Patterns of presentation of knee osteoarthritis at the Kenyatta National Hospital.

A dissertation submitted in part fulfillment for the degree of Masters of Medicine in Orthopaedic surgery at the University of Nairobi

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Certificate of Authenticity

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DECLARATION

I hereby declare that this study is my original work and has not been presented for dissertation at any other university.

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DEDICATION

I would like to dedicate this study to my late father, Mr. Abdul Rahim Alimohamed Baradia who was my role model and who with his integrity, dignity and love for his students inspired me to do medicine, and my mother, Mrs. Afrose Baradia, without whom I would not be who I am. And finally my dear wife and children, for braving through the storm and keeping the midnight oil burning and the hunger sated. I could not have done it without them.

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LIST OF ABBREVIATIONS

ASIS   Anterior Superior Iliac Spine

B. M. I.   Body Mass Index

E. R. C.   Ethics and research Committee

K. N. H.   Kenyatta National Hospital

L. C.   Lateral Compartment

M. C.   Medial Compartment

NHANES   National Health and Nutrition Examination Survey

NSAIDs   Non-Steroidal anti-inflammatory drugs

OA   Osteoarthritis

OAI   Osteoarthritis Initiative

OARSI   Osteoarthritis Research Society International

OKS   Oxford Knee Score

P. F. C.   Patello-Femoral compartment

Q-Angle   Quadriceps angle

R. O. M.   Range of Motion

SPSS   Statistical Package for the Social Sciences

U. o N.   University of Nairobi

W. H. O.   World Health Organisation

ABSTRACT

Background: Symptomatic osteoarthritis of the knee is a very common problem. Osteoarthritis of the knee leads to loss of range of motion and leads to pain which leads to restriction of activity. Patients with osteoarthritis of the knee are more likely to seek medical care as patients without arthritis.

Objective: To assess the pattern of presentation of osteoarthritis of the knee in the African population presenting to the orthopaedic outpatient clinic at the Kenyatta National Hospital.

Design: A descriptive cross-sectional study.

Setting: Kenyatta National Hospital (KNH) Orthopaedic out-patient clinic.

Patients and methods: Patients diagnosed with knee osteoarthritis who consented to be included in the study as well as meet the inclusion criteria were recruited. Participants were assessed using a standard questionnaire involving demographical data, the Oxford Knee Scoring system and clinical examination data. The duration of the study was three months during which time 164 patients were recruited out of a patient population of 1,200 who visited the orthopaedic clinic within the same period.

Results 164 patients were recruited with 132 female and 32 male. Mean age of the patients was 60.2 years with an average BMI of 30.7. Most patients were farmers or housewives (68.2%) and the mean oxford knee score was 19. There was an average flexion loss of 18° on the right and 21.8° on the left with an extension lag of 1.8° on the right and 2.1° on the left.

Discussion This study shows that the local presentation and pattern of knee osteoarthritis conforms well to studies done elsewhere.

INTRODUCTION

Osteoarthritis (OA) is not a single entity but a group of clinical and pathological processes that eventually lead to pain, disability and decrease in function of synovial joints. [1] The Subcommittee on Osteoarthritis of the American College of Rheumatology Diagnostic and Therapeutic Criteria Committee defined osteoarthritis (OA) as "A heterogeneous group of conditions that lead to joint symptoms and signs which are associated with defective integrity of articular cartilage, in addition to related changes in the underlying bone at the joint margins." [1] Osteoarthritis is characterized by pain in the synovial joints as well as reduced range of motion and swelling. Often there may be joint effusion with signs of local inflammation.

The basic pathologic basis of osteoarthritis is damage to the articular cartilage of the synovial joint.[2]Some researchers have proposed that arthritis be seen as an evolutionary process instead of an acquired disease process following research into macaque monkeys, who similar to human beings, often walk upright and develop osteoarthritis in the same joint.[3]

Histologically, the disease is characterized by breaking up of the cartilage surface, cloning of chondrocytes, vertical "breaks" in the cartilage, deposition of crystalline material, remodeling, and eventual invasion of the so called "tide-mark" by blood vessels.[2] This process can occur in any joint but the more common joints affected are the ones in the hand, spine, knee, foot and hip.

This pathological change, when severe, results in radiological changes (loss of joint space and osteophytes) which have been used in epidemiological studies to estimate prevalence of OA at different joint sites. A Kellgren & Lawrence radiological OA score of 2-4 is still the most widely used definition of radiological OA in epidemiological studies [4].

Osteoarthritis is more common in women than men but the prevalence increases dramatically with age[3]. For women middle aged and above, arthritis is the foremost chronic condition, ranking number one while for men, it ranks top after the age of 65[3].

Symptomatic arthritis of the knee is a common problem. Two percent (2%) of the United States population older than seventeen and ten percent (10%) of Americans over the age of sixty five has clinically relevant arthritis of the knee [5]. There are currently no statistical numbers that exist for the local population. We do however know that the demographic constitution of this country is slowly shifting towards an older population that is living longer due to improved health care, education and literacy.

The specific cause of degenerative arthritis of the knee is not clear, but it seems clear that the quality of the articular cartilage is lost [6]. In the beginning there may be small areas of chondral injury which then worsen to include both sides of the joint. Later on the sub-chondral bone gets thicker and sclerotic with areas of eburnation and bony out-spurs covered in hyaline cartilage known as osteophytes develop.

LITERATURE REVIEW

Although osteoarthritis is a frequent and important cause of pain and disability, its pattern of presentation has not been studied in detail in tropical Africa. There exist some studies on the pattern of presentation of osteoarthritis in the hip [7] but few exist on the knee joint.

Ebong WW, in 1985 published a paper [8] on a retrospective study in which he recruited 81 patients with 116 osteoarthritic knees over a period of six years at the University College Hospital in Ibadan, Nigeria. He found a higher female to male ratio at 1.5:1 although not as high as in the Caucasian population and also noted that trauma was less of a significant factor in his group of patients. The mean age of onset was 52 years with a mean duration of symptoms of 3.2 years. It was also reported that 30% of the patients with knee osteoarthritis were obese, with a BMI over thirty. It was noted though, that patients with severe genu valgum presented much earlier with marked knee osteoarthritis.

Adebajo AO in a prospective study published in 1991 followed up 252 osteoarthritic joints from 140 patients in a West African teaching hospital [9]. The knee was the joint most often affected. Hip and hand disease, as well as Heberden's nodes were uncommon and he noted that joint disease was predominantly monoarticular, with no patient in his study having more than three or more sites affected. He also found a greater female preponderance of osteoarthritis at a ratio of 3.5:1. The mean age of onset in this study was equivalent to other studies at 53.7 years with a mean duration of symptoms of one year. In this study, obesity with a BMI over thirty was found in 17% of the patients with symptomatic knee osteoarthritis.

Miiyawa M. and Ekuoe K. in a retrospective study at a hospital based in Lome, Togo; reviewed 212 patients with knee osteoarthritis [10]. One hundred and fourteen knees were found to have medial tibio-femoral osteoarthritis; fifty four were found to have it in the lateral femorotibial compartment, forty four in the patello-femoral compartment while the rest had features of osteoarthritis in more than one compartment. It was also reported that there was a female

preponderance of 83% with a mean onset of 50 years and obesity was noted in 70% of symptomatic patients.

Eti, E, Kouakou HB, Daboiko JC, et al at the Cocody Teaching Hospital in Abidjan, Nigeria, carried out a retrospective review of 369 osteoarthritic knees in a study published in 1998[11]. It was found that 28.2% had femorotibial osteoarthritis, 34.14% had patello-femoral osteoarthritis while 37.66% had global osteoarthritis (more than one compartment involved). There were a higher number of female patients with symptomatic OA (80.4%) while 29.04% were clinically obese. The mean onset of symptoms was 51.25 years.

Aderonke OA, Oyindamola OA, Babatunde AA et al of the Department of physiotherapy at the University of Ibadan, Nigeria, in a retrospective study published in 2007[12]noted that knee osteoarthritis was a common condition, accounting for 9% of new patients seen in the physiotherapy clinic over the study period. Out of the 1120 joints reviewed, there were 869 knees affected. The study noted a preponderance of females to males, making up 77.7% of the patients and that common impairments were pain, reduced range of motion, crepitus and joint swelling.

Oniankitan O, Houzou P, Koffi-Tessio VE, et al based in the rheumatology clinic at a teaching hospital based in Togo, reviewed 993 knees with osteoarthritis in a retrospective study going back fifteen years [13]. It was reported that 49.6% had medial femoro-tibial osteoarthritis, 22.5% had lateral femoro-tibial osteoarthritis and only 4% had patella-femoral osteoarthritis. The rest had osteoarthritis in more than one compartment. Of the patients, 85% were female, while 83% were obese with a BMI over 30. The mean age of onset was 50.3 years while the mean duration of symptoms was 4.4 years.

Aderonke OA, Alonge TO, Adekanla BA, et al in a cross-sectional descriptive study sited in a rural Nigerian village and published in 2011[14], noted a point prevalence of knee osteoarthritis

of 16.3%. He noted a higher prevalence in females, with it increasing with age and increasing body adiposity.

In a previous study by the same author published in 2009[12], knee osteoarthritis in various compartments were scored but it was not noted in what proportion were the compartments involved.

Two other studies done prior to the 1980's both based in South Africa, found an equal incidence in both males and females and noted a significant rise in incidence after the age of 40[15, 16].

Study	Year	No of Knees	Age of Onset	Duration (years)	Sex Ratio (F:M)	Obesity
Ebong WW	1985	116	52 yrs	3.2	2:1	30%
Adebajo AO	1991	252	53.7 yrs	1	3.5:1¥	17%
Miiyawa M	1993	212	50 yrs	-	1.2:1	70%*
Eti E	1998	369	51.25 yrs	-	1.2:1	29.04%
Aderonke OA	2007	869	-	-	3.5:1	-
Oniankitan O	2009	993	50.3 yrs	4.4	1.17:1	83%*
Aderonke OA	2011	229	-	-	3:1	73.4%

Note: ¥ - Not limited to osteoarthritis, rheumatoid conditions included as well. * - obesity defined as weight greater than 10% of expected, not BMI > 30

Table 1: Summary of knee osteoarthritis studies

In the western hemisphere, data from the third National Health and Nutrition Examination Survey[17] (NHANES III 1991 - 1994), the prevalence of symptomatic knee osteoarthritis was found to be 12.1%. Symptomatic knee OA prevalence did not differ by sex. Multivariable analysis showed significantly higher odds of knee OA with BMI greater than or equal to 30, greater age and with manual labour occupations.

In the Johnston County Osteoarthritis project[18], 3018 participants aged 45 years and above, were recruited, and weighted prevalence estimates for knee symptoms, radiographic knee OA, symptomatic knee OA and severe radiographic knee OA were calculated for age, ethnic, and sex. Of the participants, 16% had symptomatic knee OA with prevalence higher in women and with increasing age.

Ledingham J, Regan M, Jones A, et al assessed clinical, radiographic and synovial fluid markers in 252 patients referred to hospital due to knee osteoarthritis in a study published in 1993[19]. They noted that in patients referred to hospital due to knee osteoarthritis, it is usually bilateral and involves more than one compartment.

In the landmark Framingham Osteoarthritis Study [20], a cohort of 1,483 patients who had knee radiographs taken and answered questions about knee symptoms were followed up 8 years later in 1992-1993 and re-examined. Of the 1,051 surviving subjects, it was noted that females not only had a1.7% higher incidence of disease, but also had a more frequent disease progression.

In a meta-analysis[21] undertaken by Srikanth VK, Fryer JL, Zhai G, et al to resolve uncertainty regarding sex differences in osteoarthritis, males had a significantly reduced risk for prevalent OA in the knee. Females, particularly those aged 55 years and over, tended to have more severe OA in the knee but not in other sites.

Obesity is a known risk factor for the development of knee osteoarthritis in several populations [22–26]. Furthermore, weight reduction reduces the risk for development of symptomatic knee osteoarthritis in women.[27] While obese patients are at higher risk of developing hip and knee osteoarthritis, obesity does not appear to adversely affect outcome of joint replacement surgery.[27]

Occupations, in which workers do repetitious tasks, over working the joints and fatiguing muscles that protect the joints, increase the risk for osteoarthritis.[28] Workers whose jobs

involve physical labour have high rates of knee osteoarthritis [28, 29]. Farmers have high rates of hip osteoarthritis [30]. Jobs that lead to kneeling or include heavy weight lifting were associated with higher rates of osteoarthritis of the hip and the knee. Data from the Framingham Study suggested such activities led to development of knee osteoarthritis of between 15% to 30% in the men studied.[29]

The Oxford Knee Score

Many instruments have been developed for the assessment of knee pain and function, such as the American Knee Society Score [31] the Bristol Knee Score,[32] and the Hospital for Special Surgery Knee Score.[33] They are derived from clinical and radiological data and depend on the judgement of the surgeon.

The concerns and priorities of the patient and surgeon may differ. Research in many areas of medicine and surgery has shown that patients can provide reliable and valid judgements of their health status and of the benefits of treatment.[34] A 12-point questionnaire, the Oxford Knee Score, has been developed and validated.[35] It is reported to be short, practical, reliable, valid and sensitive to clinically important changes over time, and is now being widely applied.[36, 37]

It is a 12-item questionnaire with five possible responses to each question. Each item is scored from 0 to 4, and the items are summated, thus giving0 for the worst possible status and 48 for a normal knee. It is designed to be used as a short and simple questionnaire and is not affected by the surgeon's perception of the patient's disability. Dawson J, Fitzpatrick R, Murray D, et al[35] have demonstrated the internal consistency, reproducibility, and construct validity of the Oxford Knee Score.

STUDY JUSTIFICATION

Osteoarthritis is a common disease worldwide [4,5,7,8,9,10]. It leads to pain and disability especially when it affects the weight bearing joints. There are no local studies done to explain the patterns of presentation of this condition. This study seeks to clarify this on one of the most commonly affected joint. As can be deduced from the literature review above, there is sparse information in the current literature regarding the clinical, radiological and functional aspects of knee osteoarthritis in the African population. The aim of this study is to make clearer the demographic background of this disease in the local setup.

STUDY OBJECTIVES

PRIMARY OBJECTIVE

To determine the clinical presentation of knee osteoarthritis in patients presenting to the orthopaedic clinic at the Kenyatta National Hospital.

SECONDARY OBJECTIVES

1. To determine the age and sex distribution of osteoarthritis of the knee in the study population

2. To determine whether BMI is statistically relevant in the severity of the oxford knee score of patients with knee osteoarthritis

3. To determine the side and the compartment affected in osteoarthritis of the knee in the study population

4. To determine the effect of knee osteoarthritis on the range of motion of the joint

MATERIAL AND METHODS

STUDY SETTING

The study was conducted at the Kenyatta National Hospital (KNH) orthopaedic clinic no. 5. Kenyatta National Hospital is a 1000 bed national teaching and referral hospital in Kenya. It serves Nairobi and its environs and also serves as the referral centre for the country and its neighbouring countries.

STUDY POPULATION

All patients presenting for a routine visit to the orthopaedic clinic at the Kenyatta National Hospital with knee osteoarthritis that fulfilled the requirements of the inclusion criteria [38].

STUDY DESIGN

A cross-sectional descriptive study.

METHODOLOGY

Recruitment: Patients who presented to the Kenyatta National Hospital orthopaedic clinics on Tuesday, Wednesday and Friday, over a 3 month period were reviewed and those who had primary knee osteoarthritis were identified and referred to the primary investigator. Primary knee osteoarthritis was diagnosed according to established international guidelines by the Osteoarthritis Initiative (OAI)[38,39], in patients presenting with knee pain as well as a grade 2 Kellgren Lawrence score on their weight bearing antero-posterior knee radiograph which includes definite osteophytes as well as narrowing of the joint line.[39] Only patients with a prior diagnosis of primary knee osteoarthritis according to the definition outlined above were recruited. Out of the patients identified, those who met the inclusion criteria and consented to participate were recruited into the study. Potential participants were provided with all necessary information pertaining to the study to allow them to make an informed and voluntary consent. A witness was present for the consent who subsequently appended his/her signature to the

participants consent. All recruited patients were assigned a study number for purposes of identification as well as to maintain anonymity.

Patient recruitment involved:

Identification of patients with knee osteoarthritis

Providing the potential participant with all the information pertaining to the study

Data Collection: For the purpose of this study, a separate consulting room was set-up with a separate waiting area for the participants.

Demographic data

Two research assistants, who were trained on administering the questionnaire, collected and recorded the demographic details of the patient on serially numbered forms. The patient's weight in kilograms and their height in metres was measured and recorded. The BMI was calculated using the standard method of dividing the weight in kilograms by the square of the height in metres and recorded.

The patient was then seen in the consulting room and the rest of the questionnaire was administered by the primary researcher. The sections were administered sequentially as provided and all sections completed.

The Oxford Knee Questionnaire [40 - 42] was then administered in either English or Kiswahili depending on participant comfort with an effort being made to constrain within the limits of the questions. The participants' knee(s) were scored with each question having a possible zero to four score yielding a maximum score of forty eight (48) and a minimum score of zero (0). The score was then recorded in the space provided.

After answering the oxford knee questionnaire, the patient was asked to lie on the examining couch and exposed the lower limbs up to the mid-thigh level. The knee joints were then examined by inspection and palpation. The joint line was assessed for tenderness and any presence of joint effusion recorded. The knee was then assessed for presence of joint crepitus in either the patello-femoral or the tibio-femoral compartment and the findings recorded into the data form.

Knee goniometry was then performed beginning with active flexion and extension, followed by passive range of motion. A standard 18 cm goniometer from Prestige Medical LLC was utilised using a standardised method as outlined below [43 - 45].

Flexion

Testing Position:	Supine or reclined with hip and knee in neutral rotation
Stabilization:	Trunk and pelvis stabilized by body weight and position
Goniometer Axis:	Lateral epicondyle of the femur
Proximal Arm:	Parallel to the long axis of the femur & pointing at the greater trochanter
Distal Arm:	Parallel to the long axis of the fibula and pointing at the lateral malleolus
Movement:	The hip and knee are flexed as the heel moves toward the buttock
Expected ROM:	135°

Extension

Testing Position:	Supine with hips and knees in neutral rotation; distal leg on bolster/pillow
Stabilization:	Trunk and pelvis stabilized by body weight and position
Goniometer Axis:	Lateral Epicondyle of the femur
Proximal Arm:	Parallel to the long axis of the femur & pointing at the greater trochanter
Distal Arm:	Parallel to the long axis of the fibula and pointing at the lateral malleolus
Movement:	Knee extension
Expected ROM:	0°. Hyperextension may be present up to 10-15°

The Quadriceps-Angle (Q-angle)[46] was then measured with the patient in the standing position. With the subject standing, line from the ASIS to the middle of the patella was visualised. Then another line from the middle of patella to the tibial tuberosity was visualised. The Q-angle is the angle between those two lines. Normal Q-angles measure $< 14°$ for men, and $< 17°$ for women. The Q-angle was measured and recorded into the space provided on the questionnaire.

The patient was then given treatment if required, with a return date given.

The data form was then stored securely in a locked cabinet to which only the primary researcher and statistician had the keys, and confidentiality of the information ensured. The next participant was then interviewed following the same protocol outlined above.

On completion of the interviews for the day, the data forms were collated and the information entered into the password protected Microsoft Access Database (Office 2010) after stripping any identifying or personal data. The password protected database was serially backed up on a secure external hard drive.

SAMPLE SIZE

For large populations, Cochran developed an equation to yield a representative sample for proportions [47]

$$n_0 = \frac{z^2 pq}{e^2}$$

Where:

Z^2 is the abscissa of the normal curve that cuts off an area at the tails (1 - equals the desired confidence level, e.g., 95%),

e is the desired level of precision (or sampling error),

p is the estimated proportion of an attribute that is present in the population, and

q is 1-p.

The value for Z is found in statistical tables which contain the area under the normal curve, where the value of Z correspond to 1.96.

The incidence of symptomatic osteoarthritis of the knee has been reported as 12.1% [47].

Therefore the value of p is 0.121.

q is $1 - p$ therefore q is 0.879

The level of precision, e, is valued at ± 5% i.e. 0.05

Substituting the values into the formula above gives:

$$n_0 = 163.435$$

n_0 is therefore **164 patients**.

INCLUSION CRITERIA

1. Patients above the age of eighteen years presenting themselves to the Kenyatta National Hospital orthopaedic clinic with a prior confirmed diagnosis of primary osteoarthritis of the knee as defined in the recruitment methodology.

2. Patients able to comprehend and answer a questionnaire, or if illiterate, can be assisted by the researcher.

3. Patients who can give an informed consent.

EXCLUSION CRITERIA

1. Patients with Secondary Osteoarthritis

2. Patients with psychiatric disturbances.

3. Patients who decline to give consent.

STUDY LIMITATIONS

1. Language barrier in administering Oxford Knee Score questionnaire, particularly to Non-English/Non-Kiswahili speaking or illiterate elderly individuals. This was minimised by utilising an interpreter well versed with both languages. If an adequate interpreter was not found then the patient was not recruited for the study.

2. Bias due to poor recall by patients. This was be minimised by achieving good rapport with the participant and giving them adequate time to recall without pressure. Corroboration with their care-givers/relatives also helped to confirm the facts given.

3. Patients who opted out of the study. In order to minimise the impact of patients opting out, participants were fully informed on the nature and benefits of the study as well as reassuring them that no harm or detriment would occur in view of their participation prior to them giving consent.

DATA COLLECTION, MANAGEMENT AND ANALYSIS

Data was collected by the primary investigator and his trained research assistants using a pre-validated standard questionnaire which included sections for clinical examination and radiological data. The collected data was then entered into a password-protected customised Microsoft Access Database accessible only to the principal investigator and the statistician. After data entry, the principal investigator compared the entered data with the hard copy forms to ensure accuracy and correctness of the soft copy of the data. Data analysis was performed using SPSS version 17.

Data so obtained will then be availed to the department of orthopaedics, university of Nairobi and the library of the Kenyatta National Hospital for future reference. At the conclusion of the study, all data collected shall be saved in a password protected file and kept in a secure location in the department.

ETHICAL CONSIDERATIONS

1. Approval for the study was sought from the Kenyatta National Hospital Ethics and Research Committee (KNH-ERC)

2. All patients prior to enrolment into the study were explained the nature of the study and a written informed consent in either English or Swahili obtained from them, dependent on the language of their choice. Where a patient was not able to append his/her signature but had fully understood the nature of the study and consented, a print of his/her right thumb was taken. The consent explanation was witnessed by a third party who also appended their signature to confirm the same.

3. Patient confidentiality to be guaranteed and all collected data to be treated with utmost confidentiality utilising the World Health Organization International Ethical Guidelines for Epidemiological studies prepared by the Council for International Organizations of Medical Sciences[49].

4. No monetary gain or other form of remuneration will be undertaken to the participants by the investigators.

5. Patients who declined participating in the study did not have any discrimination or have detrimental consideration in their current or future management of their conditions or follow up for the same. Neither will their future relations with Kenyatta National Hospital or University of Nairobi be affected by their declining participation.

6. No extra expense was incurred by the participants of the study upon enrolment for purposes of the study.

7. Participants of the study had the right to withdraw from the study at any point after enrolment and no coercion by the investigator is warranted to reverse their withdrawal.

8. The findings of the study were availed to the Department of Orthopaedics, University of Nairobi and the library of Kenyatta National Hospital for future reference by interested parties.

9. The researchers undertake to publish the results of this study and follow up on any recommendations that may arise at the end of the study.

10. At the conclusion of the study, all data collected was saved in a password protected file and kept in a secure location for future statistical and analytical reference.

RESULTS

A total of 164 consecutive patients were recruited into the study according to the calculated sample size.

Sex

Out of the 164 recruited patients, 132 were female (80.5%) and 32 were male (19.5%) giving a sex ratio of male to female of 1:4. This corresponded well with the results obtained in the studies that were carried out in the western part of Africa that found a male to female sex ratio of 1:3.5 [9, 12], 1:3 [14], and 1:2 [8].
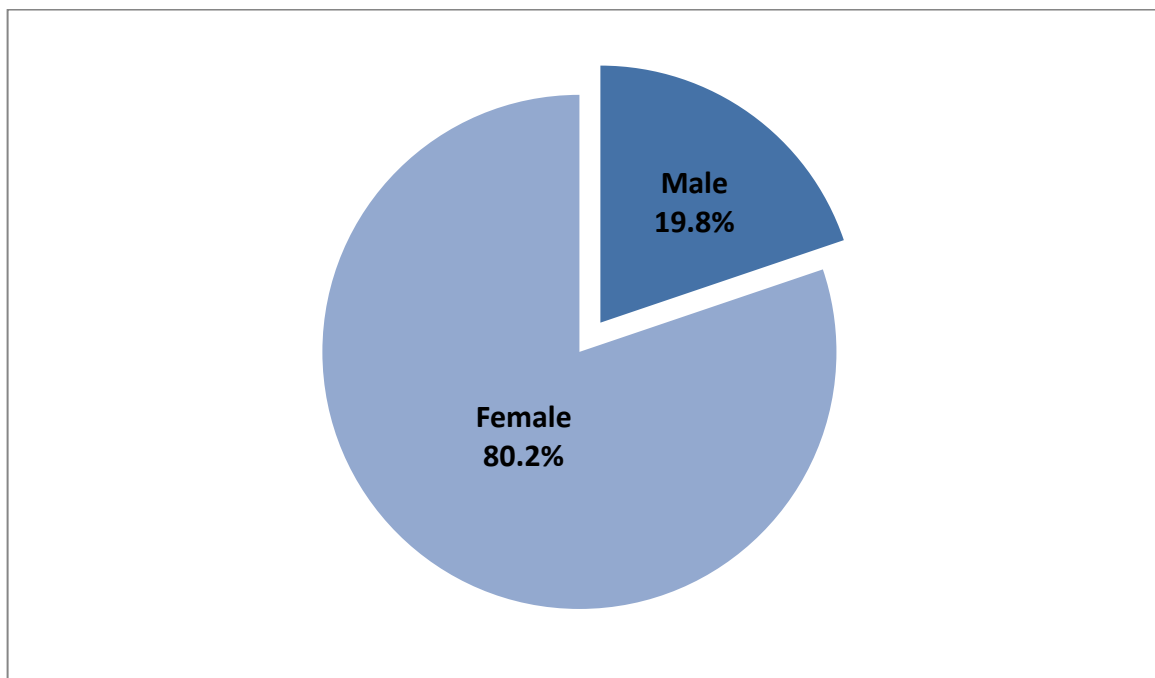
Figure 1: Sex ratio in knee osteoarthritis

Age

The youngest patient recruited was 40 years old while the oldest patient was 90 years old. The age distribution by sex is depicted in the chart below showing that the female patients were clustered around the 55 to 65 age bracket while the male patients tend to be more spread out in

age and also seem to be older when seeking treatment. The mean age of the recruited patients was 60.2 ± 11.2 years while the median was 59.0 years indicating a Gaussian distribution in age.
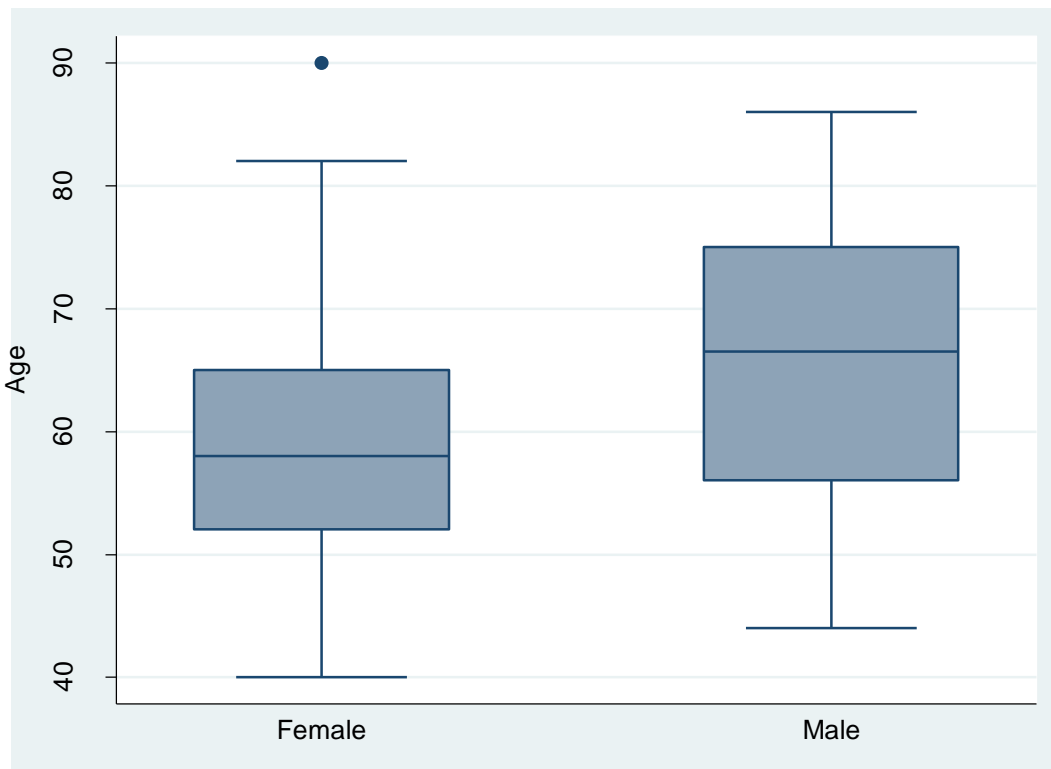
Figure 2: Age distribution by sex in knee osteoarthritis

<u>Occupation</u>

Majority of the recruited patients had occupations requiring manual labour. Farmers made up 36.5% while housewives made up 31.7%. The rest of the patients had occupations requiring minimal manual labour, including but not limited to teaching, vegetable selling and the civil service.
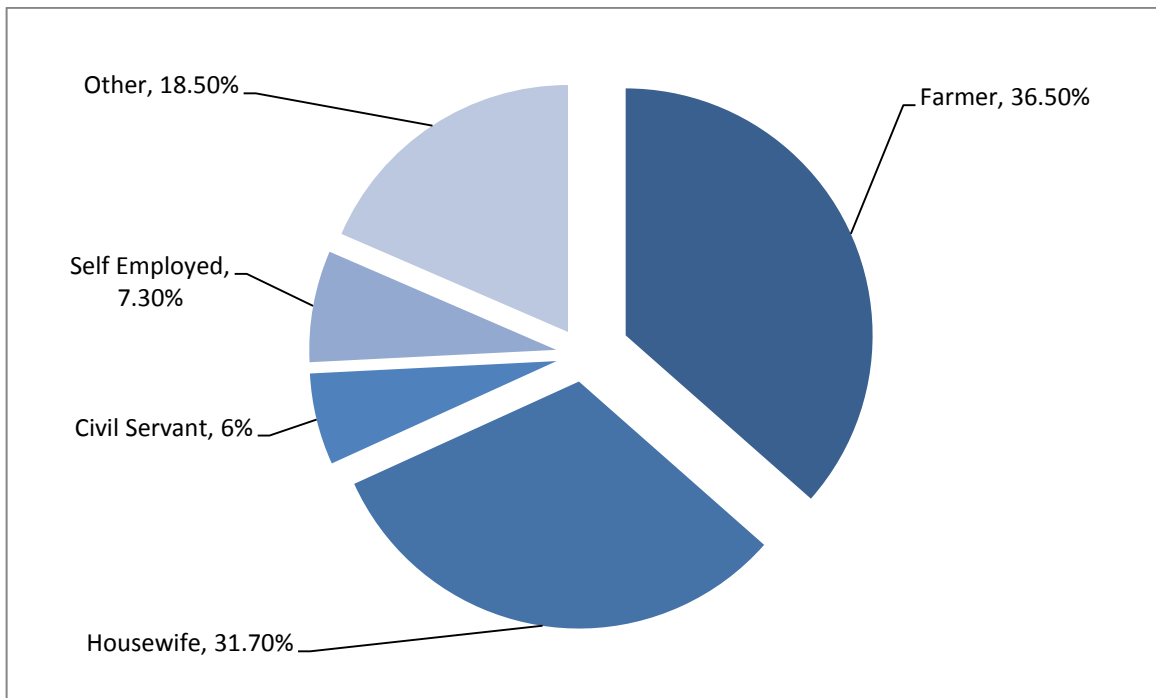
Figure 3: Occupation of patients with knee osteoarthritis

Body Mass Index

The average BMI for the recruited patients was 30.7 and a median of 29.9 while the lowest BMI was 17.9 and the highest 47.6. This indicates that the vast majority of patients were overweight compared to established BMI standards. The graph below shows the spread of BMI according to sex. This indicates that the female patients on average had a higher BMI than the male patients.
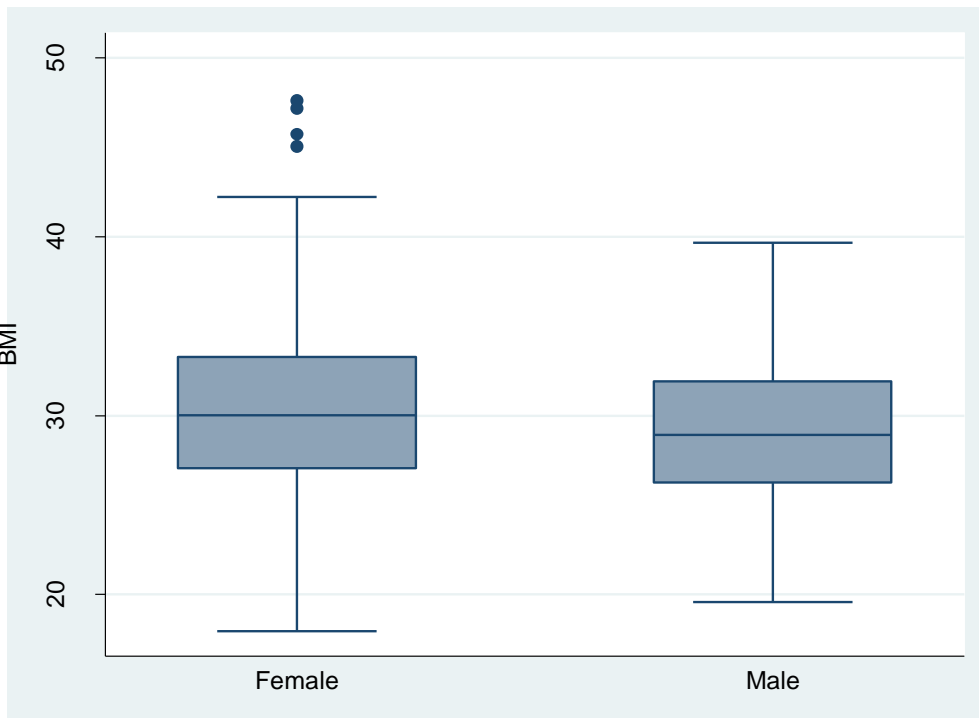
Figure 4: BMI distribution

<u>Duration of Symptoms</u>

Most patients had symptoms between 5 to 11 years with a median duration of 4 years.
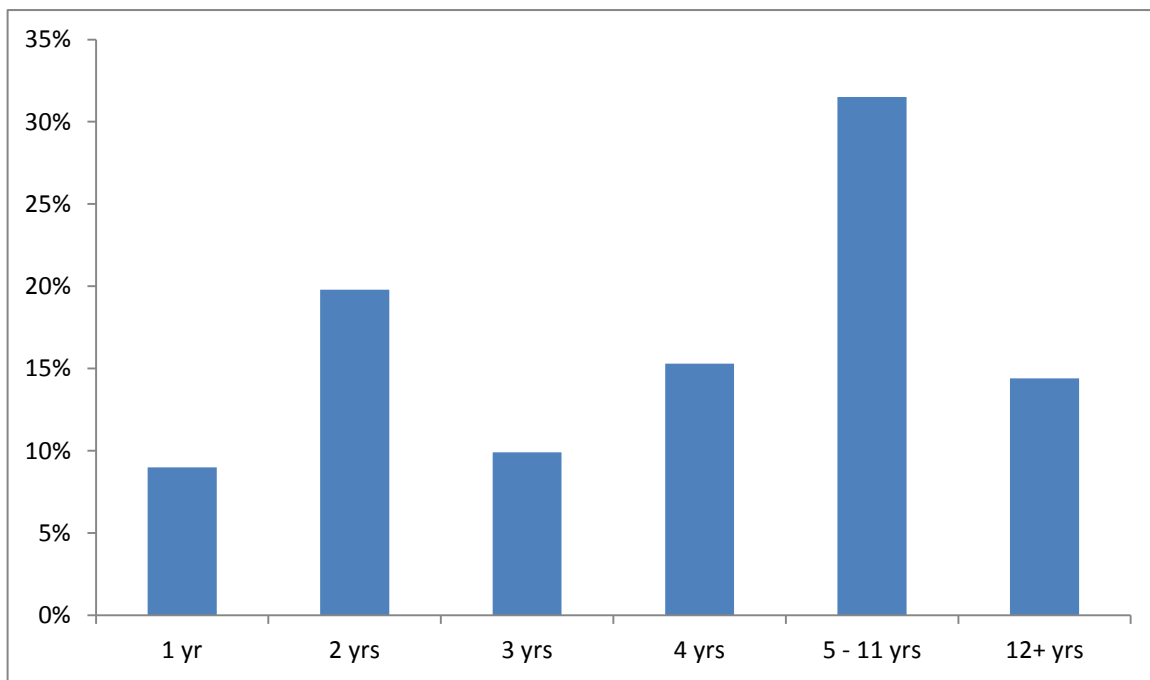
Figure 5: Duration of symptoms

Assistive Device

Most patients did not utilise an assistive device (71%) with the rest utilising walking sticks (16%), crutches (7%) and a hinged knee brace (6%) in that order of preference.
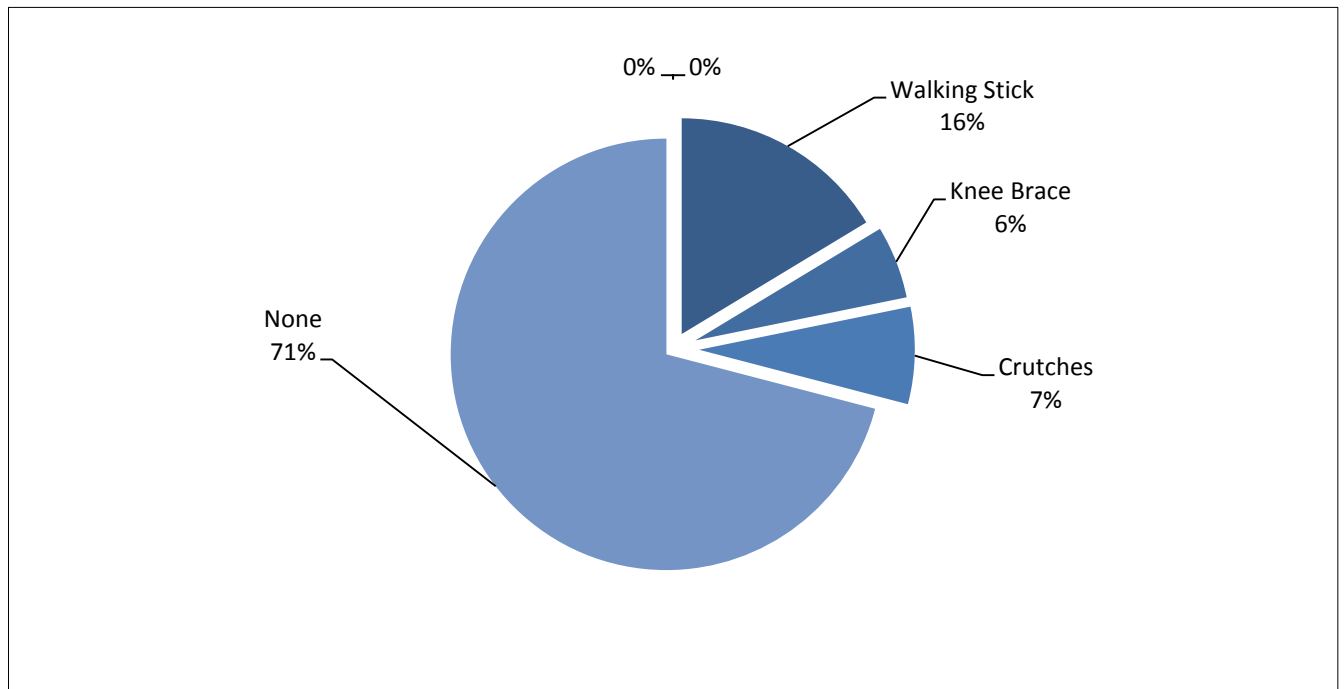
Figure 6: Assistive devices used

Medication

A large number of patients (148 or 90.2%) were being treated with various oral Non-Steroidal Anti-Inflammatory Drugs (NSAIDs). 10.8% were on topical NSAIDs and 6.3% were on Paracetamol while 15 patients (9%) were not on any medication at all. 20 patients were on oral chondroitin sulphate supplements while 4 patients were on oral calcium supplements.

Knee Affected

The majority of patients had bilateral knee osteoarthritis with isolated right knee osteoarthritis and isolated left knee osteoarthritis following in that order.
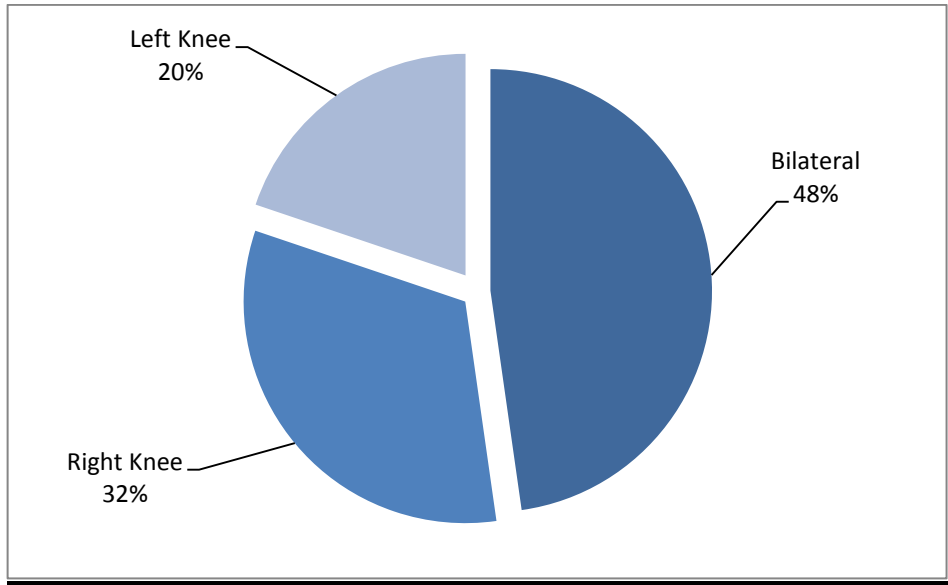
Figure 7: Knee Affected

Oxford Knee Score

The lowest score obtained was 6 while the highest score was 46 with a mean score of 22.5± 10.2 and a median score of 22. When the score is graded against the knee involved, a worse score is obtained in patients with bilateral knee osteoarthritis.
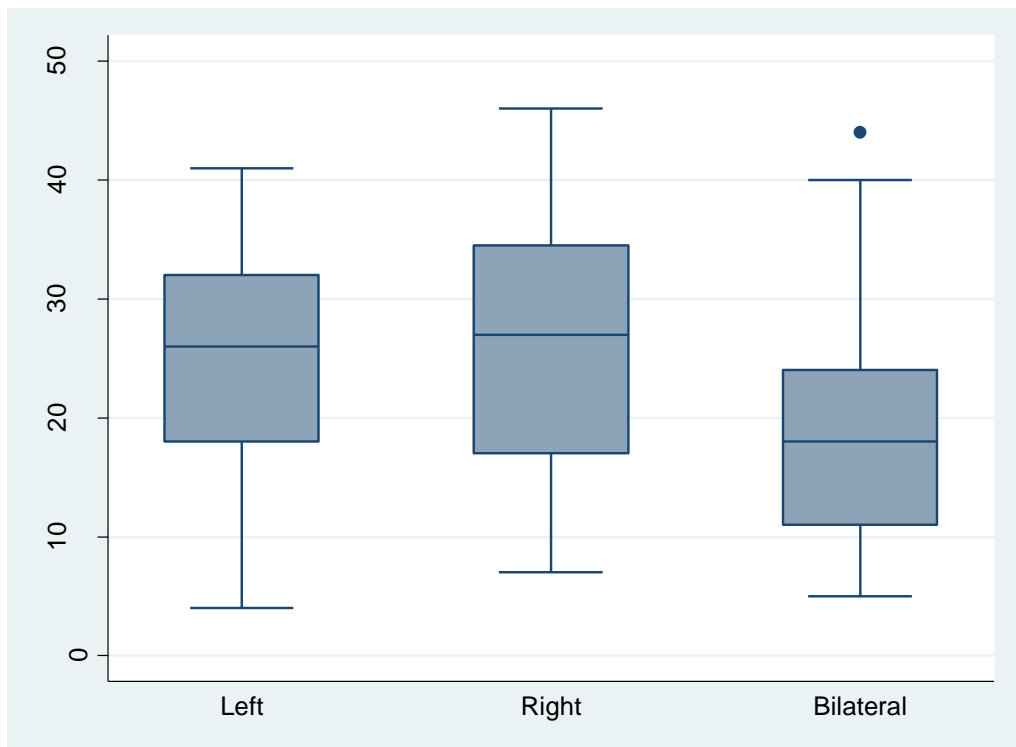
Figure 8: The Oxford Knee Score

	Average OKS	p-value
Left Knee	24.4	Ref
Right Knee	26.3	0.469
Bilateral	19.2	0.038

Table 2: Average Oxford Knee Score versus the knee affected by osteoarthritis

This result shows that the average OKS is significantly higher if both knees were affected (p-value 0.036) as compared to either to left or right knee only.

When the Oxford Knee Score is charted against BMI the following is obtained. No useful relationship could be extracted which could signify no causal relationship between obesity and severity of the knee osteoarthritis but further study is indicated.
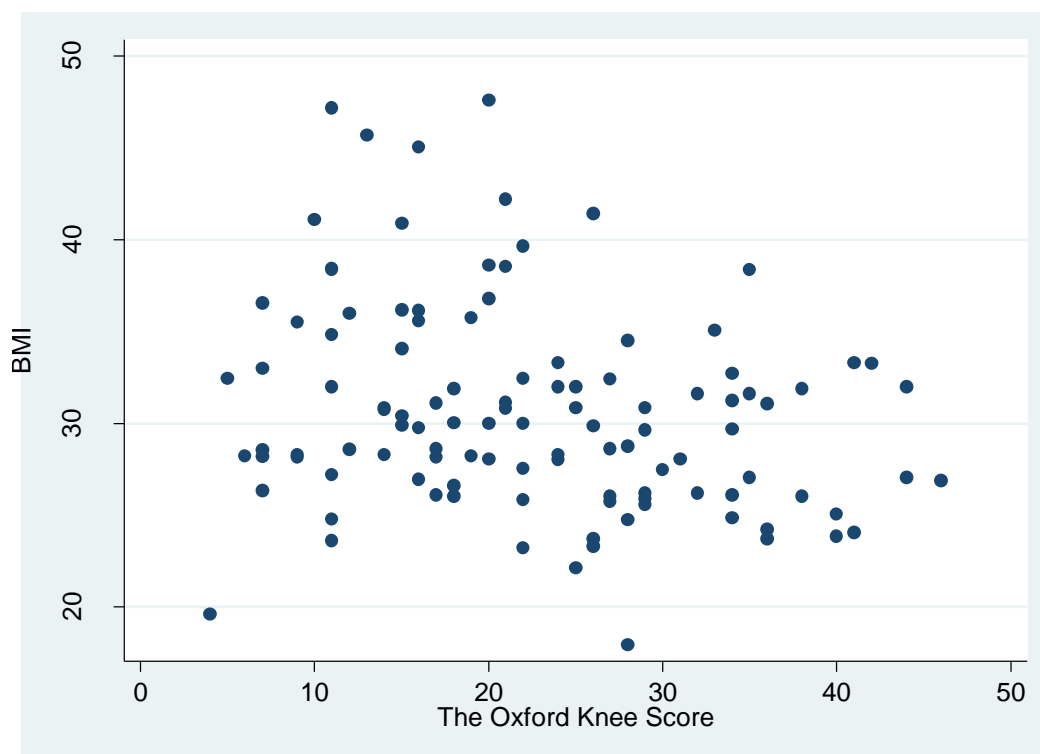
Figure 9: Oxford knee score against BMI

Duration of symptom		
One year	32.6	Ref
Two years	25.2	0.042
Three years	26.1	0.119
Four years	20.4	0.002
5-11 years	20.0	0.000
12 + Years	17.8	0.000

Table 3: Average Oxford Knee Score compared to duration of symptoms

This result shows that the average OKS is significantly higher if both knees were affected (p-value 0.036) as compared to either to the left or right knee only. The results for the duration of symptoms show that the average Oxford Knee Score (OKS) was higher for patients who had a longer duration of symptoms.

The results below are from a linear regression assessing the relationship between the BMI and the average OKS. First, to make the intercept meaning in this case we subtracted average BMI from the actual BMI. This allows the interpretation of intercept as the average OKS for a person with average BMI of 30.6. The result indicates that there is significant positive relationship between the BMI and the OKS. The average OKS for the person with average BMI is 25.4.

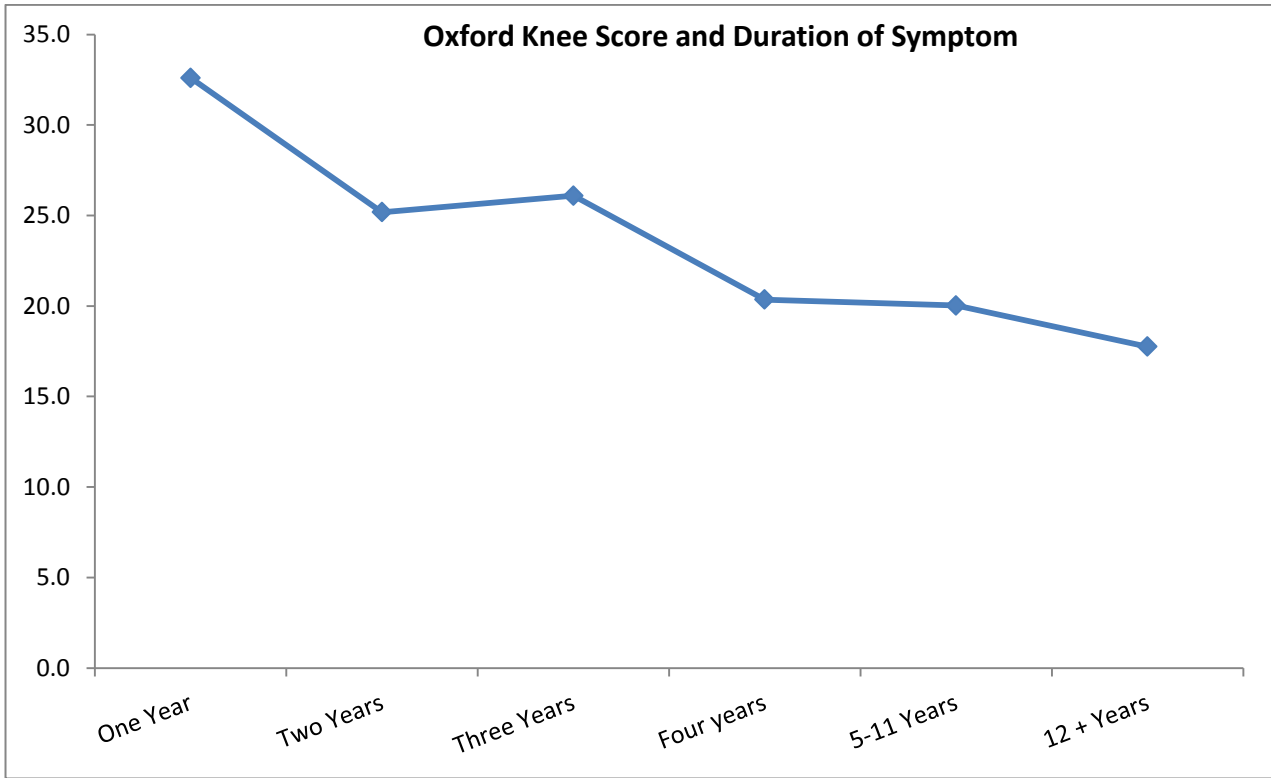|	Coefficient	Std. Err.	p-value	95% CI	
BMI	0.44	0.1659909	0.009	0.11	0.77
Intercept(30.6)	25.41	0.9355528	0.000	23.55	27.26

Figure 10: Oxford Knee Score and duration of symptoms of knee osteoarthritis

Clinical Knee Examination

Patients were examined for joint line tenderness, effusion and crepitus. Crepitus was the most frequent finding, with 85.3% of the patients eliciting patello-femoral crepitus and 75.6% of the patients eliciting tibio-femoral compartment crepitus. Joint line tenderness was elicited in 67.07% of the patients while joint effusion was the least frequent, found only in 25% of the patients examined.
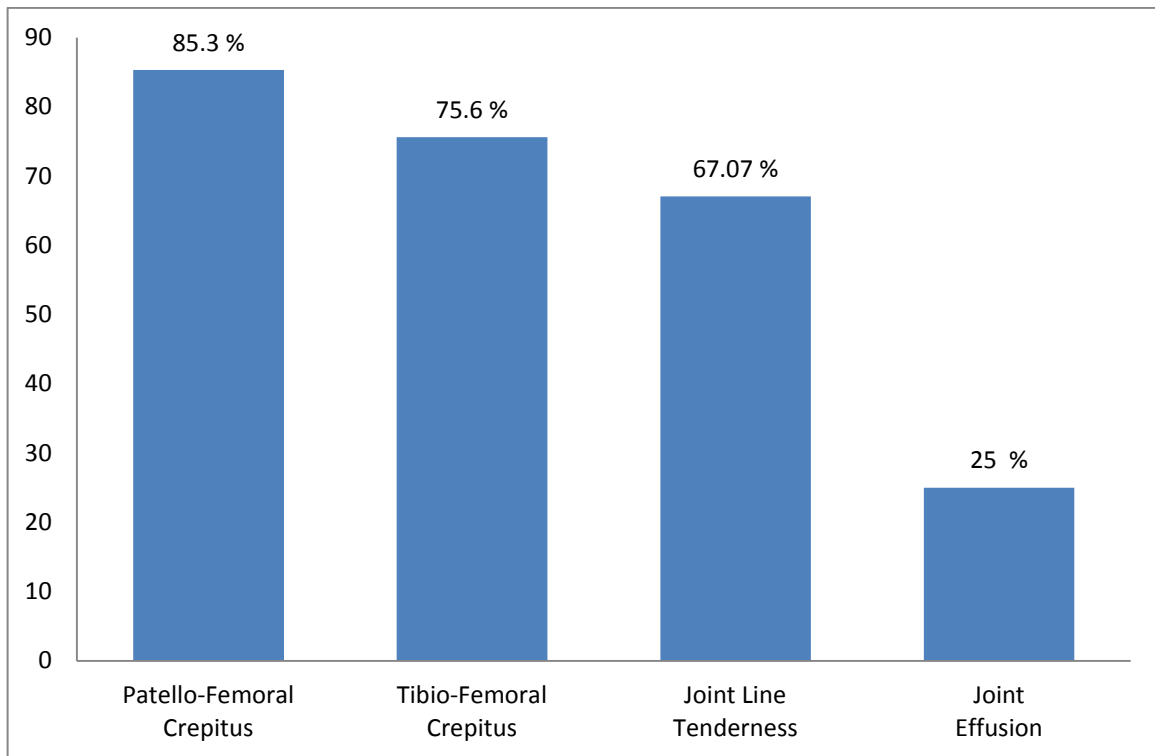
Figure 11: Clinical knee examination

Knee Goniometry

The average range of motion of the knee is accepted to be $0 - 140°$ with a normal Q angle of $14°$ in males and $17°$ in females. [45] There was an average loss of passive flexion of $18 \pm 12.8°$ and loss of active flexion of $24.1 \pm 13.0°$ on the right knee with an average passive extension loss of $1.8°$ and active extension loss of $4.4°$. On the left knee, there was an average passive flexion loss of $21.8 \pm 23.3°$ and an active flexion loss of $28.1 \pm 23.1°$ with an average passive extension loss of $2.1°$ and an active extension loss of $4.5°$. The average Q angle of the right knee was $10.7°$ and of the left knee was $9.1°$ showing a deformity towards a varus knee in most of the patients examined.

	Range		Average		Inter-quartile Range		
	Min	Max	Mean	SD	Lower Quartile	Median	Upper Quartile
Right Knee passive Flexion	71.0	142.0	122.0	12.8	117.0	124.0	130.0
Right Knee active Flexion	68.0	140.0	115.9	13.0	110.0	119.0	124.0
Right Knee Passive Extension	-10.0	45.0	1.8	6.7	-2.0	2.0	5.0
Right Knee Active Extension	-8.0	55.0	4.4	7.3	1.0	4.0	8.0
Right Knee Q-angle	0.0	26.0	10.7	5.5			
Left Knee Passive Flexion	70.0	145.0	118.2	23.3	112.0	122.0	132.0
Left Knee Active Flexion	68.0	140.0	111.9	23.1	108.0	117.0	125.0
Left Knee Passive Extension	-8.0	26.0	2.1	6.1	-2.0	2.0	6.0
Left Knee Active Extension	-6.0	28.0	4.5	6.2	0.0	5.0	8.0
Left Knee Q-angle	0.0	22.0	9.1	5.3			

Table 4: Knee Goniometry

DISCUSSION

Osteoarthritis of the knee is a debilitating disease and although Kenya has a relatively young population, as the proportion of people who are above the age of 50 slowly increases[50], the impact of osteoarthritis will become more and more evident. This should raise concerns about the education of the masses on the identification as well as options of treatment for osteoarthritis of the knee.

This study shows, and as is noted in reports elsewhere[5 – 11], that females predominate in osteoarthritis of the knee as compared to males, although that proportion changes as the age increases. The sex ratio of males to females with knee osteoarthritis was found to be 1:4 in this study which co-relates well with several studies showing that osteoarthritis occurs more frequently in females than in males. [9, 14]

The mean age of patients was noted to be 60.2 ± 11.2 years which corresponds to most of the studies undertaken in Africa [5 – 9]. This finding supports the fact that knee osteoarthritis is age related [5] and also relates to the findings of Aderonke et al [12, 14] who also reported peak prevalence of symptomatic knee osteoarthritis in the $60 – 69$ years age group.

The occupation of the recruited patients corresponded well with the association of manual labour with development of knee osteoarthritis [28, 29, 30]. A full 68.2% of the patients were made up of farmers and housewives with the rest made up by itinerant traders as well as white collar jobs such as the civil service. A large number of workers in Kenya are part of the agricultural or informal sector which by necessity requires manual labour, it is to be expected as the penetration of health delivery begins to permeate through the country, as well as by the improving life expectancy [51], the burden of knee osteoarthritis will increase. This will necessitate adequate resource allocation and planning so as to alleviate the morbidity and economic loss that would accrue from the accumulation of these patients. The burden of care for this group of patients will

steadily rise and will put an increasing pressure on equitable allocation of resources especially when competing with the focus on primary health care and infectious diseases within the developing countries such as ours. [53]

Obesity or as yet unknown factors associated with obesity have an association with development of osteoarthritis. The association between weight and knee osteoarthritis was stronger in women than in men.[54] Obesity also has an impact on progression of the disease process. In this study, the average Body Mass Index (BMI) was found to be 30.7 with a median BMI of 29.9. According to established standards,[55] a BMI between 20 and 25 is understood to be normal while between 25 and 30 is indicative of overweight while above 30 is obese. A large majority of the patients would then be classified as either overweight or obese. This could conceivably be a target for management by encouraging patients to lose weight and lead a healthier lifestyle. The paradox is that the knee osteoarthritis often limits the patient's mobility or completely prevents an active, pain free life. Although no standard exercise protocols or regimes exist or have been validated, it is clear that whether the regime chosen is resistance training, aerobic exercises or a health education programme, a modest improvement in pain and disability results with a concurrent improvement in BMI towards a healthier level.[56]

The oxford knee scores have been extensively used since they were introduced in 1996 and 1998.[58] They were designed to be a primary measure of outcome when doing randomised clinical trials to compare pre and post-operative outcomes for knee replacement surgery. It may also be used to filter patients for a knee replacement. The score ranges from zero (0) which is the worst, to forty eight (48), which is the maximal score. A score of 0 – 19 would indicate severe arthritis which may require surgical intervention, a score 20 to 29 indicates moderate to severe arthritis, 30 – 39 indicates mild to moderate arthritis while 40 – 48 indicates satisfactory joint function.[59] The average OKS obtained in the study was 22.5 with a median score of 22 as well indicating that a large number of the patients are close to crossing the threshold for knee

replacement. When the OKS is charted against duration of symptoms, it showed a linear relationship with the score worsening over time.

Joint line tenderness and crepitus were the most common signs of knee osteoarthritis with 67.07% and 80.45% presenting with those signs respectively. Joint effusion was relatively infrequent with only 25% of the patients presenting with that sign.

There was a greater loss in flexion of the knee than loss in extension. The average loss of flexion was 18° on the right and 21.8° on the left while extension loss was 1.8° on the right and 2.1° on the left. This greater flexion loss in range of motion fits in with other studies done on range of motion changes in knee osteoarthritis with one study done in Nigeria showing a flexion loss of $24.0 \pm 14.8°$ and an extension loss of $1.2 \pm 4.4°$.[60] Quadriceps angle was tending towards a varus deformity with the average Q-angle on the right being $10.7 \pm 5.5°$ while on the left it was $9.1 \pm 5.3°$ while the expected normal is between 14 - 17°.

CONCLUSION

The results and the discussion above serve to show the similarities in the local pattern and presentation of knee osteoarthritis with studies done in other populations.

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Appendix I : Data Questionnaire

Data Collection Sheet		Serial Number: 001
		Date: / /2012
Age:	Sex: ❑ M ❑ F	
Occupation:	❑ Farmer ❑ Housewife ❑ Civil Servant ❑ Vegetable trader ❑ Self employed ❑ Other, specify _____	
Weight (kg):	Height (m):	BMI (kg/m^2):

Patients subjective Knee Assessment
Year of onset of symptoms:
Duration of symptoms(months):
What brought the patient to Hospital: ❑ Pain ❑ Deformity ❑ Activity of daily living affected ❑ Referred from peripheral health centre ❑Other, specify:

Knee affected:	❑ Left ❑ Right ❑ Bilateral Which was the Index Knee: ❑ Left ❑ Right	
Use of assistive device:	❑ None ❑ Walking stick ❑ Knee Brace ❑ Crutches	❑ Walking frame ❑ Wheelchair ❑ Bedridden
Medication given: tick all that apply	❑ None ❑ Traditional remedies ❑ Paracetamol ❑ Topical NSAIDs Others_____	❑ Oral NSAIDs ❑ Opioids ❑ Glucosamine/Chondroitin ❑ Calcium supplements

Data Collection Sheet		Serial Number: 001
		Date: / /2012

The Oxford Knee Score (English)

Please answer the following 12 multiple choice questions. Tick one box for every question.

During the past 4 weeks......

1. How would you describe the pain you **usually** have in your knee?

❑	❑	❑	❑	❑
None	Very mild	Mild	Moderate	Severe

2. Have you had any trouble washing and drying yourself (all over) **because of your knee**?

❑	❑	❑	❑	❑
No trouble at all	Very little trouble	Moderate trouble	Extreme difficulty	Impossible to do

3. Have you had any trouble getting in and out of a car or using public transport **because of your knee**?

❑	❑	❑	❑	❑
No trouble at all	Very little trouble	Moderate trouble	Extreme difficulty	Impossible to do

4. For how long have you been able to walk before **pain from your knee** becomes severe? (with or without a stick)

❑	❑	❑	❑	❑
No pain/more than 30 minutes	16 to 30 minutes	5 to 15 minutes	Around the house only	Not at all – pain severe

5. After a meal (sat at a table), how painful has it been for you to stand up from a chair **because of your knee**?

❑	❑	❑	❑	❑
Not at all painful	Slightly painful	Moderately Painful	Very painful	Unbearable

Data Collection Sheet		Serial Number: 001
		Date: / /2012

6. Have you been limping when walking, **because of your knee**?

❑	❑	❑	❑	❑
Rarely/never	Sometimes, or just at first	Often, not just at first	Most of the time	All of the time

7. **Could** you kneel down and get up again afterwards?

❑	❑	❑	❑	❑
Yes, easily	With little difficulty	With moderate difficulty	With extreme difficulty	No, impossible

8. Have you been troubled by **pain from your knee** in bed at night?

❑	❑	❑	❑	❑
No nights	Only 1 or 2 nights	Some nights	Most nights	Every night

9. How much has **pain from your knee** interfered with your usual work (including housework)?

❑	❑	❑	❑	❑
Not at all	A little bit	Moderately	Greatly	Totally

10. Have you felt that your knee might suddenly 'give way' or let you down?

❑	❑	❑	❑	❑
Rarely/never	Sometimes, or just at first	Often, not just at first	Most of the time	All of the time

11. Could you do the household shopping **on your own**?

❑	❑	❑	❑	❑
Yes, easily	With little difficulty	With moderate difficulty	With extreme difficulty	No, impossible

12. **Could** you walk down one flight of stairs or down a hill?

❑	❑	❑	❑	❑
Yes, easily	With little difficulty	With moderate difficulty	With extreme difficulty	No, impossible

Total Knee Score:

Data Collection Sheet		Serial Number: 001
		Date: / /2012

The Oxford Knee Score (Kiswahili)

Tafadhali jibu hizi maswali yafuatavyo. Weka alama kwenye nafasi moja kwa kila swali.

Katika wiki nne iliyopita......

1. Uchungu kwenye magoti kwa kawaida ni kiasi gani?

❑	❑	❑	❑	❑
Hakuna	Kidogo sana	kiasi	zaidi	Mingi sana

2. Je, una matatizo yoyote ya kuosha na kukausha mwili kwa sababu za magoti?

❑	❑	❑	❑	❑
Hakuna	Kidogo sana	Kiasi	Zaidi	siwezi

3. Je, una matatizo yoyote kupanda ama kushuka kutoka gari ama matatu kwa sababu ya goti lako?

❑	❑	❑	❑	❑
Hakuna	Kidogo sana	Kiasi	Zaidi	siwezi

4. Unaweza kutembea kwa muda gani kabla ya maumivu ya goti yako kukuwa kali? (pamoja na au bila fimbo)

❑	❑	❑	❑	❑
Hakuna/zaidi ya dakika 30	Dakika 16 - 30	Dakika 5 - 15	Kwenye nyumba peke yake	Uchungu mwingi - siwezi

5. Baada ya chakula, unapata uchungu kiasi gani unaposimama kutoka kiti mezani?

❑	❑	❑	❑	❑
Hakuna uchungu kabisa	Uchungu kidogo	Uchungu kiasi	Uchungu mingi	Siwezi kuvumilia

6. Umelemewa kutembea kwa sababu ya magoti?

❑	❑	❑	❑	❑
Silemewi	Mwanzoni/ kidogo	Wakati zaidi, sio mwanzoni tu	Wakati mwingi	Kila wakati

Data Collection Sheet		Serial Number: 001
		Date: / /2012

7. Je, unaweza kuchuchuma na kusimama tena?

❑	❑	❑	❑	❑
Ndio, bila tatizo	Tatizo kidogo	Tatizo kiasi	Tatizo zaidi	La, siwezi

8. Je, uchungu kwenye magoti inakuamsha usiku?

❑	❑	❑	❑	❑
La	Usiku 1 or 2	Usiki kadha	Usiku nyingi	Kila usiku

9. Uchungu kwenye magoti imepunguza uwezo wa kufanya kazi (pamoja na ile ya nyumbani)?

❑	❑	❑	❑	❑
La	kidogo	Kiasi	Zaidi	Kabisa

10. Umehisi kwamba goti inaweza kwa ghafla "kuteleza"

❑	❑	❑	❑	❑
Silemewi	Mwanzoni/ kidogo	Wakati zaidi, sio mwanzoni tu	Wakati mwingi	Kila wakati

11. Unaweza kuenda markiti na kununa vitu vya nyumba peke yako?

❑	❑	❑	❑	❑
Ndio, bila tatizo	Tatizo kidogo	Tatizo kiasi	Tatizo zaidi	La, siwezi

12. Unaweza kushuku ghorofa mmoja ama zaidi ya ngazi ama kushuka mlima?

❑	❑	❑	❑	❑
Ndio, bila tatizo	Tatizo kidogo	Tatizo kiasi	Tatizo zaidi	La, siwezi

Total Knee Score:

Data Collection Sheet		Serial Number: 001
		Date: / /2012

7. Je, unaweza kuchuchuma na kusimama tena?

☐   ☐   ☐   ☐   ☐

Ndio, bila tatizo   Tatizo kidogo   Tatizo kiasi   Tatizo zaidi   La, siwezi

8. Je, uchungu kwenye magoti inakuamsha usiku?

☐   ☐   ☐   ☐   ☐

La   Usiku 1 or 2   Usiki kadha   Usiku nyingi   Kila usiku

9. Uchungu kwenye magoti imepunguza uwezo wa kufanya kazi (pamoja na ile ya nyumbani)?

☐   ☐   ☐   ☐   ☐

La   kidogo   Kiasi   Zaidi   Kabisa

10. Umehisi kwamba goti inaweza kwa ghafla "kuteleza"

☐   ☐   ☐   ☐   ☐

Silemewi   Mwanzoni/ kidogo   Wakati zaidi, sio mwanzoni tu   Wakati mwingi   Kila wakati

11. Unaweza kuenda markiti na kununa vitu vya nyumba peke yako?

☐   ☐   ☐   ☐   ☐

Ndio, bila tatizo   Tatizo kidogo   Tatizo kiasi   Tatizo zaidi   La, siwezi

12. Unaweza kushuku ghorofa mmoja ama zaidi ya ngazi ama kushuka mlima?

☐   ☐   ☐   ☐   ☐

Ndio, bila tatizo   Tatizo kidogo   Tatizo kiasi   Tatizo zaidi   La, siwezi

Total Knee Score: ☐

Data Collection Sheet		Serial Number: 001
		Date: / /2012

Clinical Knee Examination		
	Right Knee	**Left Knee**
Joint Line Tenderness	❑	❑
Joint Effusion	❑	❑

Joint Crepitus
          Patello-femoral
          Tibio-femoral
	❑
	❑
		❑
		❑

Knee Goniometry		
Active Flexion	°	°
Passive Flexion	°	°
Active Extension	°	°
Passive Extension	°	°
Q-angle	°	°

Appendix II: Consent (English)

<u>**CONSENT BY THE PARTICIPATING PATIENT/GUARDIAN**</u>

Study Title: Patterns of presentation of knee osteoarthritis at the Kenyatta National Hospital

Study No.:

Hospital No.:

This study is being carried out by Dr. Mohamed Arif Baradia, a post-graduate student in the Department of Orthopaedic Surgery in the University of Nairobi.

PURPOSE OF THE STUDY

The purpose of this study is to document the various clinical patterns of presentation of osteoarthritis of the knee in patients presenting to the Kenyatta National Hospital. The information gathered within this study will be used to provide better care to the patients with osteoarthritis of the knee and help in future health care planning.

RISKS AND BENEFITS

There is no harm and/or risk in participating in this study. Detailed information will be ascertained from your history and a complete knee exam will be done as part of the study. No blood/blood product or invasive test will be performed. There will be no additional cost to you for participating.

VOLUNTARY PARTICIPATION

Participation in this study is completely voluntary and you may decline/terminate participation at any time with no consequence to your continued treatment at the hospital whatsoever.

CONFIDENTIALITY

All data collected within the study will be stripped of identifying or personal information as per the guidelines laid out by the Council for International Organizations of Medical Sciences.

I, _____ have understood the purpose of the study as explained to me; and accept to participate in this study voluntarily and of my own free will.
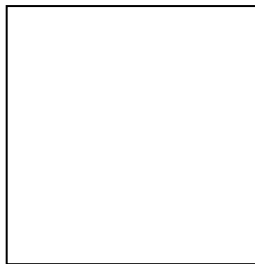
_____
Signature of Patient/Guardian   Thumbprint

_____   _____
Date   Signature of Witness

_____
Telephone/Contact

For any enquiries or further information, please do not hesitate to contact:

Dr. Mohamed Arif Baradia

     Principal study researcher

     0722 22 333 4 / 0734 22 333 4

The Chairman,

     Kenyatta National Hospital Ethics and Research Committee

     020-2726300 Ext 44355

Appendix III: Consent (Kiswahili)

<u>**CONSENT BY THE PARTICIPATING PATIENT/GUARDIAN**</u>

Study Title: Patterns of presentation of knee osteoarthritis at the Kenyatta National Hospital

Nambari:

Namba ya Hospitali.:

Utafiti huu unafanywa na daktari Mohamed Arif Baradia, mwanafuzi wa upasuaji wa mifupa katika chuo kikuu cha Nairobi.

Lengo la utafiti

Lengo la utafiti huu ni kujua vile "arthritis" ama kuharibika kwenye goti inatokea kwenye wagonjwa wanaoasili kweye hospitali kuu ya Kenyatta. Taarifa zitakazokusanywa ndani ya utafiti huu utatumika kutoa huduma bora kwa wagonjwa na "arthritis" ya goti na kusaidia katika mipango ya baadaye huduma ya afya.

Hasara ama Faida

Hakuna madhara au hatari kwa kushiriki katika utafiti huu. Hakutakuwa na gharama za ziada kwako kwa ajili ya kushiriki.

Kushiriki kwa hiari

Kushiriki katika utafiti huu ni kwa hiari yako mwenyewe na unaweza kupungua ushiriki wakati wowote bila kunyimwa matibabu wowote katika hospitali.

Usiri

Historia na majibu yako yote yatawekwa vizuri ili zisijulikane na mtu mwingine kulingana na sharia zilizopangwa na baraza la mashirika ya kimataifa ya sayansi ya madawa pamoja na Shirika la Afya Duniani (WHO).

Mimi, _____ mwenye kuweka sahihi/kidole changu hapa chini, nimeelezwa na kuelewa yaliyoandikwa hapa na nimekubali kwa hiari yangu kujiunga katika utafiti huu.

_____
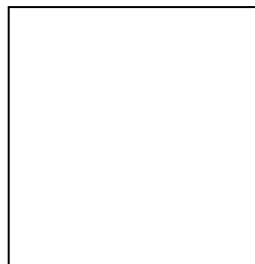
Sahihi ya mgonjwa/mlinzi   Kidole

_____   _____

Tarehe   Sahihi ya shahidi

_____

Simu ya mgonjwa/mlinzi

Kwa maswali yeyote kuhusu utafiti huu, tafadhali wasiliana kwa simu na:

Dr. Mohamed Arif Baradia

    Mchunguzi mkuu

    0722 22 333 4 / 0734 22 333 4

Mkurugenzi,

    Kenyatta National Hospital Ethics and Research Committee

    020-2726300 Ext 44355