominal	Yes/No		
Gender	What gender do you identify as?	Categorical: Nominal	Male, Female, other	n, %	
Age	What is your age?	Categorical: Ordinal	18-24, 25-29 up to 85-89	Mean using midpoint coding	
Medical Aid	Do you subscribe to a medical aid?	Categorical: Nominal	Yes/No	n, %	If most swimmers subscribe to MA age-related data can be compared
Swims per week	How many times in a week do you swim?	Categorical: Ordinal	Less than once per week, Once, Twice, Three times or more	n, %	
Distance per session	What distance do you on average swim per training session?	Categorical: Ordinal	Less than 500m, 500m-2000m, 2000-3000m, more than 3000m	n, %	
Volume-load	Swims per week*Distance per session	Categorical: Ordinal	Low (0 - 4.9 km per week), medium (4.9 - 11.9 km per week) and high volume-load (12 km and more per week)	n, %	
Years swimming	How many years have you been swimming?	Categorical: Ordinal	0-1 year, 1-3 years, 3-5 years, 5-10 years, more than 10 years	n, %	
Event last 5 years	Have you competed in an organised sporting event that included swimming in the last 5 years? This includes social, non-competitive and fun events for example the Polar Bear swim.	Categorical: Nominal	Yes/No	n, %	

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Type of event	Based on event selection	Categorical: Nominal	Pool swimming, combined events and fun swims	n, %	
Level event	Please specify the event(s). You can choose more than one option.	Categorical: Ordinal	Local, regional, national, international event	n, %	
Other events	Please specify the event(s). You can choose more than one option.	Text: coded		Described	
Motivation	Please indicate the three predominant reasons why you swim?	Categorical: Nominal	9 motivations selected from literature	n, %	% Compared to similar studies
Chronic disease	Have you ever been diagnosed with a chronic disease(s) by a health care provider?	Categorical: Nominal	Yes/No/Not disclose	n, prevalence (%)	Prevalence compared to population prevalence, athletic populations, medical aid data
Type of Chronic Disease	Please pick the chronic disease(s) that you suffer from. You can pick more than one disease or specify a disease in the text box (Other) if not on the list.	Text: coded	High blood pressure, High cholesterol or blood fat, HIV/AIDS, Diabetes (type 1 or 2), Asthma, Thyroid disease, Coronary artery disease, Heart disease, Epilepsy, Bipolar mood disorder	n, prevalence (%)	% Compared to similar studies
Other chronic disease		Text		Described	
Chronic disease per age group	From Chronic disease and age category	Categorical: Nominal	Age groups: All, 25+, 50+	n, prevalence (%)	Prevalence compared to population prevalence, athletic populations, medical aid data
Chronic medication	Do you use any prescribed medication on a daily, weekly or monthly basis to treat your chronic disease?	Categorical: Nominal	Yes/No Age Groups: All, 25+	n, %	% Compared to similar studies

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Chronic medication type	Please list the medication(s) that you are taking for your chronic disease(s).	Text: coded	Categorised by the pharmacist	n, %	% Compared to similar studies
Most prescribed medication	Chronic medication type ranked	Categorical: Ordinal		n, %	
Possible doping infringements	Number of infringements in EMGuidance app/N	Categorical: Nominal		n, prevalence (%)	% Compared to similar studies
Injury	Did you suffer any injury due to swimming that required treatment, e.g., use of medication, or required you to seek medical advice from a health professional in the last five years?	Categorical: Nominal	Yes/No Age groups: All, 25+	n, prevalence (%)	Prevalence compared to population prevalence, athletic populations
Injury per age group	From Injury and age category	Categorical: Nominal	Age groups: All, 25+	n, prevalence (%)	
Injury Region	Please indicate the region(s) of your body in which you sustained the injury or experienced the pain.	Categorical: Nominal	Shoulder, Knee, Back and/or neck, Ear, Other	n, %	% Compared to similar studies
Shoulder injury	Did you suffer any of the following injuries to your shoulder? You can pick more than one option or specify an injury not listed by selecting Other.	Categorical: Nominal	Swimmers shoulder and /or Impingement, Inflammation of tendons in shoulder or arm (tendinitis), Rotator-cuff tear, Osteo-arthritis, Shoulder pain	n, %	% Compared to similar studies
Other shoulder injury		Text		Described	
OTC Medication	Please write down any medications that you used to treat your illness or injury. Please separate the medications with a comma.	Text: coded	Categorised by the pharmacist Age Groups: All, 25+	n, %	% Compared to similar studies
PEAS -8	Legalizing performance enhancements would be beneficial for sport.	Numerical: Discreet	PEAS 8 item	Mean score, SD	Mean scores compared to similar articles
Competitors 6 rated	Swimmers taking medication to treat chronic disease, illness or injury have an unfair advantage in competitions.	Numerical: Discreet		Mean score, SD	
Life-time doping	Have you ever intentionally used banned substances or methods in order to enhance your swimming performance?	Categorical: Nominal	Yes/No	n, prevalence (%)	% Compared to similar studies

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Current doping	Do you currently use a banned substance(s) or method(s) to enhance your sporting performance?	Categorical: Nominal	Yes/No	n, %,	% Compared to similar studies
Drug or method	Please specify the drug or method that you use to improve your performance.	Text		Described	
WADA knowledge	Are you familiar with the World Anti-Doping Agency (WADA) website, anti-doping rules, regulations and policies?	Categorical: Nominal	Yes/No	n, %	% Compared to similar studies
Info source	Please indicate below where you found anti-doping information? You can select more than one answer.	Categorical: Nominal	Social media, WADA website, SAIDS website, Swimming South Africa, Family/friend s	n, %	
Other info sources		Text	Included in above categories	n, %	
Prohibited list	Have you ever heard about the WADA Prohibited list?	Categorical: Nominal	Yes/No	n, %	% Compared to similar studies
Health professionals	Have you ever asked your doctor if the medication he prescribed is legal to use when taking part in sporting events?	Categorical: Nominal	Yes/No	n, %	% Compared to similar studies
TUE self	Have you ever applied for a Therapeutic Use Exemption (TUE) for YOURSELF in any sport?	Categorical: Nominal	Yes/No	n, %	
TUE family	Have you ever applied for a Therapeutic Use Exemption (TUE) for a family member in any sport?	Categorical: Nominal	Yes/No	n, %	
Consequenc es	Are you aware of the consequences of committing anti-doping rule violations?	Categorical: Nominal	Yes/No	n, %	

n = frequency of category selection, N=total population, % =n/N, SD= Standard Deviation

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Appendix F: PEAS-8 item questionnaire

PEAS items
1. Legalizing performance enhancements would be beneficial for sport.
2. Doping is necessary to be competitive.
3. The risks related to doping are exaggerated.
4. Athletes should not feel guilty about breaking the rules and taking performance-enhancing drugs.
5. Doping is an unavoidable part of the competitive sport.
6. Doping is not cheating since everyone does it
7. Only the quality of performance should matter, not the way athletes achieve it.
8. There is no difference between drugs, fiberglass poles and speedy swimsuits that are all used to enhance performance.

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Appendix G: Faculty of Health Sciences' MSc Committee approval letter

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

MSc Committee
School of Medicine
Faculty of Health Sciences

26 March 2021

Dr K Nolte
Department of Physiology
Faculty of Health Sciences

Dear Dr,

Ms A Dressler, Student no 2372304

Please receive the following comments with reference to the MSc Committee submission of the abovementioned student:

Student name	Ms Annemarie Dressler	**Student number**	2372304
Name of study leader	Dr K Nolte		
Department	Physiology (Sport Science)		
Title of MSc	**New approved title: Health status of South African masters swimmers, their medication use and attitudes towards doping** Chronic disease, injury, medication use, doping attitudes and the implications in South African masters swimmers		
Date of first submission	February 2021		

MSc Committee, School of Medicine
Faculty of Health Sciences
University of Pretoria,
Private Bag X323
Pretoria 0001, South Africa
Tel +27 (0)12 319 2325
Fax +27 (0)12 323 0732

Fakulteit Gesondheidswetenskappe
Lefapha la Disaense tša Maphelo

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Comments to study leader February 2021	• Please revise the title as you will focus on the "Health status" of these swimmers. • Please revise the aim and objectives. The objectives should clearly state what will be achieved and how. • Please revise the flow diagram. It should be a summary of the procedures of the study. • Please ensure that all statements can be supported with the appropriate evidence. • Provide a clear description of how the candidate will ensure that swimmers will be followed up. Important to ensure that the study has sufficient participants. • Please correct all spelling, typographical and formatting errors. • Revise authorship table - supervisor should be the senior author. • Please expand the data management section. Include how it will be stored and who will have access. Also include that the metadata will be uploaded to the UP Research Data Repository system at the end of the study. • Revise the reference list as it has several inconsistencies; books should include page numbers, websites should be referenced in full and journal titles should either be written in full or abbreviated, not both. • Revise GANTT chart. • Statistical support letter should be from one of the Faculty appointed or a qualified biostatistician (include qualifications on letter).
March 2021	• Thank you for submitted the revised protocol and requested documents.
Decision	This protocol has been provisionally approved. Please submit the revised protocol to ethics, and supply the MSc committee with proof of acceptance. The internal and external examiners can be nominated and submitted to the MSc Committee six months prior to submission of the dissertation. Please ensure that the CV of the examiners includes: supervision, examination and publication records.

Yours sincerely

Prof Marleen Kock
Chair: MSc Committee

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Appendix H: SAMS permission to distribute the survey

South African Masters Swimming Association
info@samastersswimming.com

25 January 2021

Dear Ms. Dressler,

South African Masters swimming (SAMS) grants permission to distribute MSc survey

On receiving your email request to distribute the survey to our members the SAMS committee voted in favor of the request.

This letter will serve as authorization to distribute the survey prepared by Ms. Annemarie Dressler, titled "Chronic disease, injury, medication use, doping attitudes, and the doping implications in South African Masters Swimmers" to all regions affiliated to SAMS. Regions are authorized to distribute the survey to all their affiliated masters swimming clubs and coaches. Masters swimming clubs and associated masters coaches can then with the permission of SAMS distribute the survey to all their current and former competitive and non-competitive masters swimmers subscribed on their mailing list.

Yours faithfully

Wolfgang Fechter
President of SAMS

Wolfgang Fechter (President) – Wolfgang.Fechter@tongaat.com ; Stefan van der Westhuizen (Vice President) – stefan@classiceyes.co.za; Carina Hambloch (Secretary) – info@samastersswimming.com ; Rosemary Clark (Registrations) – registrations@samastersswimming.com ; Winston Clark (Treasurer) – clark.winrose@gmail.com; Ann Gray (Open Water Swimming) - anngray@telkomsa.net ; Dawn Lloyd (Trophies/Awards) – Dawn@gdlkptn.co.za ; Owen van Renen (Publications) – ovrenen@gmail.com ; Jenny & Peter Ireland (Records) - pireland@iuncapped.co.za ; Carole Bridges (Webmaster) - webmaster@samastersswimming.com

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Appendix I: Declaration of data storage

Principal Investigator declaration for the storage of research data and/or documents

I, the Principal Investigator(s), Annemarie Dressler of the following trial/study titled "Health status of South African masters swimmers, their medication use and attitudes towards doping", will after completion of the study upload and store all the research metadata on the University of Pretoria Research Data Repository system for the minimum prescribed period of 15 years.

START DATE OF STUDY: February 2021

END DATE OF STUDY: 2022

UNTIL WHICH YEAR WILL DATA WILL BE STORED: 2032

AH Dressler

Name: Annemarie Dressler

Date: 6 February 2021

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