ARTHRITIC PATIENTS' VIEWS AND PERCEPTIONS ON EXERCISE AS AN ADJUNCT TREATMENT REGIME FOR MANAGING THEIR CONDITION

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i. Declaration

I, Lervasen Pillay, student number 9503004X declare that the research report with the title "**Arthritic patients' views and perceptions on exercise as an adjunct treatment regime for managing their condition**" is hereby submitted to the Faculty of Health Sciences, University of Witwatersrand, Johannesburg, for the degree of Master of Science of Medicine in Sports Medicine. It has not previously been submitted by me for a degree or examination at this or any other university; that it is my work in design and execution, and that all material contained herein has been duly acknowledged and referenced where necessary.

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Dr. Lervasen Pillay Date

Student Number: 9503004X

This research report is dedicated to

my late father Dayalan Pillay (1951-2012)

and late sister Pranesha Pillay (1972-2003).

To my dad for instilling in me the principles of honesty, love and devotion. For his unfailing support and quiet encouragement. For his belief that failure is noble if it is a catalyst for later success.

To Pranesha whose unwavering belief in me, led me to stay the course.

Ii. Presentations arising from this research project

Electronic Poster Presentation, South African Sports Medicine Association Conference, Sandton, Johannesburg, 20-21 October 2015.

iii. Abstract

Introduction: Arthritic disease, presenting with a variety of joint pathologies has a myriad of treatment modalities. Treatment is dependant on various types of medication stemming from the specific diagnosis. Treatment is often supplemented with dietary changes, lifestyle related changes and exercise.

Objective: This study aimed to assess the view of arthritic patients towards exercise as an adjunct treatment to medication in managing symptoms of their condition, participant's knowledge of appropriate exercise regimes in managing their symptoms, whether or not healthcare providers prescribed exercise as a part of treatment, the different healthcare providers exercise prescription habits, the exercise modes and the outcome of the effects of exercise (subjective feeling of pain relief).

Methods: A cross-sectional survey study design was used. Patients presenting at two private general practitioners and a biokineticist practices based in the southern suburbs of Johannesburg were invited to participate in this questionnaire-based study. Patients that met the inclusion criteria (those participants diagnosed with any arthritic disease with or without a co-morbid disease not contra-indicating exercise) were included in the study. Questions were developed to determine various aspects of the effect of exercise and participants' attitudes toward exercise as an additional management tool in arthritic patients. These were all self-reported by the participant using the questionnaire. In addition, information on the type of healthcare providers prescribing exercise, exercise modes and outcomes of exercise were also gathered. Outcomes (improvements in the participants' arthritic condition, symptoms and activities of daily living with exercise) were used as criteria for improvement. This study did not differentiate between single joint and multi joint arthritis.

Results: A total of 67 participants were surveyed of which 25% were male and 73% female. The remaining two percent were unspecified. Age distribution was as follows: 60% >50 years old, 36 % were 30-50 years old and the remaining four

percent <30 years of age. Most participants suffered from osteoarthritis (N=29), followed by rheumatoid arthritis (N=27), gout (N=five) and post traumatic arthritis (N=three) while the remaining participants were not specific. Exercise was advised mostly by doctors, followed by physiotherapists then biokineticists. Osteoarthritis and rheumatoid arthritis accounted for the multi-joint involvement arthritic disease. Exercise that was advised by doctors was found to be general (walking-no specifics regarding intensity and time). It was not specific enough and mostly included walking (48%). Exercise alone diminished pain (not statistically significant; *p=0.18)* and improved activities of daily living by 11%, while medication alone did relieve pain (*p=0.034)* and improved activities of daily living by 21%. Pain was measured using a numeric pain scale and activities of daily living were self-reported by the participants using the questionnaire. Observations and analysis from the study concludes that medical treatment aided by exercise will improve results in the treatment of participants with arthritic disease. The largest improvement and statistically significant finding in perceived pain relief was noted in the combination of both exercise and medication (*p=0.01)* with a 32% improvement in activities of daily living.

Participants surveyed are of the view that exercise assists them in managing the symptoms of arthritis.

Conclusions: Exercise is an important adjunctive treatment modality. Doctors were in fact advising exercise more than other healthcare providers but this advice was very non-specific. Participants were physically active (N=52) and believe that exercise can benefit them. This studies findings suggest that healthcare providers need to prescribe exercise more specific to the patient's condition and physical capabilities. There is no "one size fits all" exercise prescription.

This study adds to the knowledge base of the field in the management of arthritic disease in the southern suburbs of Johannesburg in South Africa. It is consistent with other research done in this field. Future research should be directed toward exploring further these findings and the reasons why healthcare practitioners fail to be specific in their exercise advice.

Keywords: management of arthritic disease, exercise prescription, exercise as an adjunct treatment modality, exercise and pain relief.

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vii. Definition of terms

This section defines terms that are relevant to this study which lends clarity in its use in this study. Definitions are sourced from Dorland's Medical Dictionary android application published by Elsevier in 2008.

- *Acupuncture* – A technique from traditional Chinese medicine in which fine needles are inserted into acupoints for preventative and therapeutic purposes, for relief of discomfort associated with painful disorders and sometimes for anaesthesia.

- *Allied health professionals* – a person with special training, certification, and licensing with responsibilities bearing on patient care. This includes physical therapists, occupational therapists, dietetic services and clinical laboratory personnel.

- *Analgesics* – a pharmaceutical agent that relieves pain without causing loss of consciousness.

- *Anti-inflammatory drug* – medication that counteracts or suppresses inflammation.

- *Arthritis* – inflammation of a joint.

- *Chondrocalcinosis* - deposition of calcium salts in the cartilage of joints. When accompanied by attacks of gout like symptoms it is called pseudogout.

- *Cortisone* – a glucocorticoid with significant mineralcorticoid activity, isolated from the adrenal cortex, largely inactive in humans until it is converted to

- hydrocortisone (cortisol). Cortisone as the acetate ester, is used as an anti-inflammatory and immuno-suppressant and for replacement therapy in adrenocortical insufficiency.

- *Disease modifying anti-rheumatic drugs* – A classification of anti-rheumatic agents referring to their ability to modify the course of disease, as opposed to simply treating symptoms such as inflammation and pain.

- *Exercise* – performance of physical exertion for improvement of health or correction of physical deformity.

- *Gout* – a form of arthritis in which uric acid appears in excessive quantities in the blood and may be deposited in the joints and other tissue.

- *Hepatic* – pertaining to the liver

- *Hyaluronic acid* – a glycosaminoglycan found in lubricating proteoglycans of synovial fluid, vitreous humor, cartilage, blood vessels, skin, and the umbilical cord.

- *Insulin-like Growth Factor one* - insulin like substances in serum that do not react with insulin antibodies;they are growth hormone dependant and possess all the growth promoting properties of somatomedins.

- *Metabolic Equivalent of Task* - a physiological measure expressing the energy cost of physical activities and is defined as the ratio of metabolic rate (and therefore the rate of energy consumption) during a specific physical activity to a reference metabolic rate, set by convention to three point five $mlO_2.kg^{-1}.min^{-1}$.

- *Non-steroidal anti-inflammatory drug* - any in a large group of drugs that are analgesic (pain reducing), ant-pyretic (fever reducing), and anti-inflammatory (inflammation reducing).

- *Osteoarthritis* – A non-inflammatory degenerative type of arthritis marked by degeneration of the articular cartilage, overgrowth of bone at the margins, and changes in the synovial membrane.

- *Peptic ulcer* – a loss of tissues lining the lower oesophagus, stomach or duodenum.

- *Post traumatic arthritis* – arthritis of a joint after the joint congruency or cartilage is damaged.

- *Psoriatic arthritis* – That associated with severe psoriasis, usually affecting joints at the ends of the fingers and toes.

- *Renal* – pertaining to the kidney.

- *Rheumatoid arthritis* – a chronic systemic disease, classified as a type of collagen disease, characterised by inflammatory changes throughout the body's connective tissues.

- *Sjogren syndrome* - a symptom comlpex of unknown aetiology occuring in middle-age to older women marked by the triad of keratoconjunctivitis sicca, dryness of the mouth and a connective tissue disease (usually rheumatoid arthritis but sometimes systemic lupus erythematosus, scleroderma or polymyositis).

- *Spondyloarthropathy* - diseases of the joints of the vertebral column.

- *Systemic lupus erythematosus* – a chronic inflammatory disease, usually febrile, with damage to the skin, joints, kidneys, nervous system, mucous membranes, and less often other organs; it usually has periods of remissions and exacerbations.

- *Therapeutic ultrasound* – a mechanical and thermal physical modality that uses sound waves of a frequency of approximately one million hertz for the treatment of soft tissue injury.

viii. Abbreviations

ACSM = American College of Sports Medicine

ADL = Activities of daily living

AHA = American Heart Association

BMI = Body Mass Index

EULAR = European League and Association for Rheumatology

GP = General Practitioner

IGF-one= Insulin-like Growth Factor one

METs = Metabolic Equivalent of Task

N = number in serial form denoting research statistics

NSAID= Non-Steroidal Anti-Inflammatory Drug

PNS = Pain Numeric Scale

SASMA = South African Sports Medicine Association

TENS = Transcutaneous Electrical Neuromuscular Stimulation

Chapter 1: Study introduction

1.1. Introduction

Arthritis is a disease affecting a sizeable proportion of the world population. About 70% to 80% of people over the age of 55 years suffer degenerative changes to their joints[1]. Arthritis is defined by the Mayo Clinic[2] as a disease where there is degeneration of the cartilage in one or more joints. This leads to pain and stiffness of the joint, affecting mobility and the affected joints' range of movement[2]. This can affect all joints, but commonly the hip, knee, lower back, hand, shoulder, elbow, ankle, wrist and feet are affected. There are many different types of arthritic conditions encountered by health-care professionals (post traumatic, osteoarthritis, rheumatoid arthritis, psoriatic arthritis, gout arthritis and connective tissue disease related arthritis). Each disease has its particular signs and symptoms. Special investigations (like blood tests and x-rays) and clinical criteria assist in making a definitive diagnosis. Once this is done appropriate treatment can be scheduled.

Pharmacological treatment is the cornerstone in treating arthritic conditions once the specific diagnosis is made[3]. In certain types of arthritic diseases (as in rheumatoid arthritis) the use of medication is absolutely necessary for pain and disease control (i.e. corticosteroids, non steroidal anti-inflammatory drugs, analgesics and disease modifying drugs). The use of medication notwithstanding, there are alternate and additional methods of pain control. This includes inter alia using heat, Trans-cutaneous Electrical Neuromuscular Stimulation (TENS), acupuncture, dry-needling and therapeutic ultrasound with varying success and is often practised by allied therapeutic healthcare professionals. Other methods include specific exercise and strengthening programmes. General practitioners are often the first line in diagnosing and treating arthritic conditions.

A particularly neglected adjunct therapy is physical activity - specifically, a directed exercise regime. A recent review by Uthmann *et al.*(2013)[4] incorporating trial sequential analysis and network meta-analysis located 60 trials on lower limb arthritic disease and 12 different exercise interventions. This included proprioceptive exercises (balancing), quadriceps and hamstring strengthening exercises and flexibility exercises. These results showed that from 2002, there has been sufficient evidence to support the benefits of exercise in patients with lower limb arthritic disease.

It is not known if general practitioners in South Africa recommend or even prescribe exercise. If they do then the mode, load and frequency of exercise they prescribe and whether patients follow this advice is not known. Presently, the

Exercise is Medicine™ initiative aims to address these issues. Exercise is Medicine™ is a worldwide initiative aimed at getting all age groups physically active by partnering with healthcare providers - this is an initial initiative in order to get the general public active first before implementing specifically designed programmes for specific conditions. These providers with an interest in exercise medicine and science become part of a global network which helps to support patients by prescribing appropriate exercise. Exercise as an adjunct therapeutic intervention in arthritic disease is possibly widely unused appropriately in South Africa. However, if exercise is used as an adjunct therapy, there is a lack of specific exercise guidelines and prescription relating to the condition. For those patients who are advised to exercise, to them belongs the daunting task of trying to determine themselves what to do and what is the best mode and load of exercise to perform. Therefore the exercise advice must be of prescription level (specifics regarding the type and frequency of the intervention) and not just general physical activity.

This study was aimed at addressing the gap in the knowledge of exercise in its use as an adjunct therapeutic intervention in arthritic conditions in the southern suburbs of Johannesburg in South Africa.

Participants answered questions on their physical activity and exercise levels. They were questioned on the treatment advice by healthcare practitioners, and whether they adhered to this advice. The researcher, using these results, has tried to provide a sharper insight into the use of exercise prescription and whether it benefits this sample group.

The researcher aimed to quantify the participants' knowledge of exercise mode, intensity and frequency in order to achieve the best health benefits from a directed physical activity programme. This includes pain relief and improvement in daily living activities.

1.2. Statement of the problem

It is not known if general practitioners and other therapeutic healthcare practitioners in South Africa prescribe exercise for arthritic patients. If exercise is prescribed, is the type of exercise appropriate for the arthritic disease the patient is suffering from? Does exercise help patients to easily perform activities of daily living? Moreover do patients follow the advice to exercise by healthcare providers? The European League and Association for Rheumatology (EULAR)[3,5] , the American Geriatrics Society Panel on Exercise and Osteoarthritis[6,7], the American College of Sports Medicine (ACSM)[8] and the American Heart Association[8] all suggest specific exercise regimes for arthritic disease as part of their guidelines in

the management of the symptoms of the disease. If healthcare practitioners are not prescribing specific exercises for patients with arthritic disease this would suggest a lack of confidence and/or knowledge in prescribing exercise or they have not been educated in the benefits of exercise specific prescription (mode, frequency, load and timing).

It is also not known in South Africa whether patients who do perform physical activity (whether prescribed to them or not) achieve perceived pain relief and improvement in activities of daily living and if this is related to dose, frequency and mode of exercise performance.

1.3. Study aim and objectives

The aim was to determine

- if patients with arthritis engage in exercise
- If the frequency, the mode of exercise, the intensity of exercise and the duration of exercise were recommended by healthcare professionals.

The objectives of the research were to determine

- the participants' views and perception of exercise
- exercise as an adjunct to pharmacological treatment for management of symptoms in arthritic conditions
- the subjective benefit of exercise in alleviating pain in arthritic disease
- participants' knowledge of the appropriate exercise to perform in managing arthritic disease
- the prescribing habits of exercise by healthcare professionals

Chapter 2: Literature review

The literature review provides an overview of the related research completed in this area of research and is divided into different themes.

2.1. Overview of arthritic disease

Joint pain is a problem commonly encountered in general practice. There are over 200 different types of arthritic diseases. A diagnosis is made by using clinical criteria and diagnostic criteria to confirm a diagnosis. This information is used to further classify the disease stage and develop a treatment plan[2]. They can be classified as follows[9] :

- Osteoarthritis is a degenerative joint disease where inflammation is a symptom. This disease commonly involves knees, lower back, cervical region, hands distally, wrists and hips. Progresses from one joint to several.
- Connective tissue diseases (rheumatoid arthritis, systemic lupus erythematosus, systemic sclerosis, polymyositis, Sjogren's syndrome) have an auto immune aetiology. This disease commonly involves multiple joints especially proximal hands and progressively affects more joint.
- Spondyloarthropathies (psoriatic arthritis, ankylosing spondylitis and Reiter's syndrome). As the term suggests, this commonly involves the verterbral column but can progress to involve other regions.
- Crystalline-induced arthropathies (gout and chondrocalcinosis). This disease commonly affects knees, first meta-tarso-phalangeal and ankle joints. It usually affects one joint.
- Infective arthritis (bacterial, fungal, viral, post infective). Often only one joint is involved
- Juvenile arthritis. It is a term used to describe auto-immune and inflammatory conditions that develop in children under the age of 16 years.
- Post traumatic arthritis. There is primary involvement of the previously injured joint. In long-standing, the proximal and distal joints on the affected side can be affected due to the abnormal biomechanical loading.

Therefore the aetiology of arthritic disease is multi-faceted. All arthritic diseases have no cure. Symptoms can merely be controlled and disease progression tempered[3]. Although recently at the 62nd Annual American College of Sports Medicine conference in San Diego 2015, Mazor *et al.* (2015)[10] presented a poster

depicting the potential use of mesenchymal stem cells transplantation in order to "grow" new cartilage. This obviously still requires additional research but offers a potential future management procedure for osteoarthritic knee joints before considering arthroplasty.

The World Health Organisation report[11] on the burden of musculoskeletal disease in 2003 showed that the African Continent has the fifth highest incidence of musculoskeletal disease compared to the Western Pacific (first), South-east Asia (second), Americas (third) and the Eastern Mediterranean (fourth). The reasons are multi-factorial. It may be due to the level of physical activity, the incidence of obesity, the prevalence of trauma present in a nation, the ability to collate statistical data in the region or data collected only on radiological disease classification. This report also showed that the prevalence of arthritic disease is higher in females than males. The WHO[11] recognised this inconsistency. Thus it was that many experts were gathered to formulate a scientifically agreed to average using the information they had acquired (this was data from state institutions, surveys, published studies in those particular country's population groups and arthroplasties among others). It became clear that more research is needed to obtain a more realistic figure regarding the global burden of arthritic disease in the future.

The main presenting symptom in patients with arthritic disease is pain. Patients' symptoms can be managed acutely with flare ups of inflammation and chronically to prevent flare ups in order to preserve and decelerate the joint degradation process. On the basis of the diagnosis, various medications may be prescribed and patients' symptoms monitored and controlled with analgesia, non steroidal anti-inflammatory medication and disease modifying drugs. In recent years there has also been the use of chondroitin and glucosamine sulphate supplementation for osteoarthritis[12]. Patients using medication often develop side effects from chronic use of such medication especially in the case of using non-steroidal anti-inflammatory drugs. Patient's therefore need to be constantly monitored for other metabolic complications (this involves liver and renal function) associated with the use of medication[3]. Sometimes even life threatening complications (like acute gastrointestinal bleeds, peptic ulcer disease, liver dysfunction, renal dysfunction and hepatic dysfunction) can develop. The monitoring and treatment of side effects of oral medication thus makes it financially burdensome in managing the condition.

Another treatment method consists of injecting joints with either cortisone to assist with inflammation or hyaluronic acid to act as a joint replacement viscous supplement. Divine(2007)[13] proved the efficacy in symptomatic improvement

when using intra-articular joint injections of hyaluronic acid. However, the in-room procedure is both expensive and uncomfortable .

Many other non-pharmacological methods are used to manage pain[14]. Examples of this are physiotherapy (soft tissue massage), TENS, therapeutic ultrasound, patient education (so that patients are more aware and educated to what aggravates their condition and to limit or avoid these situations) and exercise.

2.2. Effect of exercise on obesity and arthritic disease

It has been noted that obesity is becoming an epidemic and much research is being done in the field of physical activity and its health benefits[15]. To put South African physical activity into perspective, we must review local evidence. There are no statistics regarding the epidemiology of arthritic disease in South Africa. Kolbe-Alexander *et al.* (2012)[16] asserts that only 36% of South African men and 24% of South African women report sufficient levels of daily physical activity. This low level of physical activity would suggest a trend toward the development of obesity. The Framingham study by Felson *et al.*(1988)[15] clearly demonstrated the positive correlation between obesity and knee osteoarthritis. With regard to South African youth, the recent physical activity scorecard of "D"[17] is evidence that levels of physical activity are diminishing in the youth group. The indirect consequence is that obesity can become an epidemic in South Africa. This has a direct consequence on the present and future prevalence of osteoarthritis in South Africans. These issues need to be dealt with from a preventative perspective and needs to be improved drastically. This yet again emphasises the importance of physical activity.

The American College of Rheumatology subcommittee on osteoarthritis management recognises that osteoarthritis' contributing causal factor is biomechanical stress[3]. Obesity will then directly change biomechanical stress that presents through a joint, especially the knee[14] leading to medial compartment knee osteoarthritis. Research by Sanchez *et al.* (2007)[18] and Li *et al*. (2007)[19] suggest a link between nutritional behavior, obesity, watching too much television, low levels of physical activity and the development of metabolic syndrome respectively. Scientific, peer reviewed research provides evidence of the positive effects of physical activity in a multitude of medical problems, including arthritic disease. Sevick *et al*. (2009)[20] has also shown that dietary interventions and physical activity in obese patients with knee osteoarthritis is the most cost-effective management of these conditions. It has shown improvement in both weight loss as well as knee pain. Messier *et al.*(2004)[21] involved 316 community dwelling individuals with established knee osteoarthritis (confirmed radiographically and clinically). These same patients also had body mass indices

(BMI) equal to or greater than 28 kg/m^2. In this study, the Western Ontario and McMaster Universities Osteoarthritis Index was used to measure self reported physical function, pain and stiffness scores and weight loss amongst others. Their results showed that a moderate amount of weight loss and a moderate exercise load improves self reported function and lessens pain. This was in comparison with either weight loss or exercise alone. All these studies and recommendations agree unanimously that exercise not only improves general health perspectives but also arthritic disease.

2.3. Exercise prescription for patients with arthritis

In the face of the above evidence and with the knowledge that general practitioners are the first line of call in patients presenting with arthritic disease, it is axiomatic that one must consider their role in exercise prescription. Studies in France and Canada by Chevalier *et al.*(2004)[22] on surveying general practitioners showed a surprisingly small percentage (less than 15%) of doctors considered prescribing exercise as part of the treatment regime for patients with arthritis. Reasons ranged from practitioners not being comfortable with exercise prescription, to poor knowledge on the positive effects of physical activity in this group of participants. A recent study by Persson *et al*. (2013)[23] in Sweden showed that general practitioners did not use a physical activity prescription tool for several reasons. These included uncertainty on prescription of exercise and not considering non-pharmacological treatment as a viable treatment option. These practitioners would rather refer to another healthcare professional for exercise prescription. This begs the question that if practitioners feel hamstrung in prescribing exercises, how confident are patients in performing prescribed exercise if it is prescribed to them? Munneke *et al*. (2003)[24] and Ettinger *et al*. (1997)[25] both shed further light onto the subject of arthritic disease and physical activity. They respectively showed that when patients are prescribed an intensive dynamic exercise programme over a prolonged period of time there is an improved adherence to the programme. This was confirmed by the American College of Rheumatology exercise guidelines[3] further demonstrating that with health education, there was strong adherence to an exercise programme. However this was dependent on the intensity at which the programme was done. Those individuals that perform low or very high intensity programmes stopped exercising while the majority that continued exercising were those individuals performing moderate intensity exercise.

Radeke (2007)[26] demonstrated that if patients interpreted the prescribed exercise as beneficial and enjoyable then their tolerance and physical response would improve.

In South Africa, the researcher has noted that there are no guidelines or research regarding exercise prescription by general practitioners to the arthritic population and/or the patients' views on how they see exercise forming part of their treatment.

2.4. Positive effects of exercise in arthritic disease

The evidence is no longer anecdotal and demonstrates the positive effects in the use of exercise as medicine in treating arthritic conditions[8,23-25]. Consensus statements (regarding exercise prescription and health benefits) are being made by respected institutions like the American College of Sports Medicine[8] as well as associated websites like www.exerciseismedicine.org.

Pain is the main symptom in arthritic disease. Patients who performed a guided exercise routine lose weight as well as benefit from knee osteoarthritis pain improvement[21]. Zhang *et al*. (2009)[14] tabulated the difference in pain relief between activity (aerobic, water based and strengthening exercises) and medical treatment (acetaminophen, oral and topical NSAID) in patients with osteoarthritis. The most pain relief by far was achieved by those patients who performed aerobic exercise. Exercise offers an adjunct therapy to regular or chronic medication use. Karatay *et al.* (2007)[27] confirm the positive effects of exercise even in auto-immune diseases. They showed that dynamic exercise is effective, and that circulating levels of immuno-globulin factor one in conditions like rheumatoid arthritis and ankylosing spondylitis, actually decrease thereby ‘modifying’ the disease. Guidelines by EULAR suggest that for patients with any arthritic condition, exercise is an important non-pharmacological component of their management[28]. This not only helps with pain relief, but also to reduces the incidence of stiffness, maintains range of movement and hence improves the quality of life. The latter is important as in the future, a patient may require arthroplasty. Manninen *et al*. (2001)[29] demonstrated that cumulative hours of recreational physical activity had decreased the risk of development of knee osteoarthritis and consequently knee arthroplasty. A good pre-surgical range of movement and body mass index promote better post-operative outcomes[5,28,29] – this is another important need for exercise in patients with arthritic disease. One of the expensive consequences of arthritic disease is the need for joint replacement surgery involving implants. Hence positive economic effects may also be achieved in public hospital expenditure as the number of joint arthroplasty procedures may be reduced.

Exercise has been shown to delay arthritic progression[5,29] thereby delaying progression towards the need for arthroplasty. This also allows for patients to perform activities of daily living easier with less discomfort, thereby decreasing the

burden of disease on patients and their lifestyles. However, the positive effect is better noted when the exercise prescription is supervised and specifically involves quadriceps strengthening and hip/knee kinematics restoration programmes (in the case of knee arthritis). The symptomatic nature of arthritic disease prevents patients from being overtly active. In some patient's the pain and stiffness of joints is debilitating. This can be to such an extent that a sedentary lifestyle (minimal physical activity that has no positive effect on health) is easier to cope with at that particular point. This very low level of non-beneficial energy expenditure increases the risk of other cardiovascular medical conditions (e.g. Hypertension, hyperlipidaemia and type two diabetes mellitus) as shown by Pies *et al.* (1995)[30] - this places a further burden on an already stressed public healthcare system. They also observed that physical activity can assist the mobility of patients with arthritic illness which then assists in reducing the cardiovascular risk as well. That being said, there will always exist contraindications for physical activity. The prescribing healthcare provider must always be cognizant of this, so as not to cause irreparable harm. Table 2.1. derived from a study by de Rooij *et al.* (2013)[31] outlines the more common exercise restrictions and contra-indications for exercise in patients with co-morbid diseases.

Table 2.1. Exercise restrictions and contraindications in patients with co-morbid diseases

Cardiac

Co-morbid condition	Exercise restriction	Contraindication
Coronary heart disease	-Chest pain with exercise -Arrythmias -Level three New York Heart Association dyspnoea -Drastic blood pressure changes with exercise -Fear of exertion -Inactive lifestyle -Inappropriate exercises -Malaise, fainting, nausea with exercise	-Pain in the chest before exercise -Myocardial infarction in the last three months -Present cardiac inflammation, changes or new arrythmias, unstable angina, fever or fever within the last ten days -Level four New York Heart Association dyspnoea -Dyspnoea at rest -Symptomatic aortic stenosis
Heart failure	As above including : -Low pulse rate with the use of beta-blockers -Breathlessness and fatigue disproportionate to the level of exertion -Reduced recovery capacity -Left ventricular ejection fraction < 30%	As above including: Increase in body weight more than two kilograms in the last two days
High Blood pressure	-Left ventricular hypertrophy -Reduced aerobic capacity due to the use of beta blockers -Inactive lifestyle	Resting systolic blood pressure of > 200mmHg of diastolic > 115mmHg

Metabolic

Type 2 diabetes mellitus	-Blood glucose > 16 mmol/l or < five mmol/l -Hypoglycaemia 48-72 hours after exercise -Poor glucose control -Delayed recovery when injured -Developing foot ulcer -Autonomic neuropathy -Loss of sensibility of feet -Increased eye pressure with exercise -Fear of exertion -Inactive lifestyle -Poor glucose monitoring -Poor understanding of medication, disease and exercise	Foot ulcers
Obesity	-Increased stress, pressure and joint pain -Shortness of breath -Poor thermo-regulation during exercise -Inactive lifestyle -Fear of movement -Lack of motivation to lose weight	

Pulmonary

Chronic Obstructive Pulmonary Disease	-Peripheral muscle weakness/atrophy -Respiratory muscle weakness -Poor nutritional status -Saturations < 90% -Present disease excacerbation -Severe disease or dyspnoea -Poor control of respiration or cough reflex -Fear of breathlessness -Inactive lifestyle -Poor understanding of disease, medication and exercise -Instruments required to measure saturations	-Pneumonia -Loss of > ten percent weight in the last six months or > five percent weight in the past month

Musculoskeletal/Pain

Osteoarthritis of the hand and feet	-Increase in pain with exercise -Limited use of a walking aid	
Lower back pain	-Severe pain before exercise -Pain during and after exercise -Neuropathy or radiculopathy before exercise -Inadequate pain coping skills -Inactive lifestyle -Fear of exercise	Specific spinal pathology
Chronic pain	-Increase in pain with exercise -Fatigue during exercise -Pain limiting exercise tolerance -Inadequate pain coping skills -Inactive lifestyle -Fear of exertion	

Other

Depression	-Generalised fatigue limiting exercise -Lack of treatment compliance -Fear of exercise -Inactive lifestyle -Lack of motivation	-Major depression -Serious psychiatric disorder
Vision/ hearing impaired	-Orientation problems -Cannot process images and text/speech -Fear of falling -Inactive lifestyle -Inadequate environment for home exercise -Problems with light contrast and furniture/equipment when exercising	
Chronic cystitis	-Urinary incontinence -Increase abdominal pressure with exercise -Fear of incontinence -Inactive lifestyle	

Arthritic conditions put a strain on the healthcare system. It also has negative effects on lifestyles, activities of daily living, general activity levels, dependency on others and the patient's psychology.

2.5. Patients are seeking exercise advice

If general practitioners do not stress the use of exercise as a component of managing arthritic pain, patients will not be inclined to understand its importance as part of an effective treatment modality. A search on reputable arthritis foundation's websites (www.arthritis.org.za[32], www.rheumatology.org[33], www.hopkinsrheumatology.org[34], www.mayoclinic.org[2], www.cdc.gov/arthritis[35])

produces results with the specifics of exercise as an adjunct treatment to arthritic disease. The description for exercise and exercise advice is rather complex and requires knowledge in the field to understand the terminology. However, there are some useful videos showing basic exercises. A patient has to first know precisely what type of exercises they are looking for in order to search for the associated advice on the internet. Only patients usually already involved in these centres and having specific access to these organisations, enjoy easy access to exercise and arthritic advice and referral. Hence, patient education regarding exercise with arthritic conditions is difficult to access unless specifically advocated, prescribed and reinforced by healthcare providers. This was confirmed by Skou *et al.*(2014)[36] - that an improvement in pain alleviation and quality of life is linked to a combination of exercise, education and positive exercise reinforcement. The MOVE (where 'MOVE' is not an acronym but simply defining some evidence base for practitioners to use as guidelines when prescribing exercise in patient's with arthritis) consensus statement by Roddy *et al*.(2005)[37] surveyed several studies in order to produce a document guide encapsulating evidence based medicine and exercise recommendations in patients with knee and hip osteoarthritis. Level I evidence (evidence from at least one properly designed randomised control trial) was not limited to strengthening but aerobic exercise as well. This level of evidence also included developing methods to ensure exercise compliance (by the mode of exercise, venue of exercise performance and exercise in a group or individually). Most other evidence was at the Level III- (evidence from multiple time series designs with or without an intervention) evidence scale which includes evidence that exercise needs to be individualised and age and other co-morbidities must be taken into consideration when prescribing exercise.

Physiotherapists and researchers always stress the importance of physical activity in disease management and prevention[38,39]. Pedersen *et al*. (2009)[40] designed physical activity routines at the workplace. There was a significant improvement in musculoskeletal pain, among other positive effects. The American College of Rheumatology also has medical guidelines on management of arthritic disease. This includes aspects of loss of weight, exercise, compliance to exercise prescription and basics of exercise[3].

The Exercise is Medicine™ initiative was launched in South Africa during the South African Sports Medicine Association Biennial Conference in 2013. It is a programme which enables practitioners to become part of a network of providers nationally and globally (medical doctors, physiotherapists, exercise scientists and biokineticists). In turn these practitioners are able to access exercise prescription methods, rationale and outcomes. This is motivated by a general perspective of reducing the burden of disease (of which arthritic disease is one) on the

healthcare system[19]. The Exercise is Medicine™ initiative's vision is to enable practitioners to become more comfortable with prescribing appropriate exercise in specific patients thereby changing an "over the counter medication" to a "scheduled drug". Therefore, this initiative will now provide practitioners within the health and physical activity promotion environment, with a sound basis to confidentially provide exercise prescription to a larger base of individuals with joint related illness. Patient's with arthritic disease (amongst others example cardiac disease, respiratory illness) will have access to a larger volume of healthcare providers in the promotion of healthy exercise lifestyle industry. The consequences of this will be a more physically active sector of patient's with arthritic disease and the positive effects of reduction of the burden of the disease[19.].

2.6. The evidence based guidelines for physicians

The American Geriatric Society has provided some basic guidelines of different modes of exercise[6]. This is recommended for the geriatric patient with diminishing muscle loss and arthritic disease changes be it uni- or multi-jointed. This is divided as mode, volume and frequency. Below is a brief description from the American Geriatric Society Consensus Practice Recommendations[6]:

- Flexibility:

  -Initially:

  daily for five to 15 seconds each muscle group.

  -Long term:

  stretch to full range, hold for 20 to 30 seconds, involve three to five muscle groups, three to five times daily.

- Strengthening:

  -Isometric:

  forty to 60% of sub-maximal volumetric contraction, each muscle group one to ten contractions holding for one to six seconds daily.

  -Isotonic:

  -Low (40%) one repetition maximum, ten to 15 repetitions.

-Medium - (40% to 60%) one repetition maximum, eight to 10 repetitions.

-High (greater than 60%) one repetition maximum, six to eight repetitions.

All the above strengthening exercises should be done two to three times a week.

- Aerobic endurance:

  Low to moderate activity at 40% to 60% of heart rate maximum accumulated. This should be done two to five times for 20 to 30 minutes a day.

These recommendations do not differ much from the ACSM and American Heart Association recommendations. Reviewing the recommendations by the ACSM and AHA, they are specific for exercise advice for healthy adults and older adults. In their study[8] the older adult was defined as all adults over the age of 65 years and adults between the ages of 50 and 64 with clinically significant chronic conditions as well as limitations in their Activities of Daily Living and movement.

ACSM and AHA recommendations[8] for healthy adults state that in order to achieve health benefits from physical activity, an individual should engage in aerobic as well as muscle strengthening exercises:

- Aerobic exercise in a healthy adult should consist of at least 30 minutes or three accumulated ten minute bouts (duration) at least five times a week (frequency) at a moderate level of intensity (three to six metabolic equivalents (METs)). Should the intensity be vigorous (more than six METs), then the duration should be at least 20 minutes continuously for at least three days a week (frequency).
- Muscle strengthening in a healthy adult should be done at least two days a week (frequency) performing eight to ten exercises involving all muscles groups of with eight to 12 repetitions of these exercises. No flexibility or balance is recommended in the healthy adult.

ACSM and AHA exercise recommendations[8] in older adults have some similarities to the healthy adults physical activity recommendations:

- Aerobic exercise in an older adult is the same regarding frequency and duration. The only difference is the rating of the intensity. A moderate level of intensity in the older adult is defined as rating the exertion five to six on a

scale of ten. If the intensity be vigorous, the exertion rating is defined as seven to eight on a scale of ten.

- Muscle strengthening recommendations in the older adult is the same regarding frequency and number of exercises. There is, however, an increase in the repetitions (ten to 15 repetitions). Exercises for balance and flexibility should be done at least two times a week in those patients at risk for falls.

There must also be a focus on the area affected by the arthritic disease (for example in knee osteoarthritis, more exercises should be focused on quadriceps strengthening[24]). In combining all these recommendations, a physical activity planning programme must be developed for older adults in order to maintain compliance, avoid boredom of activities and stimulate continuous physical activity. The “dose - response” to physical activity is important to realise as those patients that wish to safely further improve their medical benefits from exercise safely may continue to do so under supervision.

2.7. Conclusion

The recent publication of Patterns of Morbidity and Mortality by Statistics South Africa in 2013[41], showed that 13% of older persons were advised by a medical practitioner or nurse that they were suffering from arthritis. Of these, 17% percent were female and seven percent were male suffering from arthritis. A majority of 84% of these patients were taking medication for arthritis. A recent review and meta-analysis study by Usenbo *et al.* (2015)[42] shows clearly that determining the prevalence and burden of arthritic disease on the African continent is vague and generally stated. There are also no studies in South Africa that investigate the patients’ views toward exercise as an adjunct treatment for arthritic disease. There are also no studies in South Africa exploring doctors and other healthcare providers exercise prescription incidence.

The evidence base is strong regarding the benefits patients may receive from prescribed exercise. The particular interventions are also clear as to what aspects need to be focused on in order to gain benefit from exercise as an adjunct treatment regime.

This study endeavoured to provide information regarding patients’ knowledge on exercise (frequency, mode and load). It also determined the incidence of exercise prescription amongst healthcare providers and whether the advice is effective in relieving pain and improving function in activities of daily living. The researcher aimed to establish whether exercise was used as an adjunct tool of management in arthritic disease. This studies aims to add an opinion regarding prescribed exercise in the arthritic population in the southern suburbs of Johannesburg.

Chapter 3: Methodology

3.1. Introduction

This research study was completed using a questionnaire based method for data collection. The questionnaire was not validated and no pilot study was performed. This chapter outlines all aspects of the research methodology.

3.2. Study design

A cross sectional survey research design was used in the form of a questionnaire with a closed and open ended question format.

3.3. Study site

One general medical practice (with two general practitioners) and one biokinetics practice based in the Johannesburg Southern Suburbs were used as the research sites after the practitioners agreed to this. Several other general practitioners, physiotherapists, biokineticists and chiropractors were approached. They initially agreed but never returned any questionnaires.

3.4. Study population

A wide range of patients in the participating practices was used as the study population. Age groups ranged between 20 and 70 years old (the age range decision was simply so that it included participants who would understand the need for the research and the questions posed in the survey). These subjects were those previously diagnosed with any arthritic condition, with or without concurrent co-morbidities and consulted at the biokineticist or general practitioners practices.

3.5. Sampling

Using statistics tables on www.raosoft.com/samplesize.html, it was determined that for statistical significance in a study population of 1000, 298 participants would be required. The study produced a total of 97 respondents of which only 67 questionnaires were used in the study. The 30 questionnaires excluded from the study were incomplete. They could not be used in the statistics as the informed consents were not signed by the participants. A study population base of about one thousand patients were used. The sampling of the study population was arrived at by requesting the two participating general practitioners and biokineticist to consider patients over a three month period. It counted those

patients who have consulted with any ICD-10 diagnostic code suggesting arthritic disease (M00-M25) or who they felt complied with the inclusion criteria. The data collection process concluded after three months.

3.6. Selection and recruitment of subjects

As part of the initial process, the information leaflet (Appendix A) was handed to patients by the receptionist to those patients either identified or interested in knowing more about the study. The information leaflet outlined the reasons for the study being done as well as the researcher's contact details. The participant was given an opportunity to ask questions and was referred to the researcher for additional questions they felt was warranted or for further clarification.

Four methods were used for recruitment.

- The first method of identification occurred with potential participants being identified by the practice receptionist when they arrived in the consulting room. The receptionist would identify these patients from any previous consultations where they were diagnosed with arthritis (if ICD-10 diagnostic codes M00-M25 were used before) and inform them about the study. Those who fulfilled the inclusion criteria were invited to participate in the study.

- The second method was placing signs at the participating practices reception area to alert patients that the study was being conducted and to ask the receptionist, healthcare practitioner or researcher for further details.

- The third method was where participants were identified by the practitioners themselves and invited to participate.

- The fourth method was accessing those patients who had consulted with any ICD-10 diagnostic code suggesting arthritic disease (M00-M25) - the practitioners receptionists used the individual practices medical aid claim and account submitting software to do this. The receptionists then informed these patient's about the study, handed them the information leaflet and invited them to participate. Participation in the study was completely voluntary and patients were able to recuse themselves from the study at any point.

Recruitment was based on the participants' understanding of the need for the research (by reading the information leaflet) and that it was voluntary. Only after the participant felt comfortable with participating in the study was the informed consent (Appendix B) signed and the questionnaire (Appendix C) administered.

3.7. Inclusion and exclusion criteria

3.7.1. Inclusion criteria

This included patients that had been diagnosed with any arthritic disease and fell within the age range in which the research was done. Among them were osteoarthritis, rheumatoid arthritis, psoriatic arthritis, post traumatic arthritis, gout arthritis, and any other arthritic disorders.

3.7.2. Exclusion criteria

This included patients who have had joint replacements or arthrodesis. Patients with other medical conditions contra-indicating physical activity (severe osteoporosis, bone tumours with high fracture risks, recent deep venous thrombosis, recent myocardial infarctions, recent strokes) were also excluded.

3.8. Measuring tools

A questionnaire based tool consisting of mixed (closed and open) ended questions were used to collect data. Patients answered questions directly on the questionnaire (Appendix C). As a broad description, the questionnaire consisted of questions in the following areas:

3.8.1. Participants demographics - information included here was participant age range and gender.

3.8.2. Participants present load of activity - what type of exercise was done and what was the frequency, duration and intensity thereof.

3.8.3. Participants views and knowledge towards exercise, exercise prescription and healthcare provider advice regarding exercise.

3.8.4. Participants opinions regarding their improvement/detriment in pain and activity levels with exercise alone, medication alone and a combination of exercise and medication.

The sample of the questionnaire can be found in Appendix C.

3.9. Demographics

Age and gender were the demographic information collected. Using this information this enabled the researcher to determine the demographic profile of patient's with symptomatic arthritic disease.

3.10. Views and knowledge

Various open and closed-ended questions were used. Specific questions allowed the researcher to assess the participants' views on exercise and managing

arthritic disease. The questions aimed to determine whether there had been positive or negative influence on the patients views regarding exercise prescribed by healthcare providers.

A series of closed-ended questions were formulated to address the appropriateness of exercise in those participants who do partake in physical activity. Other questions shed light on how participants perceived the effectiveness of exercise in managing their disease, and whether it improves their symptoms and ADL.

3.11. Data collection methods

Information leaflets (Appendix A), informed consent (Appendix B) and questionnaires (Appendix C) were made available at practices that agreed to assist with data collection. These documents were kept by the respective receptionists. Participants that fulfilled the inclusion criteria and read the information leaflet were invited to complete a questionnaire. Only participants who agreed to fill in the questionnaires voluntarily and who signed the informed consent were included in the study. If any potential participants had questions, they directed them to the healthcare provider they were visiting or they were advised to contact the researcher directly via cell phone or email.

After signing the consent and agreeing to participate, the participant then answered the questionnaire. If participants required further information before consenting, the researcher had undertaken to answer their questions fully. Participants were requested to complete the questionnaire immediately, leave the questionnaire at the participating practice. The completed questionnaires were collected over a period of three months by the researcher.

Questionnaires and informed consent were collected daily from each practice receptionist and if necessary, issues were discussed with those patients unsure about the research protocol.

Patients who consulted at the participating healthcare provider more than once in the study period were only surveyed once. A temporary register was used at each participating practice (Appendix D) to avoid patients completing questionnaires more than once. The file number was used as reference and no names or other identifying information was used. These were disposed of by the participating practitioners after the questionnaires were collected.

3.12. Ethics

Ethical approval had been applied for and was approved unconditionally from the Medical Human Research Ethics Committee of the University of Witwatersrand (clearance certificate number M10M101138). Consent forms as per (Appendix E) were used. To maintain confidentiality, participants' details remained anonymous once collected from the participating practice and only demographic information and information ascertained from the questionnaire were used. These were all kept in a locked cupboard at the investigators medical practice. After the researcher had confirmed that informed consents were signed, these were separated from questionnaire and stored under lock and key. The only other person besides the researcher that had access to the questionnaire data was the biomedical statistician. Each completed questionnaire was assigned a number for coding purposes for statistical analysis. Participants were allowed to withdraw at any time from the study group. The survey posed no health risk to the patient with completion of the questionnaire.

3.13. Data analysis

Data was analysed using a computer program (IBM SPSS). Descriptive and inferential statistical methods were used in order to analyse the data. This was done with the assistance of a biomedical statistician.

Tables were generated to graphically represent (a) the incidence of exercise amongst the participating population and specifics of level, frequency and load of exercise, (b) those that benefit or not from exercise and (c) which healthcare practitioner advised exercise (d) demographics (e) the types of exercise advised by doctors (f) patient's perceptions and consideration for exercise prescription. Figures were also generated representing (a) weekly exercise frequency (b) types of exercises performed (c) exercise session time. These were done on Microsoft's Excel software.

The chi-square method was used to determine level of significance from the various data sets. The level of significance was set at 95% (p=0.05). Dispersion was measured using standard deviations.

All questions which consisted of "yes" and "no" options were correlated where '-1' suggested a negative linear relationship, '0' no relationship and '+1' a positive relationship.

The open ended questions (question 16 and question 17) were subjectively determined by the researcher and categorised as (a) causes pain (b) pain relief (c) use of less medication (d) use of more medication. Correlation will be used to

determine where (a) and (d) will have a value of ‘-1’ while (b) and (c) will have a value of ‘+1’.

Chapter 4: Results

4.1. Introduction

This chapter discusses the results obtained from the sample group. A total of 67 questionnaires were completed. Although 298 participants were required for statistical significance, unfortunately this amount could not be obtained over the three month data collection period.

4.2. Demographics

Majority of the participants were over the age of 50 (Table 4.1.)

Table 4.1. Age demographics of participants.

Age of respondents	**N**	**Percentage**
<30 years	three	Four percent
30 to 50 years	24	36%
>50 years	40	60%
Total	**67**	**100%**

The majority of participants were female (Table 4.2.).

Table 4.2. Gender demographics of participants.

Gender	**N**	**Percentage**
Male	17	25%
Female	49	73%
Unspecified	one	two percent
Total	**67**	**100%**

Osteoarthritis and rheumatoid arthritis were the prevalent disease conditions amongst the participants (Table 4.3.)

Table 4.3. Types of arthritis in participants.

Type of arthritis	N	Percentage
Osteoarthritis	29	42%
Gout	five	seven percent
Rheumatoid arthritis	27	41%
Post traumatic arthritis	three	five percent
Unspecified	three	five percent
Total	**67**	**100%**

Medication was used by 49 of the 67 participants with arthritic disease (N=49;73%). Thirty one of the participants using medication (N=31;63%) used it on a daily basis. Pain was relieved by all of the 49 participants that used medication. However, the level of pain relief with medication alone was not objectively scored in this study.

4.3. Present physical activity levels

Majority of physically active participants were involved in some type of activity two to three times a week.

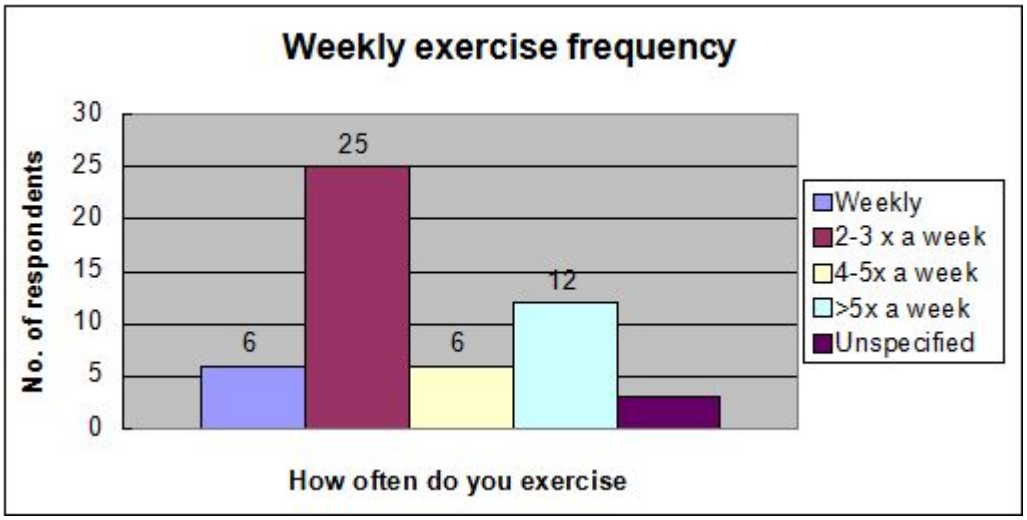

Figure 4.1. Weekly exercise frequency amongst participants

The physical activity performed by these participants was not based on a directed regime. This study did not investigate into their choice of the type of exercise performed. Some participants also engaged in more than one physical activity.

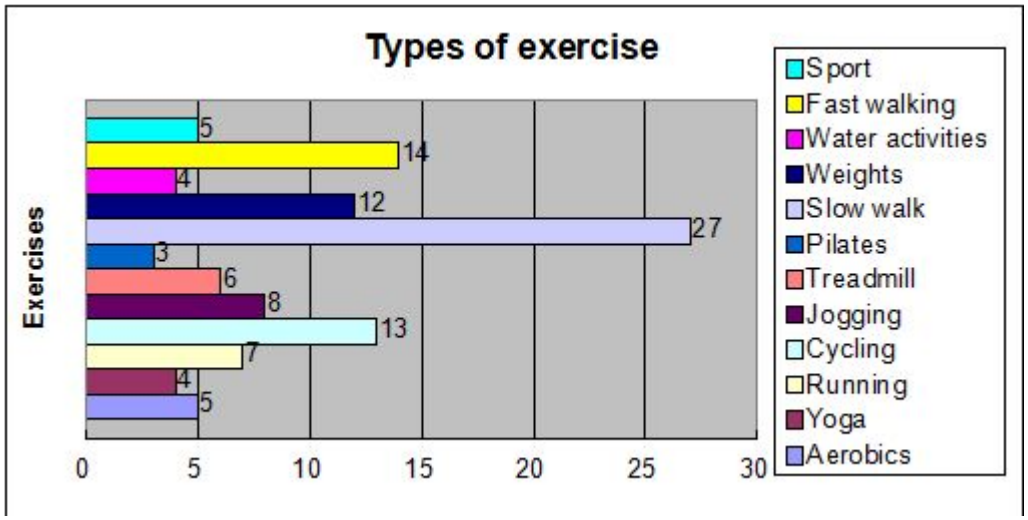

Figure 4.2. Types of exercise performed by participants who are already active

The “Slow walk” was a very common physical activity.

Exercise session times were also surveyed. Most participants performed physical activity as per ACSM guidelines (Figure 4.3.)

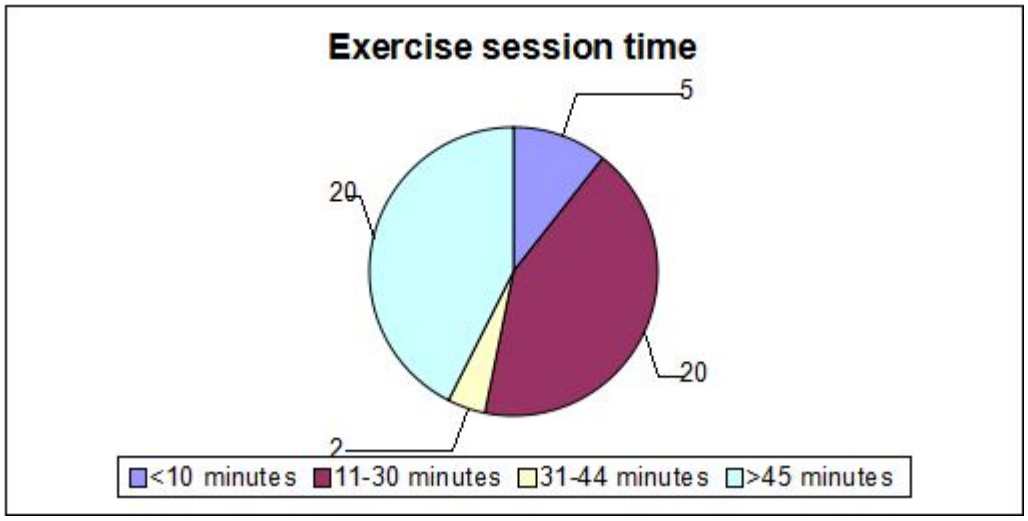

Figure 4.3. Exercise session time

A large majority of the participants (N=29;64%) were involved in some type of physical activity for more than one year. There were 17 (N=17;36%) participants that were physically active for less than six months . Six participants had forgotten to answer this question. More details on this aspect are found in Table 4.4. One

needs to take into mind that “Slow walking” was the most common physical activity performed.

Table 4.4. Length of time of physical activity.

How long has the participant been physically active	**N**	**Percentage**
<1 month	7	13%
1-6 months	8	15%
6 months-1 year	2	4%
>1 year	29	56%
Unspecified	6	12%
Total	**52**	**100%**

Participants were also asked to comment on the location of their physical activity. Most participants performed physical activity alone while a smaller number performed activities in a group setting.

4.4. Recommendation for physical activity

A large percentage of participants who already were physically active were advised by doctors. Although the same amount of participants had decided to participate in physical activity with no advice from anyone. Physiotherapists , biokineticists and friends had by far the least impact regarding recommendation of exercise (Table 4.5.).

Table 4.5. Who advised exercise?

Healthcare provider	**N**	**Percentage**
Doctor	20	38%
Physiotherapist	five	ten percent
Biokineticist	four	eight percent
Friend	three	six percent

No one	20	38%
Total	**52**	**100%**

Participants had very strong opinions on what their doctors perception was regarding physical activity. Thirty seven (N=37;55%) of the participants agree that their doctors emphasised the importance of exercise in managing their arthritic condition. Even more (N=47;70%) are convinced that their doctor believes that exercise can relieve pain. Participants themselves were even more positive when it came to physical activity perceptions. Fifty three (N=53;79%) of participants were convinced that exercise could assist with pain relief. Sixty one (N=61;91%) would still consider exercise if prescribed. Table 4.6. echoes the participants belief that their doctors feel that exercise will benefit their arthritic condition.

Table 4.6. Participants' perceptions and consideration for prescription exercise.

Participants perceptions/consideration for exercise	**Yes**	**Percentage**
Does your doctor emphasise the importance of exercise at all visits?	37	55%
Do you think your doctor believes exercise can relieve pain?	47	70%
Do you think exercise can assist you?	53	79%
Would you consider exercise if prescribed?	61	91%
Do you do any physical activity?	52	78%

By contrast to this, doctors did not advise on specific exercises that participants should perform. A non specific activity like walking was advised most of the time to 23 participants (N=23;48%). Aerobic exercise was also recommended but to very few of the participants (N=9;19%) and again, it was not enough. Strengthening (N=five;ten percent), swimming (N=six;13%) and jogging (N=five;ten percent) were also advised but these were abject generalisations - the participants were not advised on time, speed, cadence and distance of exercise.

The participants were advised by doctors to perform physical activity however specifics of exercise (time, weights, distance and mode) were left open to interpretation by the participant (Table 4.7.) and not as advised by several consensus statements (i.e. AHA, ACSM, EULAR).

Table 4.7. Modes of exercises advised by doctors.

Type of exercise	**N**	**Percentage**
Strength	five	nine percent
Cardio-respiratory	nine	17%
Swimming	six	12%
Walking	23	44%
Jogging	five	ten percent
Unspecified	four	eight percent
Total	**52**	**100%**

4.5. Healthcare practitioners consulted for pain relief

The range of practitioners that were consulted for pain management included physiotherapist, biokineticists and a combination of general practitioners, rheumatologists and homoeopaths as in Table 4.8.. Physiotherapists were consulted the most for pain relief. They were followed by biokineticists, specialists, GP's and homoeopaths. These consultations included exercise advice, prescription medication (analgesics and anti-inflammatory medication) and alternative methods of treatment (example TENS, ultrasound).

Table 4.8. Pain management consultations by participants.

Practitioner consulted	**N**	**Percentage**
Consulting physiotherapist for pain management	19	37%
Consulting biokineticists for pain management	nine	17%
Other (homoeopaths, gym, pilates,	13	25%

yoga, GP's, rheumatologists)		
Unspecified	11	21%
Total	**52**	**100%**

The difference between pain relief received from physiotherapists, biokineticists, GP's, specialists and homoeopaths were negligible and all contribute to on average the same incidence of pain relief.

4.6. Perceived pain relief and frequency of exercise

The frequency of exercise in relation to perceived pain improvement in the participants was also compared. The data collected by the researcher with regard to exercise frequency showed that just more then half of the participants experienced a perceived improvement in pain if they were physically active two to three times a week. (Table 4.9.). If activities were performed less often, the perceived pain relief was not profound. When they exercised for more than four times a week perceived pain relief was less.

Table 4.9. Comparing frequency of exercise and pain improvement.

Frequency of exercise	**Pain relief perceived YES**	**Pain relief perceived NO**	**Pain relief perceived SOMETIMES**
Once a week	One;two percent)	One;two percent	Four;nine percent
Two to three times a week	Eight (19%)	Six (14%)	Nine (21%)
Four to five times a week	One;two	Zero;zero percent	Three;seven percent
> Five times a week	Three;seven percent	Three;seven percent	Four;nine percent

4.7. Improvement in activities of daily living

Generally most participants had improvement of ADL's (Table 4.10.). The majority of participants did notice an improvement in their sleeping patterns.

Table 4.10. Effect on daily living activity changes with exercising.

Activity	**Improve**	**Worsen**	**No difference**
Bathing	14 (45%)	One;three percent	16 (52%)
Walking	27 (69%)	Four;ten percent	Eight (21%)
Lifting objects	15 (45%)	Eight (24%)	Ten (31%)
Gardening	12 (40%)	Five (17%)	13 (43%)
Driving	Ten (37%)	Eight (30%)	Nine (33%)
Sleeping	21 (60%)	Six (17%)	Eight (23%)
Washing clothes	Seven (26%)	Seven (26%)	13 (48%)
Sitting	13 (41%)	Six (18%)	13 (41%)

Table 4.11. compares the improvement in ADL with period, frequency and length of exercise sessions.

Participants that have been exercising longer than a year, two to three times a week and for more than 40 minutes per session described a significant improvement in ADL's.

Table 4.11. Improvement in ADL with frequency, period and length of exercise sessions.

Period of exercise	**Improvement in ADL's**	***p***
< 1 month	N=six 14%	0.32
1 month to 6 months	N=seven 17%	0.88
7 months to 1 year	N=two five percent	No value
> 1 year	N=27 64%	0.07

Length of exercise sessions			
< 10 minutes	N=five	11%	0.103
11 minutes to 30 minutes	N=18	41%	0.2
31 minutes to 45 minutes	N=two	five percent	No value
> 45 minutes	N=19	43%	0.01*
Weekly frequency of exercise			
Once a week	N=six	14%	0.23
2 to 3 times a week	N=22	50%	0.01*
4 to 5 times a week	N=five	11%	0.833
> 5 times a week	N=11	25%	0.069

.* *statistically significant*

4.8. Perceived pain relief from exercise, medication and a combination

On the pain numeric scale (where zero is no pain and ten is the worst pain) most participants fell into the PNS level one group (Table 4.12.). The combination of medication and exercise shows by far the most effective perceived pain relief.

Table 4.12. Pain improvement perception and statistical significance according to the PNS pain scoring in relation to exercise alone, medication alone and a combination of exercise and medication.

PNS	**Medication**	**Exercise**	**Exercise and medication**
0	Four (13%)	One;four percent	Two;five percent
1	Seven (21%)	Three (11%)	13 (33%)
2	One;three percent	Three (11%)	Five (13%)

3	Five (15%)	Six (22%)	Seven (18%)
4	Three;nine percent	Three (11%)	Four;ten percent
5	Seven (21%)	Six (22%)	Two;five percent
6	Two;six percent	Two;seven percent	Three;eight percent
7	One;three percent	Zero;zero percent	One;two percent
8	One;three percent	Two;seven percent	One;two percent
9	Zero;zero percent	One;four percent	Zero;zero percent
10	Two;six percent	Zero;zero percent	Two;six percent
p	0.034	0.18	0.01*

**statistically significant*

.

Chapter 5: Discussion of results

5.1. Introduction

This studies hypothesis was that patients in the southern suburbs of Johannesburg do believe that exercise can be used as an adjunct method in treatment in arthritic disease is beneficial. But even though they subscribe to the value of exercise in the adjunct treatment of arthritic disease, healthcare providers, particularly doctors, do not know how to appropriately prescribe exercise. Results of this study described the following :

- Perceived pain relief was better in participants performing physical activity and taking medication.
- Participants who were physically active for more than a year, two to three times a week for more than 40 minutes a session had an improvement in ADL's
- Participants are not given proper exercise prescription in relation to their specific arthritic disease and co-morbid disease profile - general guidelines are advised by practitioners and that too, not within the ACSM or AHA guidelines
- Participants believe that exercise helps with pain relief but wish to be guided further

5.2. Demographics of research

Of the 67 questionnaires completed, almost 60% were completed by participants older than 50 years of age with varying degrees of established arthritic disease and varied aetiology. In almost equal proportions, the prevalence of disease was osteoarthritis (42%) and rheumatoid arthritis (41%). Gout (seven percent) and post traumatic arthritis (five percent) were therefore not very prevalent in the surveyed group. Five percent were unspecified as they did not answer the question. Most of these patients were using either prescribed or over-the-counter medication. Seventy three percent of all participants were using medication. Sixty three percent of these participants were using medication on a daily basis for their arthritic disease. Nearly all participants (84%) suffered a co-morbid medical related disease like hypertension, hypercholesterolaemia, thyroid dysfunction, non-insulin dependent diabetes mellitus among others.

All the demographic data obtained from the research falls in line with what the WHO had found regarding the burden of musculoskeletal disease in developing countries in 2003[11]. The larger number of participants in the researchers study

were women and comprised of 73% of the surveyed population. Male participants accounted for only 25% of the surveyed population. Two percent had failed to answer this question.

5.3. Are patients already active?

A large percentage of the study group (78%) were already physically active. The types of exercise performed by the research group comprised of yoga, pilates (both flexibility exercises), aerobics, running, cycling, jogging, slow walk, fast walk, treadmill (aerobic), weights and water activities (strength and resistance training) and sports (combination exercise). It must be noted that these patients were not prescribed any particular exercise programme even though the majority of the participants had pre-existing medical conditions. However, they were either advised by healthcare providers (this is discussed in more detail in section 5.4.), friends that they should participate in physical activity or decided upon themselves. At first glance, the data suggests that they are conforming with the general recommendations of Bennel and Hinman (2005)[31] and the American Geriatric Society advice[6]-physical activity include flexibility, aerobic and resistance training. This is clarified in the accompanying discussion.

In the researcher's study group, the duration of exercise recommendation was over-achieved. An equal amount of participants exercised between 11 and 31 minutes and greater than 45 minutes (38% in each group). This suggests that the study group was, in fact, more active than suggested by ACSM and AHA. The researcher also noted in this study that just less than half of the participants (N=25;48%) exercised two to three times a week (Figure 4.1.) which is in line with the frequency as recommended by ACSM and AHA. The researchers data highlighted one very important aspect - the intensity of exercises that were performed were mostly a low intensity type (walking - N=27;52%) and a smaller amount (N=12;23%) involved muscle resistance training (Figure 4.2.). There was minimal attention to the proprioceptive and flexibility (yoga and pilates) aspect of exercise (total of both:N=seven;13%). Therefore, even though these participants were more physically active according to recommendations, their activity was not done at the advised intensity from the aerobic exercise perspective. The muscle strength and flexibility/balance aspect of the performed exercises were far from being desired compared to the recommendations by ACSM and AHA .

5.4. Exercise recommendations by healthcare providers and specifics thereof

This research study showed that doctors did indeed advise exercise. However, it was only recommended by doctors 38% of the time. The other healthcare

providers (physiotherapists and biokineticists) only recommended exercise and an adjunct treatment modality to ten percent and eight percent of participants respectively.

Doctors advised walking as an exercise mode 48% of the time. Walking is a very broad exercise recommendation and patients did not elaborate on the intensity, duration and frequency that was advised. So despite the basic knowledge of exercise being an important adjunct to add to a patients treatment regime, doctors were not knowledgeable in exercise medicine and subsequently failed to specifically prescribe the mode of exercise, its intensity and duration.

Regarding specifics of exercise, Hurley and Scott (1998)[39] showed that in patients with knee osteoarthritis, the patients focused on exercises specific to stability, proprioception and quadriceps strengthening. Amongst their study participants, there was an improvement in pain and the patients maintained the exercise regime prescribed for at least six months. Therefore, exercise prescription needs to be specific to the region involved and should include an aerobic exercise component, joint stability/flexibility and strengthening exercises. It seems that if these specific guidelines are not followed, exercise as an adjunct treatment modality in arthritic disease might have less benefit. There are various combinations of specific modes of exercises that patients with arthritic disease can perform. Exercise advice in patients with arthritic disease should involve proprioception, strengthening, flexibility, resistance training, aquatic exercising and cycling[31]. These are all combinations of aerobic, strength, flexibility and low-weight bearing activities..

Even though 78% of the participants were already physically active, 91% of them would be willing to undertake a directed exercise prescription. In a study by Ettinger *et al*. (1997)[25] and a more recent study by Skou *et al*. (2014)[32] both had shown that patient education (explaining the rationale behind the particular modes of exercises and the benefits thereof) and a more specific programme (defining aerobic, strength, proprioceptive and flexibility exercises as well as mode, duration, frequency and intensity) allows for better exercise prescription compliance from patients. Patients will be more likely to continue with the programme for a longer period of time.

5.5. Effect of exercise on activities of daily living

In clinical practice, it is very difficult to determine the correct exercise “dosage” in patients with arthritic disease. It is dependent on several conditions : the joint affected by arthritic disease, the radiological severity grading of the arthritic joint, the mode of exercise considered, the exercise load planned for the joint, the

intensity of the exercise, the involvement of aerobic and resistance training, and the present inflammatory state. The healthcare provider who prescribes exercise should also be very aware of other co-morbid medical conditions (for example hypertension, diabetes, hyperlipidaemia, hyperthyroidism, cardiac arrhythmia,deep venous thrombosis) as well as pre-existing disabilities in order to prescribe appropriate exercise routines. This will ensure that an appropriate exercise prescription can be advised thereby reducing the risk for adverse complications (like myocardial infarctions, strokes, stress fractures and muscle strains). This information will also ensure that the exercise mode, intensity and frequency is manageable without inducing any joint inflammatory flare ups which will increase the patients risk for non-compliance.

The evidence in this study appears to agree with the American Geriatric Society exercise recommendations[6] with regards to time spent doing physical activity weekly frequency of physical activity. If one has been exercising frequently for a moderate period of time per session, there is a better improvement in ADL's.Those participants exercising more than 45 minutes experienced an improvement of at least three out of eight activities of daily living (standard deviation = 2.961 and p=0.01). Those participants exercising more than two to three times a week saw an improvement of at least two out of eight ADL's (standard deviation = 2.278 and p=0.01). Manninen *et al*. (2001)[29] retrospectively assessed patient's previous physical activity at presentation for first time knee arthroplasty. They assessed patient's physical activity in the past by determining the frequency and load they performed in exercises pertaining to aerobic fitness, agility, flexibility, strength and resistance training. It was evident that those patients that were active for a longer period of time and performing moderate activity exercise had a delay in the development of knee osteoarthritis. The conclusions of this study[29] are therefore an important aspect in promoting physical activity. It can be used as evidence to educate patients that exercising affected joints can be beneficial.

5.6. The perceived pain relief effect of exercise

The American Geriatric Society panel on chronic pain management in the older patients[7] advises that drug therapy is most effective when combined with non-pharmacological therapy. Non-pharmacological therapy includes exercise (flexibility, strength, water activities and balance) as well as physiotherapist directed treatment (soft tissue massage, range of movement exercises and release of related muscle and tissue structures).

The researchers raw data revealed that if the participants have been infrequently (weekly) or too often (greater than five times a week) and for a short period (less

than ten minutes of activity at each session) performing exercise related activities, then the perceived pain relief was minimal. Alternatively when exercising at a moderate frequency (two to three times a week) and for a moderate period of time (eleven to thirty minutes) there was better perceived pain relief. Although the statistical and inferential data suggests that there was no statistical significant relationship between pain relief and length of session (p=0.133), frequency (p=0.749) and length of time in exercising (p=0.773), the rate and frequency of exercise performed by respondents in this study and perceived pain relief agrees with the American Geriatric Society panel on exercise and osteoarthritis recommendations for older adults[6].

The researcher's study data demonstrates that exercise alone scored only four participants on the Pain Numeric Scale less than and equal to one (p=0.180). Medication alone scored only 11 participants less than and equal to one on the PNS (p=0.034). The greatest benefit is seen in a combination of exercise and medication where 15 participants scored less than and equal to one on the PNS (p=0.01).

5.7. Study limitations

One of the limitations of this questionnaire based study was the few number of participants. The study also only managed to collect data from two general practices and one biokineticist practice. Other general practitioners and other providers were approached to assist in the data collection. Although they had agreed in principle and completed questionnaires, they never returned them. Future based studies in this area in South Africa should have a more data collection sites.

5.8. Conclusion

- The findings of this research concludes that many individuals in the southern suburbs of Johannesburg with arthritic disease believe that if an exercise programme is prescribed and adhered to they can reap the benefits of exercise as an adjunct therapy to their joint related condition.
- The population sample already seemed to be physically active individuals but they will prefer to be guided correctly as to how to exercise : duration, frequency and modes of exercise. At present patients are doing a combination of aerobic, flexibility, minimal weight bearing and strength exercises. Even though the exercises performed are appropriate, the "dosage" of exercise appears inadequate.

- Participants gained the best improvement in ADL's when exercising longer than 45 minutes per session for two to three times a week if they have been exercising for over a year. The evidence from this study shows that participants experience at least an improvement of two out of eight of the ADL's used in this study. In a patient with several debilitations which may not only include physical but psychological as well, this is a significant step toward independence.

- This study has evidence that the combination of exercise and medication appears more beneficial than either exercise or medication alone.

- Doctors do advise exercise more often than other allied healthcare providers. However, their advice regarding exercise is not specific enough. It mostly includes non specific walking as a suggestion.

The data from this South African based evidence is very similar to European evidence, where a combination of exercise and medication achieves better results in perceived pain relief. This study has shown that participants with arthritic disease believe that physical activity can improve their symptoms, function and ADL's. It can be utilized as an adjunct treatment modality in the management of arthritic disease. The participants appear to be involved in physical activities regularly but are not at the appropriate frequency and load.

The researcher believes that the Exercise is Medicine™ initiative will assist healthcare providers to provide specifics toward physical activities in patients with arthritic disease.

5.9. Recommendations

- Patient's would prefer to be guided by healthcare professionals as to what activities, loading and frequency will reap the best benefits. It is for this reason healthcare practitioners (especially doctors) should bolster their knowledge of basic exercise prescription for arthritic disease and understand its benefits. Arthritis sufferers would benefit from a disease specific exercise prescription involving aerobic, resistance, balance and flexibility training. They should be consider it as a "scheduled medication" and not just "an over the counter medication".

- Practitioner's advice should be more specific regarding aerobic exercise, strength training, proprioception, flexibility and medication to achieve optimal pain relief. This could perhaps delay the progression to severe arthritis and allow better levels of ADL in patients with arthritic illness. The researcher surmises that this might be one reason why there is minimal compliance from

patients. The researcher believes that the reasons needs to be further researched but some data suggests that patients are not confident with generalised exercise advice. Patients also require more clarity in order to benefit from the positive outcomes of exercise in arthritic disease. The researcher recognises that the reason for this is that patients are in urgent need of a properly prescribed exercise programme in order to assist them with pain control and improve ADL's.

- Exercise routines and group exercise should be embraced and motivated in order to allow continuous participation. This is one method to attain compliance to physical activity but the researcher believes that this aspect deserves further exploration.
- Future research in this field in South Africa should be guided as to whether patient's with arthritic disease have access to exercise prescribing practitioners, the practitioners views towards using exercise as an adjunct treatment regime and the cost implications for patients.

References

1. Issa, S.N., Sharma, L. Epidemiology of osteoarthritis:an update. *Current Rheumatology Reports.,* 2006;8:7-15.

2. Mayo clinic. July 2014. Definition of Arthritis. www.mayoclinic.org/diseases-conditions/arthritis/basics/definition/con-20034095 . [Accessed 03.10.2014].

3. American College of Rheumatology Subcommittee on Osteoarthritis. Recommendations on the medical management of osteoarthritis of the hip and knee.2000 update. *Arthritis and Rheumatology*., 2000;43:1905-1915.

4. Uthmann, O.A., van der Windt, D.A., Jordan, J.L., Dziedzic, K.S., Peat, G.M., Healey, E.L., Peat, G.M., Foster, N.E. Exercise for lower limb osteoarthritis:a systematic review incorporating trial sequential analysis and network meta-analysis. *British Medical Journal.,* 2013;347:F5555.

5. Jordan, K., Arden, N., Doherty, M., Bannwart, B., Bijlsma, J.W., Dieppe, P., Gunther, K., Hauselmann, H., Herrero-Beumont, G., Kaklamanis, P., Lohmander, S., Leeb, B., Lequesne, M., Mazieres, B., Martin-Mola, E., Pavelka, K., Pendelton, A., Punzi, L., Serni, U., Swoboda, D., Verbruggen, G., Zimmerman-Gorska, I., Dougados, M., EULAR recommendations 2003: an evidence based approach to the management of knee osteoarthritis: Report of a task force of the Standing Committee for International Clinical Studies Including Therapeutic Trials (ESCISIT). *Annals of the Rheumatic Diseases.,* 2003;6(12):1145-1155.

6. American Geriatrics Society Panel on Exercise and Osteoarthritis. Exercise prescription for older adults with osteoarthritis pain: consensus practice recommendations. *Journal of the American Geriatrics Society.,* 2001;49:808-23.

7. American Geriatrics Society Panel on Chronic Pain in Older Persons. The management of chronic pain in older persons. *Journal of the American Geriatrics Society.,* 1998;46:635-651.

8. Nelson, .M.E., Rejeski, W.J., Blair, S.N., Duncan, P.W., Judge, J.O., King, A.C., Macera, C.A., Castaneda-Sceppa, C., American College of Sports Medicine, American Heart Association. Physical Activity and Public Health in Older Adults: Recommendation from the American College of Sports Medicine and the American Heart Association.

Official Journal of the American College of Sports Medicine. *Medicine and Science in Sports and Exercise.,* 2007;1435-1445.

9. Hardin J.G. Rheumatic Pain. In: Walker HK, Hall WD, Hurst JW, editors. Clinical Methods: The History, Physical, and Laboratory Examinations. 3rd edition. Boston: Butterworths,1990; p. 753-758.

10. Mazor, M., Cesaro, A., Larguech, G., Coursier, R., Cherief, M., Lespessailles, E., Toumi, H. A potential breakthrough in the treatment of osteoarthritis: alternative method for cartilage repair by viable cells from osteoarthritic area. In:Poster presentation. American College of Sports Medicine Conference, San Diego, 26-30 May 2015. Universite D'Orleans.

11. WHO (World Health Organization). 2003. The Burden of Musculoskeletal Conditions at the Start of the New Millennium. WHO Technical Report Series 919, WHO, Geneva.

12. Hochberg M.C., Martell-Pelletier J., Monfort J., Moller I., Castillo J.R., Arden N., Berenbaum F., Blanco F.J., Conaghan P.G., Domenech G., Henrotin Y., Pap T., Richette P., Sawitzke A., du Souich P., Pelletier J. Combined chondroitin sulfate and glucosamine for painful knee osteoarthritis: a multicentre, randomized, double blind, non-inferiority trial versus celecoxib. *Annals of the Rheum atic Diseases.* 2014;doi:10.1136/annrheumdis-2014-206792.

13. Divine, J.G., Zazulak, B.T., Hewitt, T.E. Viscosupplementation for Knee Osteoarthritis: A Systemic Review. *Clinical Orthopaedics and Related Research.,* 2007;455:113-122.

14. Zhang, W., Nuki, G., Moskowitz, R.W., Abramson, S., Altman, R.D., Arden, N.K., Bierma-Zeinstra, S., Brandt, K.D., Croft, P., Doherty, M., Dougados, M., Hochberg, M., Hunter, D.J., Kwoh, K., Lohmander, L.S., Tugwell, P. OARSI recommendations for the management of hip and knee osteoarthritis: Part III: changes in evidence following systematic cumulative update of research published through. *Osteoarthritis Cartilage.,* 2009;(18):476-99.

15. Felson, D.T., Anderson, J.J., Naimark, A., Walker, A.M., Meenan, R.F. Obesity and knee osteoarthritis:The Framingham study. *Annals of Internal Medicine.,* 1988;109:18-24.

16. Kolbe-Alexander, T.L., Bull, F., Lambert, E.V. Physical activity advocacy and promotion:The South African experience. *South African Journal of Sports Medicine.,* 2012;24(4):112-116.

17. Draper, C.E., Basset, S.,de Villiers, A., Lambert, E.V., HAKSA Writing Group. Results from South Africa's 2014 Report Card on Physical Activity for Children and Youth. *Journal of Physical Activity and Health.,* 2014;11(1):98-104.

18. Sanchez, A., Norman, G.J., Patrick, K. Patterns and correlates of physical activity and nutrition behaviours in adolescents. *American Journal of Preventative Medicine*., 2007;32(2):124-130.

19. Li, C-L., Lin, J-D., Lee, S-J., Tseng, R-F. Associations between the metabolic syndrome and its components, watching television and physical activity. *Public Health*., 2007;121:83-91.

20. Sevick, M.A., Miller, G.D., Loeser, R.F., Williamson, J.D., Messier, S.P. Cost-effectiveness of exercise and diet in overweight and obese adults with knee osteoarthritis. *Medicine and Science in Sports and Exercise*., 2009;41(6):1167-1174.

21. Messier, S.P., Loeser, R.F., Miller, G.D., Morgan, T.M., Rejeski, W.J., Sevick, M.A., Ettinger, W.H., Pahor, M., Williamson, J.D,. Exercise and dietary weight loss in overweight and obese older adults with knee osteoarthritis:the Arthritis, Diet, and Activity Promotion Trial. *Arthritis and Rheumatology.,* 2004;50(5):1501-1510.

22. Chevalier, X., Marre, J., de Butler, J., Hercek, A. Questionnaire survey of management and prescription of general practitioners in knee osteoarthritis:a comparison with 2000 EULAR recommendations. *Clinical and Experimental Rheumatology*., 2004;22:205-212.

23. Persson, G., Brorsson, A., Hansson, E.E., Troein, M., Strandberg, E.L. Physical Activity on Prescription (PAP) from a general practitioners perspective – a qualitative study. *BioMed Central Family Practice.,* 2013;14:128.

24. Munneke, M.,de Jong, Z., Zwinderman, A.H., Jansen, A., Ronday, H.K., Peter, W.F., Boonman, D.C., van den Ende, C.H., Vlieland, T.P., Hazes, J.M.. Adherence and satisfaction of rheumatoid arthritis patients with a long-term intensive dynamic exercise program (RAPIT program). *Arthritis Care and Research.,* 2003;49(5):665-672.

25. Ettinger, W.H., Burns, R., Messier, S.P., Applegate, W., Rejeski, W.J., Morgan, T., Shumaker, S., Berry, M.J., O'Toole, M., Monu, J., Craven, T. A randomized control trial comparing aerobic exercise and resistance exercise with a health education program in elderly patients with knee osteoarthritis:the Fitness Arthritis and Seniors Trial (FAST). *Journal of the American Medical Association.,* 1997;277:25-31.

26. Radeke, T.D. The relationship between enjoyment and affective responses to exercise. *Journal of Applied Sports Psychology.,* 2007;19(1):105-115.

27. Karatay, S., Yildrim, K., Melikoglu, M.A., Akcay, F., Senel, K. Effects of dynamic exercise on IGF-1 and IGF-BP3 levels in patients with rheumatoid arthritis or ankylosing spondylitis. *Clinical Rheumatology.,* 2007;26(10):1635-1639.

28. Combe, B., Landewe, R. EULAR recommendations for management of early arthritis. EULAR 2005. Vienna, Austria, June 8-11, 2005. Abstract SP0060.

29. Manninen, P., Riihimaki, H., Heliovaara, M., Suomalainen, O. Physical exercise and risk of severe knee osteoarthritis requiring arthroplasty. *Rheumatology.,* 2001;40:432-437.

30. Pies, M.D., Philbon, E.F., Groff, G.D. Relationship between severity of gonarthrosis and cardiovascular fitness. *Clinical Orthopaedics.,* 1995;313: 169-176.

31. Mariëtte de Rooij, Martijn P M Steultjens, Ellis Avezaat, Arja Häkkinen, Rob Klaver, Marike van der Leeden, Tjieu Maas, Leo D Roorda, Hanneke van der Velde, Willem F Lems, and Joost Dekker. Restrictions and contraindications for exercise therapy in patients with hip and knee osteoarthritis and comorbidity. *Physical Therapy Reviews.,* 2013;18(2):101-111.

32. The Arthritis Foundation
www.arthritis.org.za [Accessed 07.12.2014].

33. American College of Rheumatology
www.rheumatology.org [Accessed 07.12.2014].

34. John Hopkins Medicine Rheumatology
www.hopkinsrheumatology.org [Accessed 12.12.2014].

35. Centers for Disease Control Arthritis www.cdc.gov/arthritis [Accessed 12.12.2014].

36. Skou, S.T., Simonsen, M.E., Odgaard, A., Roos, E.M. Predictors of long-term effect from education and exercise in patients with knee and hip pain. *Danish Medical Journal.,* 2014;61(7):A4867.

37. Roddy, E., Zhang, W., Doherty, M., Arden, N.K., Barlow, J., Birrell, F., Carr, A., Chakravarty, K., Dickson, J., Hay, E., Hosie, G., Hurley, M.,Jordan, K.M., McCarthy, C., McCmurdo, M., Mockett, S., O'Reilly, S., Peat, G., Pendelton, A., Richard, S. Evidence based recommendations for the role of exercise in the management of osteoarthritis of the hip or knee - the MOVE consensus. *Rheumatology.,* 2005;44(1):67-73.

38. Bennel, K.L. and Hinman, R. Exercise as a Treatment for Osteoarthritis. *Current Opinion in Rheumatology.,* 2005;17(5):634-640.

39. Bennel, K.L., Dobson, F., Hinman, K.R. Exercise in Osteoarthritis: moving from prescription to adherence. *Best Practice and Research Clinical Rheumatology.,* 2014;28:93-117.

40. Pedersen, M.T., Blangsted, A.K., Andersen, L.L., Jorgensen, M.B., Hansen, E.A., Sjogaard, G. The effect of worksite physical activity intervention on physical capacity health and productivity:A 1 year randomized control trial. *Journal of Occupational and Environmental Medicine.,* 2009;51(7):759-770

41. Statististics South Africa. September 2011. www.statssa.gov.za/?page_id=1854&PPN=Report-03-09-11 . [Accessed 09.11.2015].

42. Usenbo A, Kramer V, Young T, Musekiwa A. Prevalence of Arthritis in Africa: A Systematic Review and Meta-Analysis. Nurmohamed M, ed. *PLoS ONE*., 2015;10(8).

39. Hurley, M.V. and Scott, D.L. Improvements in quadriceps sensorimotor function and disability in patients with knee osteoarthritis following a clinically practical exercise regime. British Jourrnal of Rheumatology., 1998;37:1181-7.

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Appendix A

University of Witwatersrand

Centre for Exercise Science and Sports Medicine

Information Leaflet

Dear Sir/Madam

My name is Dr Lervasen Pillay.

I am a general practitioner completing my master's degree in sports medicine at the University of Witwatersrand.

Part of the programme requires me to do a research project.

You are invited to participate in my research. My proposed research will be undertaken using a questionnaire. This should take you about 10 minutes to complete. The questions all relate to exercise and arthritis.

The questionnaire relates to people with any type of arthritis (osteoarthritis, gout, rheumatoid etc.). The aim is to ascertain how well arthritic pain is controlled amongst patients in the southern suburbs of Gauteng and if exercise is used as an adjunct treatment in order to assist patients with their disease.

I therefore invite you to participate in the survey.

A minimum amount of 298 completed questionnaires are needed in order for the information gathered to be statistically significant.

There is no medical risk to you whatsoever and you are free to withdraw from the research at any point. Your refusal or withdrawal from the study will not affect the level of medical care you presently receive. There is no immediate benefit to you and you will not be compensated for completing the questionnaire.

A consent form will also be necessary for you to complete which states that you are aware of the purpose of the research and consent that the information you divulge can be used for scientific research purposes. The results may be used for dissemination of knowledge within the medical field and confidentiality will always be maintained. Only the researcher and my supervisor will have access to personal details. Your personal details will not be divulged and all data will be coded when recorded. All that we require is your age and sex for demographic purposes.

The research has been approved to be conducted by the University of Witwatersrand research Ethics committee.

Please feel free to contact me or the University of Witwatersrand research ethics committee at any time should you have any questions or concerns.

Regards,

Dr Lervasen Pillay

Cell:0829051826

Email:drpillay@absamail.co.za

Practice tel:0114334966

Appendix B

University of the Witwatersrand

Centre for Exercise Science and Sports Medicine

Informed consent

1. Research title

   Arthritic patients' views and perceptions on exercise as an adjunct treatment regime for managing their condition.

2. Explanation of the study

   There are many modalities for treating arthritic pain. One modality is exercise. The purpose of this study is to determine whether exercise is prescribed to these patients, and what ***their*** perceptions and knowledge of exercise in treating arthritic pain is.

3. Risks and discomforts

   There are no risks as you are only required to complete a questionnaire.

4. Expected benefits from study

   There is no immediate benefit to you by participating in this study.

5. Freedom of consent

Your voluntary permission is required. You may refuse to continue with the study at any time and you will not be prejudiced from medical care. Please note there is no reward offered for completion of the survey.

6. Enquiries

You are encouraged to ask the researcher any further questions regarding the research and its process. You may also contact the University of Witwatersrand research ethics committee should need be.

7. Confidentiality

Your confidentiality is maintained at all times and only your age and gender is required from you.

I Mr/Mrs/Ms/Dr/Prof/Adv_____have read the

Information leaflet and above points and am fully informed on the purpose of this research. I hereby consent to the researcher using information gathered from the research for scientific purposes. I understand that all personal information divulged is confidential. I am aware that I may withdraw from the survey at any point without being prejudiced against.

Signature_____ Date_____

Witness_____ Date_____

Dr Lervasen Pillay (MBChB) Pret.

Cell: 0829051826

Office: 0114334966

Email: drpillay@absamail.co.za

Appendix C

University of the Witwatersrand

Centre for Exercise Science and Sports Medicine

Questionnaire

Mark appropriate boxes with "X" and complete where necessary

1. How old are you?

<30 years		30 to 50 years		>50 years	

2. Gender?

Male		Female	

3. Please indicate what other medical conditions you have, if any.

None		High Blood pressure		High Cholesterol		Diabetes		Asthma	
Other:									

4. What type of arthritis do you have?

Osteoarthritis		Gout		Rheumatoid Arthritis		Post traumatic arthritis	
Other:							

5. What medication are you currently using for arthritis?

6. How often do you use medication?

Daily		2 to 3 x a week		4 to 5 x a week		Weekly	

7. Does the use of medication relieve pain?

Yes		No	

8. Have you ever consulted a physiotherapist for pain management?

Yes		No	

9. Have you ever consulted a biokineticist for pain management?

Yes		No	

10. Have you ever consulted any other person for pain management ? (e.g. homeopaths, yoga, pilates etc)

Yes		*No*	

If yes, who? :

11. If **YES** to **question 8, 9 or 10**, did physiotherapy, biokinetics *or the other provider help with pain relieve?*

Physiotherapy	Yes		No	
Biokinetics	Yes		No	
Other	*Yes*		*No*	

12. Have you ever been advised by a doctor to *exercise to help with pain management?*

Yes		No	

13. If **YES** to **question 11**, what type of exercise has been prescribed?

Strength (weights)		Cardio-respiratory (treadmill/bicycle)		Swimming/ Pool activities		Walking/ Speed walking		Jogging	
Other:									

14. Does your doctor emphasise the importance of exercise at all visits?

Yes		No	

15. Do you think your **doctor** believes that exercise can assist you with pain relieve?

Yes		No	

16. Do **you** think exercise can assist you?

Yes		No	

17. If **YES** to **question 16**, how do you think exercise can benefit you?

18. If **NO** to **question 16**, *why* do you think exercise cannot benefit you?

19. Would you consider exercise to manage your pain if it was prescribed to you?

Yes		No	

20. Do you do any type of physical activity?

Yes		No	

If question 20 is YES then continue with the questionnaire.

If question 20 is NO then stop here. Thank you.

21. What *physical activity* do you do?

Aerobics		Yoga		Running		Bicycle	
Jogging		Treadmill		Pilates		Slow walk	
Weights (gym/home)		Water activities (swimming/water		Fast walking		Sport	

		Aerobics)					
Other:							

22. How long have you been regularly exercising (regular exercise is defined by the American College of Sports Medicine and American Heart Association as at least 30 minutes a session at least 5x a week of moderate exercise OR at least 20 minutes a session at least 3x a week of vigorous exercise?

<1 month		1-6 months		**7** months-1 year		>1 year	

23. Who advised you to exercise?

Doctor		Physiotherapist		Biokinetisist		Friend		No one	
Other:									

24. How long do you usually exercise per session?

<10 minutes		11-30 minutes		31-44 minutes		>45 minutes	

25. How often do you exercise?

Once a week		2-3x a week		4-5x a week		>5x a week	

26. Where do you exercise?

Home		Pool (home/gym)		Gym	
Other:					

27. Do you exercise in a

Group		Alone		Instructor supervised	

28. Does exercise relieve pain?

Yes		*No*		*Sometimes*	

Elaborate :

29. *Since you started exercising, have you found improvement or*

Worsening of pain in the following situations ?

Please mark the appropriate box with a tick

	Improve	*Worsen*	*No difference*
Bathing			
Walking			

Lifting objects			
Gardening			
Driving			
Sleeping			
Washing clothes			
Sitting			

30. Do you exercise when in acute pain?

Yes		*No*		*Sometimes*	

30. *What type of exercises do you perform in the following situations?*

Acute Pain	
Minimal pain	
No Pain	

31. Using the pain scale below as reference, please indicate using 1 to 10(1 being no pain and 10 being the worst imaginable pain), how the 3 options rate on the pain scale regarding your affected joint/s

Adaptation of the visual assessment pain scale:

1	2	3	4	5	6	7	8	9	10
No pain				Pain relieve with regular analgesia use					Worst pain imaginable

Exercise **only**	
Medication **only**	
Exercise and medication	

Thank you for completing the questionnaire

Regards,

Dr Lervasen Pillay

(0829051826)

Appendix D

Surveyed patients log

File number	Surveyed (Yes/No)	File number	Surveyed (Yes/No)	File number	Surveyed (Yes/No)

Appendix E EthicalClearance

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Dr Lervasen Pillay

CLEARANCE CERTIFICATE	**M10M101138**
PROJECT	arthritic Patients' Views and Perceptions on exercise as a Adjunct Treatment Regime: Regime for Managing Their Condition
INVESTIGATORS	Dr Lervasen Pillay.
DEPARTMENT	CESSM
DATE CONSIDERED	26/11/2010
DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

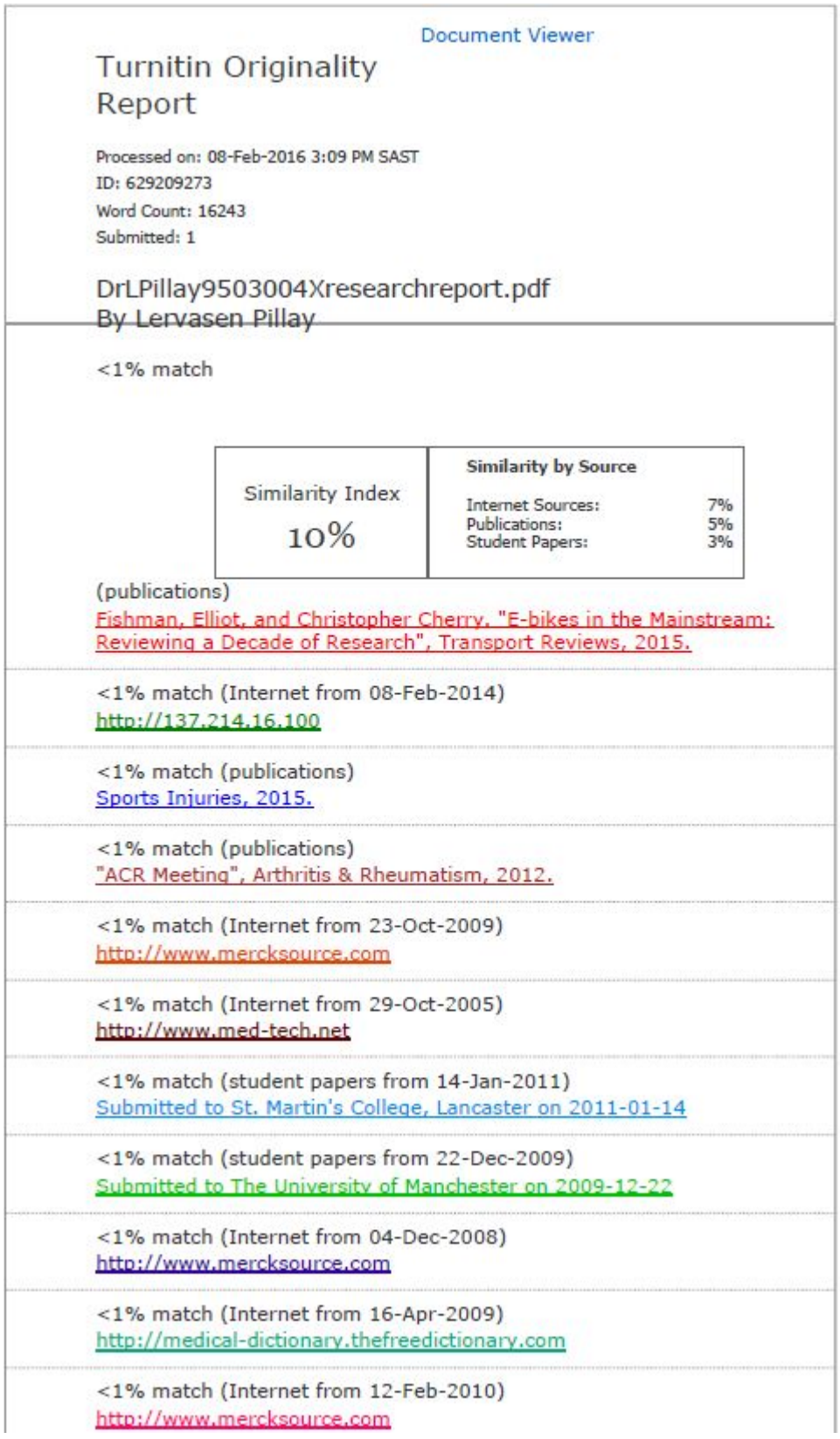
DATE 26/11/2010 **CHAIRPERSON** .....
(Professor PE Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable
cc: **Supervisor :** Dr D Constantinou

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**
PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES...

Appendix F



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