RISK FACTORS AND SOCIO-ECONOMIC BURDEN OF CHRONIC OSTEOMYLITIS AMONGST PATIENTS ADMITTED ON SURGICAL WARD OF KAMPALA INTERNATIONAL UNIVERSITY TEACHING HOSPITAL

BY

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DECLARATION

I **Kalinzi Deo** hereby declare that the work presented in this report for the award of bachelor of medicine and bachelor of surgery degree of Kampala International University is original except where references are cited. This work has not been presented in part or fully to any university, institution or college for the award of any academic qualification.

Signature……..Date……...

Kalinzi Deo (MBChB Candidate)

REPORT APPROVAL

I **Dr. Lule Herman,** the supervisor of **Kalinzi Deo** do certify that this research report developed under my supervision is now ready for submission to the faculty of medicine and dentistry of Kampala International University.

Signature ……..Date……..

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LIST OF ACRONYMS

CD4	Cluster of differentiation 4
COI	Cost of illness
HIV/AIDS	Human immunosuppressive virus
HT	Hypertension
KIUTH	Kampala international university teaching hospital
MCH	Mother Child health
OPD	Outpatient department
T.B	Tuberculosis
SCD	Sickle cell disease
CRP	C-reactive proteins
ESR	Erythrocyte sedimentation rate
DM	Diabetes mellitus
CBC	Complete blood count
IV	Intravenous

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ABSTRACT

Background: Chronic osteomyelitis is a severe, persistent and sometimes incapacitating infection of the bone or bone marrow caused by bacteria or fungal infection when enters bone tissue from bloodstream, due to injury or surgery with Staphylococcus aureus as the leading cause followed by haemophilus influenza and salmonella infection in sickle cell patient (Schmitt, 2017).

Methodology: A retrospective data collection method was used and files of 400 patients who were admitted on surgical ward in Kampala international university teaching hospital from June 2012 to July 2017 were reviewed. Questionnaires were filled and Microsoft word was used to analyze data. The data was presented in form of pie charts, Bar graphs, frequency table.

Results: There were 285(71.25%) males and 115(28.75%) females, 60% of the patients were between 16-30years of age, and 77.5% of patients come from rural areas, urban areas accounted for 22.5% and 70% of them unemployed with biggest percentage of 60% primary drop outs. The risk factors for chronic osteomyelitis noted among patients included upper respiratory tract infections with 43%, 25% trauma, 10% HIV/AIDs, 8% surgery, 7% poor hygiene, 2%DM, 0.05% SCD among others were noted. 85% of patients were diagnosed using x-ray, 5%blood culture which indicated staphylococcus aureus as the cause and salmonella in SCD with CBC, CRP and ESR as baseline investigations were used scoring 8% and 2%MRI. Antibiotics including ceftriaxone, flucamox and cloxacillin in 36% patients and sequestrectomy in 62% of patients plus amputation in 1% of patients were used as management modalities. 50% of patients were hospitalized for 3months with a charge between 131.6-263.2 US dollars on discharge , 35% for one month charged between 52.6- 131.6 US dollars followed by 10% six months with a charge of 263.2 -789.5 US dollars and 5% > six months were the least charged >789.5 US dollars. 70% ended up with inability to walk, 20% with pathological fractures, 6% internal fixators and 4% had no complications.

Conclusion: chronic osteomyelitis is still a socio-economic burden with catastrophic and irreversible complications which needs effective and urgent preventive and curative measures within the community.

CHAPTER ONE

1.0 Introduction

Osteomyelitis is an infection and inflammation of the bone or the bone marrow(Schmitt, 2017). This chapter consists of background information about chronic osteomylitis, problem statement, and justification, of the problem, study objectives, research questions and scope of the study.

1.1 Back ground:

Osteomyelitis can happen if a bacterial or fungal infection enters the bone tissue from the bloodstream, due to injury or surgery(Schmitt, 2017)**.**Staphylococcus is the organism responsible for 90% of cases of acute and chronic osteomyelitis (Kalinka et al., 2014). Other organisms include, Haemophilus influenzae and salmonella infection with the latter may occur as a complication of sickle cell anemia.

Haematogenous osteomyelitis begins with entry of bacteria through a break in the skin or mucosa from otitis, pharyngitis, respiratory tract infections, or urinary tract infections, the physiological status of the host is a determinant factor(Marais, Ferreira, Aldous, & Le Roux, 2014). Most often the bacteria are staphylococcus, but in sickle-cell children, both salmonella and staphylococcus are implicated. The bacteria are haematogenously disseminated and deposited in the trabecular bone or marrow, usually in the metaphysis of the proximal tibia or distal femur. Sluggish blood flow in the metaphysis provides an ideal milieu for bacterial replication. The pus under pressure escapes outward through Volkmann and Haversian canals and then spreads subperiosteally, stripping the cortex of its periosteal blood supply(Cohen, Lifshitz, Fruchtman, Eidelman, & Leibovitz, 2016)

Without either endosteal or periosteal blood supply, the cortex becomes nonviable bone called sequestrum. As the devascularised cortex is being absorbed, the inner surface of the periosteum produces new bone, called involucrum (Ferguson & Sandu, 2012).

Chronic osteomylitis is a debilitating dirty disease endemic in peasantry communities associated with major source of morbidity and mortality, increasing poverty (Ibingira et al 2004). Direct medical charges per episode of staphylococcus osteomyelitis, including average hospital facility charges, professional fees, and post discharge costs, was estimated to 35,000 dollars in 1995 in a New York hospital; no specification of IV or oral (PO) therapy , 135-263 dollars/day for

outpatient intravenous antimicrobial therapy versus cost of oral doses of antibiotics(Gomes, Pereira, & Bettencourt, 2013)

Imaging studies(Radiologic imaging, magnetic resonance imaging, bone scintigraphy) demonstrating contiguous soft tissue infection or bony destruction and the diagnostic criteria includes: clinical signs, exposed bone, persistent sinus tract, tissue necrosis overlying bone, chronic wound overlying surgical hardware, chronic wound overlying fracture in addition to a positive blood culture, elevated C-reactive protein level and elevated leucocytes(Ferguson & Sandu, 2012)

Recognition of the imaging features of osteomyelitis requires a good understanding of its pathogenesis. In this review, the key imaging findings in osteomyelitis are correlated with the underlying pathological processes. There is a particular emphasis on magnetic resonance imaging (MRI), which is the best available imaging modality owing to its high sensitivity for detecting early osteomyelitis, excellent anatomical detail and superior soft tissue(Lee, Sadigh, Mankad, Kapse, & Rajeswaran, 2016). Direct sampling of the wound for culture and antimicrobial sensitivity is essential to target treatment. The increased incidence of methicillin-resistant Staphylococcus aureus osteomyelitis complicates antibiotic selection, particularly in developing countries where there are limited diagnostic laboratories. Surgical debridement is usually necessary in chronic cases, but this surgery requires expertise that the socioeconomically poor clients are often unable to afford. In developing countries like Uganda, the recurrence rate remains high despite surgical intervention and long-term antibiotic therapy. Acute hematogenous osteomyelitis in children typically can be treated with a four-week course of antibiotics whereas in adults, the duration of antibiotic treatment for chronic osteomyelitis is typically several weeks longer with challenges of loss to follow-up and non-adherence. In both situations, however, empiric antibiotic coverage for S. aureus is indicated. The risk factors to chronic osteomyelitis, overall cost for investigations, surgery, admission and antibiotic therapy is however poorly documented in Uganda, which the present study seeks to address.

1.2 PROBLEM STATEMENT

Chronic osteomylitis remains a major global and local health burden and problem affecting all ages but more common in children irrespective of the sex and race. The burden of chronic osteomyelitis disproportionately affects African countries where poor hygiene, HIV/AIDS, Sickle cell disease, respiratory tract infections, surgery, trauma and diabetes mellitus are potential risk factors(Chihara & Segreti, 2010). Age 3month -12 years is another important risk factor in the development of chronic osteomyelitis (Andre, Khonsari, Ernenwein, Goudot, & Ruhin, 2017) The resultant body deformities and death due to chronic osteomyelitis leave many families still lying below poverty line as the cost and duration of management affect directly the family socio-economic status; widening the gap between the poor and the rich that needs to be addressed with definitive solutions. However the exact risk factors and socio-economic impact of this disease in our local community is poorly documented

1.3 JUSTIFICATIN OF THE STUDY

This study seeks to contribute to the existing body of knowledge regarding modifiable risk factors for chronic osteomyelitis in our local context and the extent of economic burden the disease imposes on the affected communities. Knowledge of risk factors to chronic osteomyelitis is prerequisite for designing successful preventive strategies and holistically addressing the morbidity attributable to the disease in order to enhance productivity and economic empowerment of affected communities.

1.4 PURPOSE OF THE STUDY

1.4.0 General objective

The study was to determine the risk factors and socio-economic burden of chronic osteomylitis in patients admitted on surgical ward in kampala international university teaching hospital

1.4.1 Specific objectives

(i) To determine the risk factors associated with chronic osteomylitis in patients admitted on surgical ward in KIUTH

(ii) To assess the socio-economic burden of chronic osteomylitis to patients admitted on surgical ward in KIUTH

(iii) To determine the commonest management modalities of chronic osteomyelitis amongst patients admitted on surgical ward in KIUTH

1.5 RESEARCH QUESTIONS

(i) What are the risk factors associated with chronic osteomylitis in patients admitted on surgical ward in KIUTH

(ii) What is the socio-economic burden of chronic osteomylitis to patients admitted on surgical ward in KIUTH?

(iii) What are the commonest modalities used in management of chronic osteomyelitis among patients admitted on surgical ward in KIUTH

1.6Scope of the Study

1.6.1 Time scope

The study analyzed the pre-hospital risks for chronic osteomyelitis just before the infection takes place up to when a definitive surgical intervention was made and a patient is discharged.

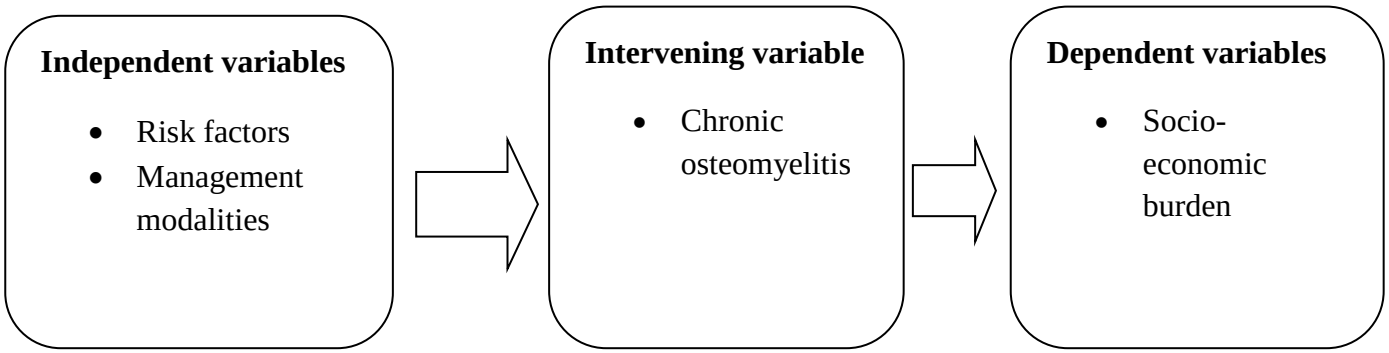
1.6.2 Content scope

The study mainly concentrated on risk factors and socio-economic burden of chronic osteomylitis to patients attending to in patients admitted on surgical ward in KIUTH.

1.6.3 Geographical scope

There was need for research to be done in the entire Uganda but because of limited resources, this study was conducted in patients admitted on surgical ward of Kampala international university teaching Hospital. Because the hospital receives patients from both rural and semi-urban areas of bushenyi, sheema, kasese districts, the findings were presumed to be representative to the general population.

1.6.4 Conceptual framework



CHAPTER TWO

LETRITURE REVIEW

2.0 Introduction

The literature review was addressed in accordance to the specific objectives of the study and logically illustrates how each specific objective is analyzed globally, regional and nationally.

Around 80% of cases develop because of an open wound, bone infections commonly affect the long bones in the leg and upper arm, the spine, and the pelvis (Antonio Loro head of orthopeadics department CoRSU Hospital 15th February 2016).Chronic osteomyelitis is estimated to affect 2 out of 10000 people in the Unit states (Lito, Lomessy, Vaudaux, & Uçkay, 2015). Study conducted in Uganda by Ibingira et al., 2003, One hundred and twenty patients with chronic osteomyelitis seen in a period of six years, involving various bones of the body. Forty five percent were females, the highest incidence occurred in the age range of 10 - 19 years. The commonest etiological history was by pricks. The bones most frequently affected were phalanges (43.3%) followed by the tibia (21.6%). Forty four percent of these patients first used local herbs before going to hospital. Fifty five percent of the patients were found to have a big spleen of not less than 12cm below the costal margin and the best treatment option was sequestrectomy and curettage with empirical administration of antibiotics. Children diagnosed with chronic osteomyelitis at 3 tertiary care centers in the United States between 1985 and 2009 were identified. Their charts were reviewed and clinical, laboratory, histopathologic, and radiologic data were extracted and results showed that seventy children with chronic osteomyelitis (67% female patients) were identified. Median age at onset was 9.6 years (range 3-17), and median follow-up was 1.8 years (range 0-13). Half of the patients had co-morbid autoimmune diseases, and 49% had a family history of autoimmunity.(Borzutzky et al., 2012)

Chronic haematogenous osteomyelitis in children is now rare in industrialized nations, but continues to be debilitating bone infection and a significant cause of morbidity globally. No accurate data on the incidence and prevalence exists, but there are a number of studies that illustrate indirectly the extent of the disease(Olson & Horswill, 2013). The incidence of septic arthritis in a district of Malawi has been estimated as 1 in 5000 per year in those aged under five and 1 in 13 000 in those aged between five and 15 years. The incidence of osteomyelitis is estimated to be half that of septic arthritis in children under two years, but the incidences are

approximately equal by the age of two. A recent survey of the orthopedics needs of children in Rwanda suggested that 3% were suffering from a musculoskeletal impairment due to infection. Nearly two billion children under the age of 18 live in developing countries, and 400 million in the least-developed countries, compared to only 200 million in industrialized countries. If the prevalence of musculoskeletal impairment due to infection across the least developed countries is similar to that in Rwanda, in these countries alone approximately12 million children are affected. Chronic osteomyelitis places a significant burden on the health services available in developing countries. In a review of pediatrics surgical services at the main government referral hospital in Banjul, Gambia, osteomyelitis accounted for 7.8% of pediatric surgical admissions and 15.4% of total in-patient days. An audit of surgical activity in Malawi revealed that, nationally, 3% of all procedures were related to osteomyelitis. A study conducted in Uganda indicated that Osteomyelitis was diagnosed in 325 (3.5%) of the surgical operations; in 32% of these operations the patients were children aged between 10 and 14 years. The tibia was the bone most frequently involved (31%), and sequestrectomy was the most frequent surgical procedure (60%). These findings suggest that osteomyelitis disproportionately affects the young, and is a burden on both clinical and surgical services(Stanley, Rutherford, Morshed, Coughlin, & Beyeza, 2010) A retrospective study from a specialist orthopaedics hospital in Malawi reported that 6.7% of all orthopaedic procedures in children were for chronic osteomyelitis, the majority being asequestrectomy (Stanley et al., 2010).

To estimate the clinical burden of osteomyelitis they systematically sampled the medical records of orthopaedic clinics at five hospitals in Uganda, they reviewed the diagnosis in 9354 operations conducted during a 1 year period at the same five hospitals. Of 1844 outpatients with a documented diagnosis sampled over 1 year, 187 (10%) had osteomyelitis. Only 20% of those with osteomyelitis were older than 20 years, whereas this age group accounted for 52% of patients with another orthopaedic diagnosis or no diagnosis ($P<0.001$). Osteomyelitis was diagnosed in 325 (3.5%) of the surgical operations; in 32% of these operations the patients were children aged between 10 and 14 years. The tibia was the bone most frequently involved (31%), and sequestrectomy was the most frequent surgical procedure (60%). These findings suggest that osteomyelitis disproportionately affects the young, and is a burden on both clinical and surgical services. To decrease this burden in populations treatment of osteomyelitis should be done in

centers with expertise in the treatment of this challenging disease.(Hogan, Heppert, & Suda, 2013)

In adults, osteomyelitis can either be acute or chronic. People with diabetes, HIV/AIDS or peripheral vascular disease are more prone to chronic osteomyelitis, which persists or recurs, despite treatment. Whether chronic or acute, osteomyelitis often affects an adult's pelvis or vertebrae of the spine in patient with the above conditions .It can also occur in the feet, especially in a person with diabetes ((Victoria) & Practice, 2013)

The signs and symptoms of osteomyelitis depend on the types which include; Pain which can be severe, and swelling, redness, and tenderness in the affected area, irritability, lethargy, or fatigue, Fever, chills, and sweating, drainage from an open wound near the infection site or through the skin .Other symptoms may include swelling of the ankles, feet, and legs, and changes in walking pattern, for example, a limp. There are three main types of osteomyelitis. Acute osteomyelitis: Infection develops within 2 weeks of an injury, initial infection, or the start of an underlying disease. The pain can be intense and the condition can be life-threatening. Sub-acute osteomyelitis: Infection develops within 1 to 2 months of an injury, initial infection, or the start of an underlying disease. Chronic osteomyelitis, infection starts at least 2 months after an injury, initial infection, or the start of an underlying disease.(Lito et al., 2015)

Chronic osteomyelitis and poverty are closely related. Poor hygiene, frequent bacteraemias due to inadequate dental care and skin lesions, host deficiencies and poor healthcare provision are the major factors that predispose children to the condition (Dodwell, 2013). Malnutrition, anemia, malaria and HIV infection are common in the tropics, and often co-exist. Environmental factors such as a hot climate and seasonal variations may also contribute to high levels of musculoskeletal sepsis. Sickle cell disease is common in sub-Saharan Africa, and these patients are particularly susceptible to acute skeletal infections, often caused by a non-typhoid salmonella species (Cheng et al., 2018).

A weakened immune system, due, for example, to chemotherapy or radiation treatment dialysis, having a urinary catheter, injecting illegal drugs, and so on ,Circulatory problems, as a result of

diabetes, peripheral arterial disease, or sickle cell disease. A deep puncture wound or a fracture that breaks the skin and Surgery to replace or repair bone.

Risk factors associated with chronic osteomylitis.

HIV/AIDS

According to [Wood et al., 2015], the incidence of HIV disease is high in most sub-Saharan countries. Intuitively, it would be expected that patients with a low CD4 count would be more susceptible to caused localized osteomyelitis and other musculoskeletal infections. There is some evidence that the overall burden of surgical sepsis has increased with the increasing prevalence of HIV, but there are no published data to confirm that haematogenous osteomyelitis is more common in HIV-positive children studies have recently shown that HIV disease may not be a contraindication to the fixation of open fractures. The implications of HIV disease with regard to treatment and prognosis, however, are unknown. The potential benefits of treatment with antiretroviral agents with regard to chronic haematogenous osteomyelitis are also unknown.

Chronic haematogenous osteomyelitis continues to affect many children throughout the world and it is a cause of severe morbidity and disability. Despite this, it is the subject of little current research.

Diabetes mellitus

Amongst patients who underwent standardized assessments where they monitored for all foot complications, defined infections by criteria consistent with International Working Group guidelines, and defined osteomyelitis as a positive culture from a bone specimen. Results showed that: “1666 persons were enrolled, 50% male, mean age 69years. Over a mean of 27.2 months of follow-up, 151 patients developed foot infections, 30(19.9%) of which involved bone. Independent risk factors for osteomyelitis were: wounds that extended to bone or joint (relative risk [RR] =23.1), previous history of a wound prior to enrollment (RR=2.2), and recurrent or multiple wounds during the study period (RR =1.9). results suggest that suggest that independent risk factors for developing osteomyelitis are deep , recurrent and multiple wounds” (Lavery et al., 2009).

Osteomyelitis of the foot in patients with diabetes was polymicrobial in 83 percent of patients with an average of 2.25 pathogens per patient. Infections in patients with diabetes are frequently

polymicrobial and the microbiology of diabetic osteomyelitis in the lower extremity follows this trend. Staphylococcus aureus, Staphylococcus epidermidis, Enterococcus and Streptococcus species were most commonly isolated from bone culture. (Lalani, 2016)

Salmonella osteomyelitis in patients without hemoglobulinopathy is quite uncommon. Osteal involvement is seen in only 0.8% of all Salmonella infection cases. The case of a 67-year-old diabetic woman who developed Salmonella osteomyelitis and subsequently underwent a surgical excision of a tibial lesion followed by two months of intravenous (IV) antibiotic therapy, the patient responded very well to the treatment(Pak & Pham, 2017)

Trauma

According to (k.sullivan, 2013), a total of 442 consecutive patients with chronic osteomyelitis (COM) were included. Males accounted for 336 (76%) of the cases. The mean age at the initial presentation was 18 years with a range of 1month to 84 years. The majority (68%) of patients came from rural areas. Discharging sinus was the commonest clinical presentation observed (411, 93%) followed by swelling (260, 59%), pain (240, 54%), limping (188, 42%), and limitation of movement (131, 30%). The disease started spontaneously in 70% (312) and it followed trauma in 27% (118). Tuberculosis osteotitis was proven in three of the suspected patients and the disease occurred post operatively in eleven patients. Compound fracture accounted for 93 (79%) of the post traumatic onset and the osteomyelitis followed simple fractures in 12 (10%) of the patients. More than half (230, 52%) of the patients visited bone setters in the course of their illness and “difficulties” at Hospitals were one of the main reasons (41, 18%).

Poor hygiene

Fusobacterium's exceptional ability to adhere to both gram-negative and gram-positive plaque microorganisms in biofilms (specifically in soft tissue) makes it a highly invasive microbe. Primarily given attention for its periodontal implications, strains of Fusobacterium have been identified as pathogen in many parts of the body as one of the causes vertebral osteomyelitis caused by fusobacterium species with bacteremia and sepsis syndrome that has been as a result of poor oral hygiene (Khatoon & Hunter, 2015).

Mandibular chronic osteomyelitis usually arises as a result of a long-standing odontogenic infection. In this study, however, the major predisposing factor was advanced periodontal disease which is common in the population studied. It was surprising that in spite of the large number of extractions performed for advanced periodontal disease, there were very few cases that were attributable to post-extraction infection. The low incidence of chronic osteomyelitis complicating mandibular fractures, the treatment of which was often delayed, might be due to routine administration of antibiotic in such cases.(E. et al., 2012)

Upper respiratory Infections

Frontal sinusitis which is due to upper respiratory infections is the most important predisposing factor for Cranial Osteomyelitis especially in children and young adults than in other age-groups. The predilection for this age-group is explained by the peculiarities of the development of frontal sinuses. Adolescents are likely to have highly vascular diploic bone, which increases valve less bidirectional flow between the frontal sinus mucosa and dural venous drainage. A cranial osteomyelitis was seen in 0.5–9% of patients with suppurative intracranial complications of paranasal by (Sliver, 2016)

As all other forms of Cranial Osteomyelitis, Pott's puffy tumor is reported as rare in the antibiotic therapy era, although, despite the use of broad-spectrum antibiotics, the number of cases reported has increased since 2000 (Akhaddar, 2016) . In 2012,141 cases of Pott's puffy tumor were reported in the world literature .This form of cranial osteomyelitis is more common in male and almost always confined to the second decade of life, more rarely in adults and newborns. The prevalence in young males is attributed to their larger diploic veins, which makes it easier for infections to spread. Besides the frontal sinus, the other paranasal sinuses should be taken into considerations: ethmoidal sinuses, maxillary sinuses .if not all paranasal sinuses (pansinusitis). Osteomyelitis of the calvaria can also spread from orbital, oral or dental infections. One of our patients developed an occipital osteomyelitis 3 weeks following a dental procedure.

Sickle cell disease

A total of 187 sickle cell patients were reviewed. Mean age of the study population was 6.95(plus or minus) 4.23. There were more males (105) than females (82) giving a male female ratio of 1.3:1. Out of the 187 subjects with sickle cell anemia 15 had osteomyelitis which accounted for a prevalence of 0.08%. Acute osteomyelitis accounted for 100% of cases.

Salmonella infections was commonest organism isolated from blood culture 5(33.3%). Fever, leg swelling and bone pains were the commonest mode of presentation. The Tibia bone was commonly involved 8(53.3%).The etiological organisms were sensitive to ceftazidine and gentamycin in 55% of the positive blood culture(George, Briggs, & Ihezie, 2011)

Twenty-seven patients with known sickle cell disease were included in this study complaining of acute painful vaso-occlusive crisis. All the patients complaining of bony pain in different body region(Khedr, Hassaan, Shabana, Gaballah, & Mokhtar, 2012)

Socio-economic burden of chronic osteomylitis

According to (Malizos & Poultsides, 2007) states that the number of reports examining the cost of Musculoskeletal disorders in the last two decades is small in comparison with the unanimous recognition that bone and joint infections induce major financial cost, and more severely, great human suffering. Raising awareness of the patient, the physician and the society in general is of paramount importance. Recognition of the burden of the musculoskeletal infections will result in greater awareness of the pervasive effect they have on the individual and of their cost to society. So estimating the burden will facilitate the process of setting appropriate priorities and adopting relevant strategies towards its reduction.

Direct medical and non-medical costs, for which actual payments are made, have an impact on both the patient and health services. They include treatment costs, hospital and medication costs, which can be divided into fixed and variable ones. Control of variable costs such as implants and supplies plays a predominant role in cost-containment programs. Personal payments such as the cost of transport to the health provider and specialist aids, as well as the building's opportunity cost consist the direct non-medical costs.(Stanley et al., 2010)

As for the costs due to loss of productivity no direct payment is actually made. They include morbidity costs, which consist of lost resources due to the patient's or a relative's absence from work, less production during the work shift, and early retirement due to illness. The mortality costs also reflect lost production (potential years of life loss and loss of productive years) due to premature death caused by a lethal infection.

The third category refers to psychosocial or intangible costs, which represent deterioration in the quality of the patient's life, as well as their families' and friends'. People with musculoskeletal

infections suffer from disability, pain, reduced self-esteem, and feelings of non-well-being, those being factors extremely difficult to quantify.

Management modalities and complications

The diagnosis and management is generally poor because the quality of published work to guide clinicians. Diagnosis should be based primarily on clinical signs supported by results of pathologic and radiologic investigations. Although the gold standard comes from the histological and microbiological examination of bone available evidence suggests that in many cases (excepting those in whom immediate surgery is required to save life or limb) a nonsurgical approach to management of osteomyelitis may be effective for many, if not most although experts have traditionally recommended surgical removal of infected bone (Game et al., 2013.)

The treatment of choice of this severe infective condition is represented by an aggressive radical debridement, bone fenestration, reaming, bone troughing, the Masque let-technique, segmental resection with callus distraction with the aim to drainage pus and to remove infective and non-vital tissue. In case of concomitant severe peripheral vascular disease any revascularization procedures, surgical or endoluminal, have to be performed once the local and systemic infection has been controlled. Surgical debridement has to be performed as soon as possible since any delay corresponds to an increase of the risk of major amputation and deaths(Hogan et al., 2013)

Plain radiograph still provide the best screening for acute and chronic osteomyelitis. There is a particular emphasis on magnetic resonance imaging (MRI), which is the best available imaging modality owing to its high sensitivity for detecting early osteomyelitis, excellent anatomical detail and superior soft tissue resolution (Lee et al., 2016). The decision to use oral or parenteral antibiotics should be based on results regarding microorganism sensitivity, patient compliance, infectious disease consultation, and the surgeon's experience which helps in quick management to avoid permanent deformity or loss of the limbs (Schmitt, 2017)

Choice of antibiotic therapy haematogenous osteomyeliti should be determined by culture and susceptibility results if possible, in the absence of such information, broad-spectrum, empiric antibiotics should be administered forexample clindamycin 600mg intravenous every 6 hours with alternative regimen of cefotetan 2 grams intravenous every 12 hours for anaerobic bacteria (Baker & Macnicol, 2008).

According to (Lima et al., 2014)stated the fifteen patients who had sickle-cell disease and osteomyelitis (affecting thirty bones) were treated with operative decompression and parenteral administration of antimicrobial treatment between 1973.and 1988. Organisms were isolated on culture of specimens of bone from all fifteen patients. Parenteral antibiotic therapy was continued for a minimum of six weeks after operative decompression. The osteomyelitis resolved in twenty-nine (97 per cent) of the thirty affected bones after follow-up ranging from two to fifteen years. With their compromised immune status and poor circulation of blood in bone, patients who have sickle-cell disease and osteomyelitis are prone to have complications.

Treatment of osteomyelitis is challenging particularly when complex multiresistant bacterial biofilm has already been established. Bacteria in biofilm persist in a low metabolic phase, causing persistent infection due to increased resistance to antibiotics. Staphylococcus aureus and Staphylococcus epidermidis are the most common causative organism responsible for more than 50% of osteomyelitis cases. Osteomyelitis treatment implies the administration of high doses of antibiotics (AB) by means of endovenous and oral routes and should take a period of at least 6 weeks. Local drug delivery systems, using non-biodegradable (polymethylmethacrylate) or biodegradable and osteoactive materials such as calcium orthophosphates bone cements, have been shown to be promising alternatives for the treatment of osteomyelitis(Gomes et al., 2013)

CHAPTER THREE: METHODOLOGY

3.0 RESEARCH METHODOLOGY

3.1 Study design

A retrospective study was used covering four years from 2017 July way back to 2012 June.

3.2 Study area

Kampala international university teaching hospital is a privately owned tertiary specialized hospital

Located in ishaka town along mbarara-kasese road in bushenyi district in western Uganda. It offers specialized services like orthopedic surgery and rehabilitation, physiotherapy, general surgery, imaging and laboratory services.

3.3 Study variables

Dependent variable; risk factors for chronic osteomylitis

Independent variable; socio-economic burden and management.

3.4 Study population selection

Kampala internal university teaching hospital receives about 200 patients who are admitted on different wards on a daily basis with an approximation of about 30 patients on surgical ward with different conditions chronic osteomyelitis inclusive. This means therefore that in a month surgical ward receives about 900 patients. So that will be the researcher's sample populations.

3.5 Sample size determination

The sample size of the study was obtained using Yamane

Formula (Yamane, 1967)

$$n = \frac{N}{1+N(e^2)}$$

Where

n= the expected sample size.

N=the total number of patients admitted on surgical ward in KIUTH in a month is 900; thus N= 54000 patients in 5 years of retrospective review.

e=is the standard error, 5%.

Substituting for N and e, n=398

3.6 Sampling technique

A consecutive review of case files technique was employed where 400 patients were selected due to limitation in time and funds. This ensures that the selected sample were representative of the whole population.

3.7 Inclusion and exclusion criteria

3.7.1 Inclusion criteria

Patients of all ages were considered.

Only patients records admitted in the period of June 2012 to June 2017 were considered.

3.8 Data collection methods

The data was collected using a data collection check list and the information will include the bio-data (age, gender), presumed risk factors to the disease, costs, duration of hospital stay, and complications to the patients caused by chronic osteomylitis.

The whole data collection process was done by the researcher and his research assistants.

3.9 Ethical consideration

i) Permission to carry out the study was sought from Kampala International University western campus from the concerned authorities in the administration and the research approval was done by the ethical review board of Kampala International University.

ii) A letter from the director of hospital services was obtained for introduction and for access to health center personnel. The letter was taken to the in-charge of records department where relevant information was taken.

iii) Confidentiality, anonymity and privacy was guaranteed

3.10 Data collection

Records both in soft copies and hard copies from surgical ward of all patients admitted and managed for chronic osteomylitis in duration of five years back were reviewed and data collected from them.

3.11 Data Management and analysis

Microsoft word was used to analyze data. The data was presented in form of pie charts, graphs, frequency table and cross tabulations which made it easy to describe the work.

3.12 Study limitations

Incomplete records were anticipated since data in case files were not intended for the current protocol. Also the study looked at cases only without their comparator controls to ascertain the presumed risk factors. Consecutive recruitment without random sampling could lead to selection bias

3.12 Quality control

Only case files with complete parameters of interest were considered. Large sample size was considered to compensate for non-random sampling

CHAPTER FOUR:

4.0 DATA COLLECTION AND ANALYSIS

4.1: INTRODUCTION

This chapter presents the data retrieved from the files of patients who were admitted in the period between June of 2012 to June of 2017 using questionnaires and analyzed in tables, graphs and pie-charts that includes patient's biodata, risk factors and socio-economic burden of chronic osteomyelitis, common diagnostic methods and management.

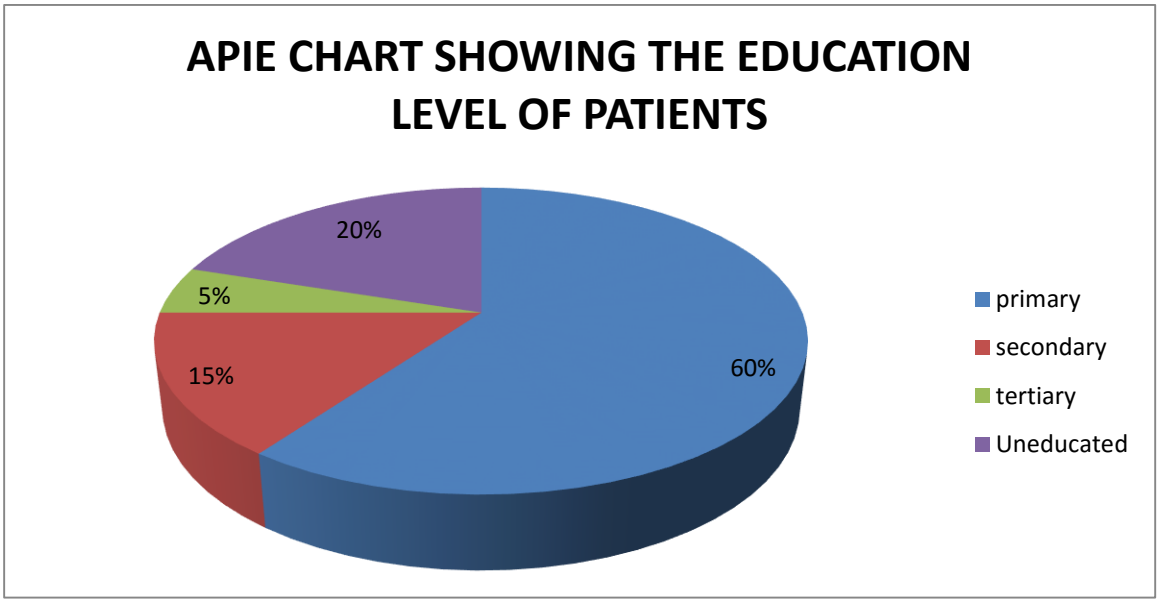
4.2. PATIENTS BIOGRAPHIC DATA

A TABLE OF RESULTS FOR SOCIODEMOGRAPHIC DATA

AGE IN YEARS	**FREQUENCY FOR AGE**	**PERCENTAGE %**
0-15	70	17.5
16-30	240	60
31-60	60	15
61-90	30	7.5
>90	0	0
GENDER		
MALE	285	71.25
FEMALE	115	28.75
TOTAL	400	100
AREA OF RESIDENCE		
RURAL AREAS	310	77.5
URBAN AREAS	70	22.5
TOTAL	400	100
MARITAL STATUS		
SINGLE	265	71.25
MARRIED	115	28.75
DIVORCED	400	100
TOTAL		

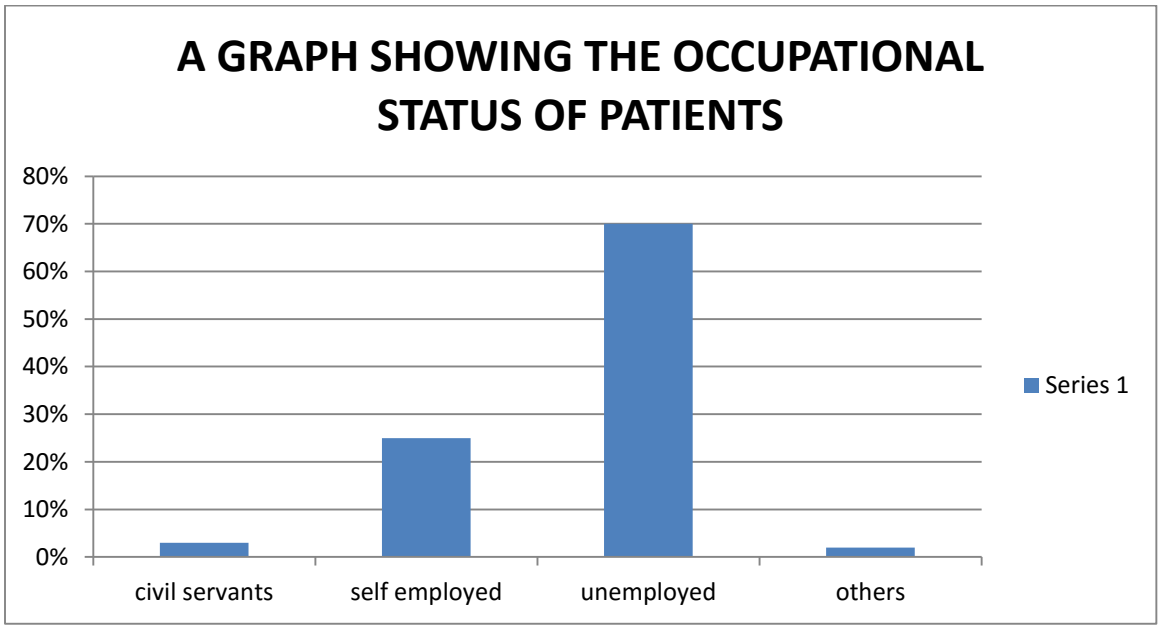
4.3 RISK FACTORS TO CHRONIC OSTEOMYELITIS.

Figure 1.



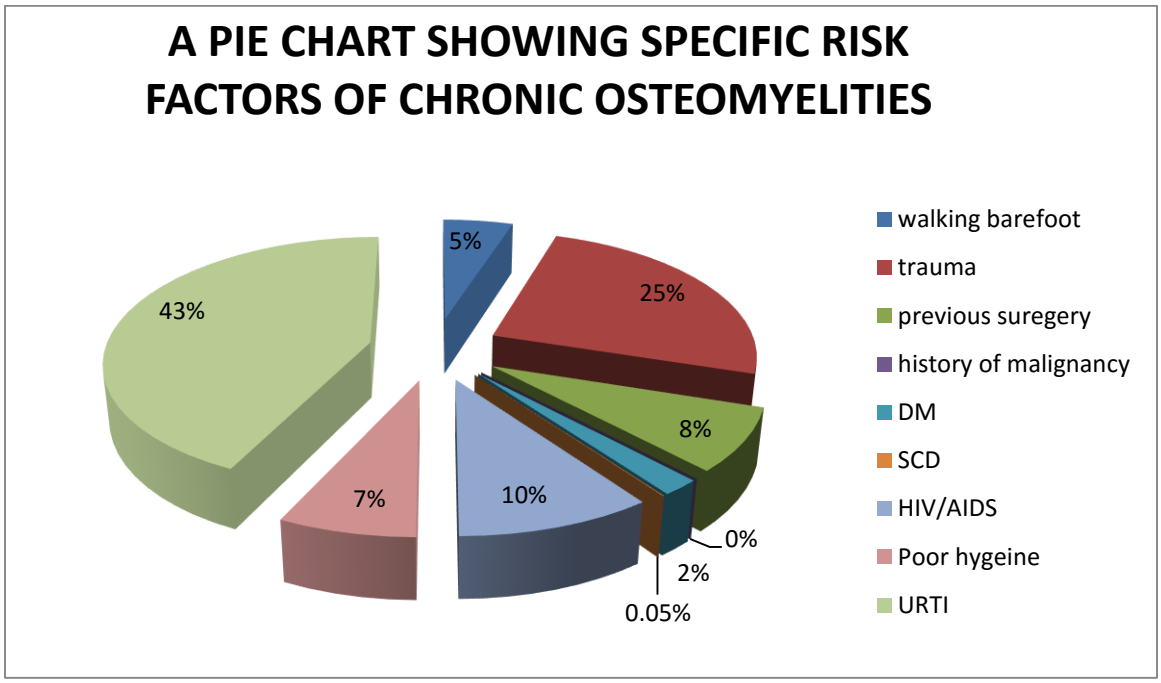
60 % of the patients are primary dropouts, 15% stopped in secondary, 5% tertiary and 20% didn't go to school.

Figure 2



70% of patients are unemployed, 25% self-employed, 3% civil servants and 2% students

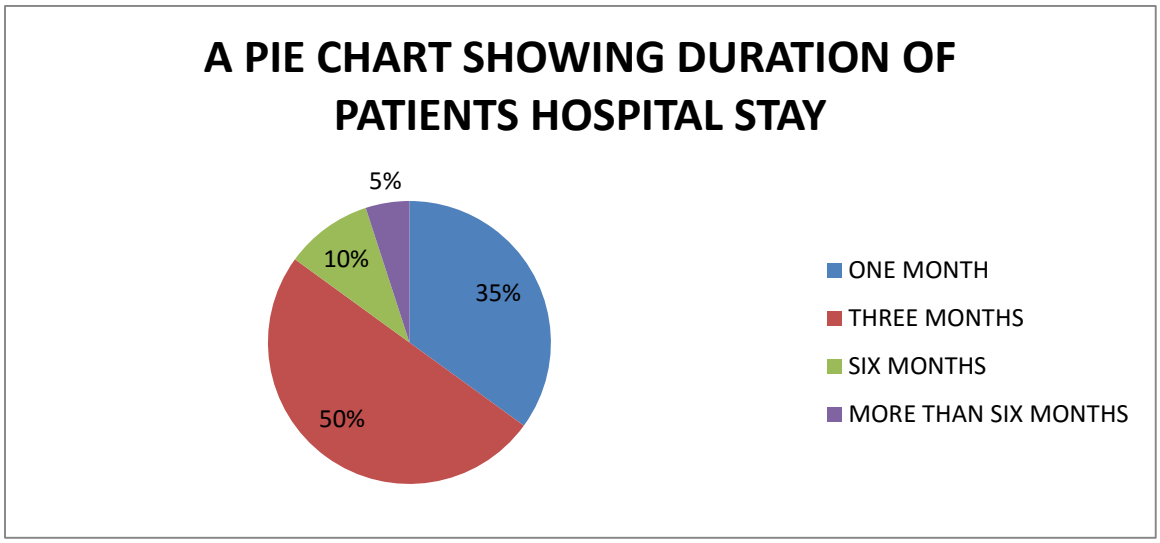
Figure 3



43% of chronic osteomyelitis is secondary to URTI, 25% due to trauma, 10% due to HIV/AIDs, 7% poor hygiene, 8%previous surgery, 5% walking barefooted, 2% DM, 0.05% SCD, and 0% history of malignancy

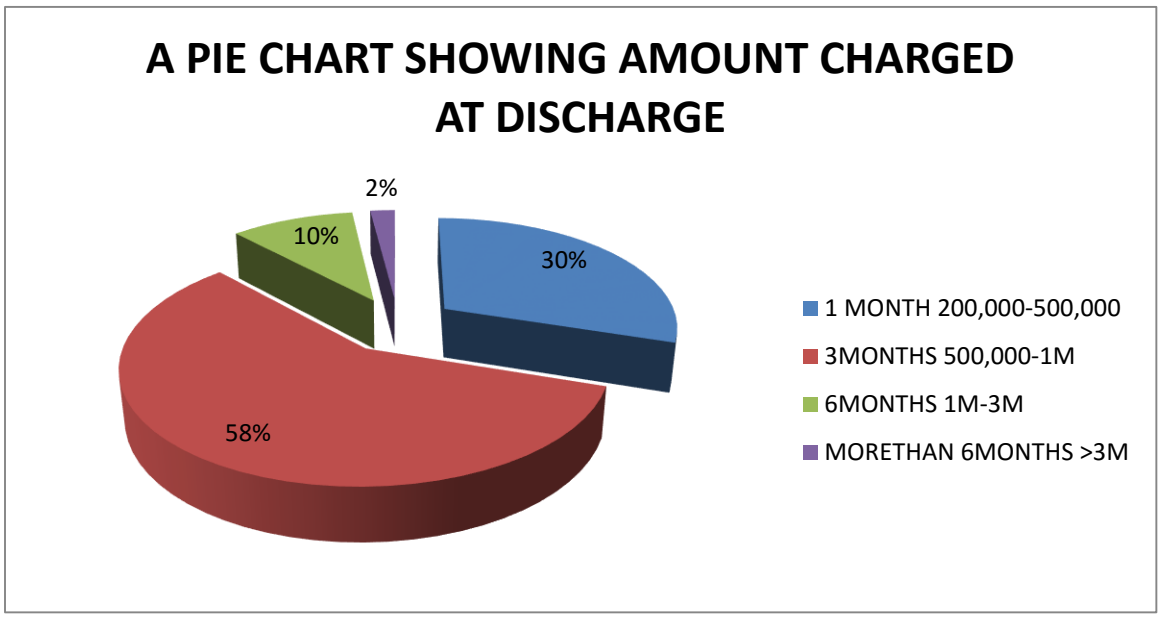
4.4 SOCIO-ECONOMIC BURDEN

Figure 4



35% of patients stayed in hospital for one month, 50% three months, 10% six months and 5% stayed more than one month.

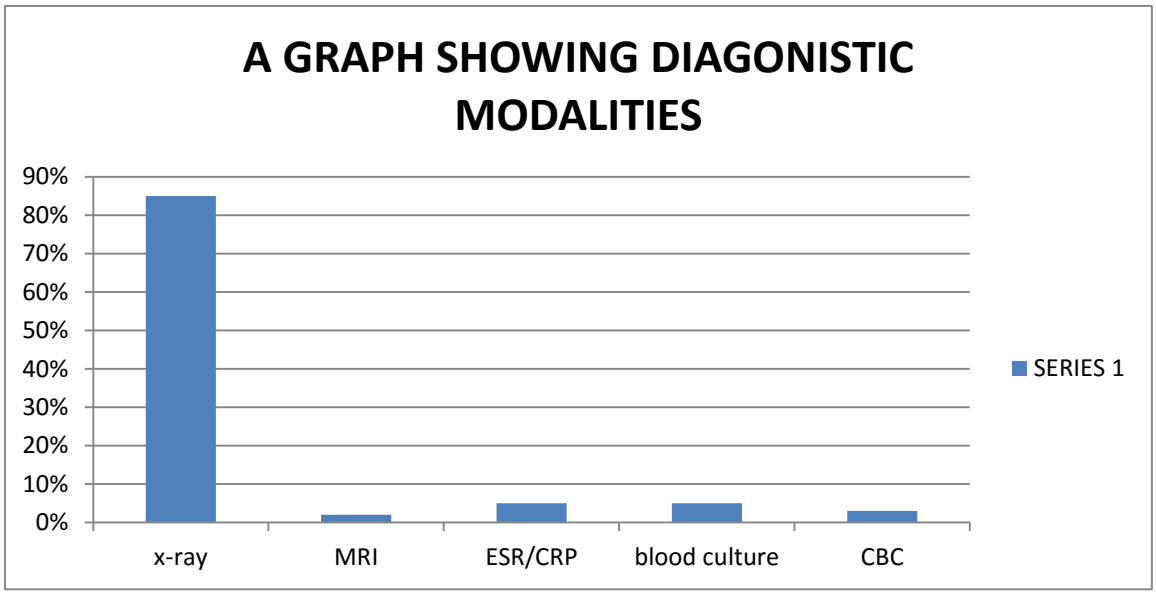
Figure 5



30 % charged between 52.6-131.6US dollars, 58% charged 131.6US dollars-263.2US dollars, 10% charged 263.2-789.5US dollars, and 2% > 789.5US dollars.

4.5 DIAGONISTIC MODALITIS UESD AT KIUTH

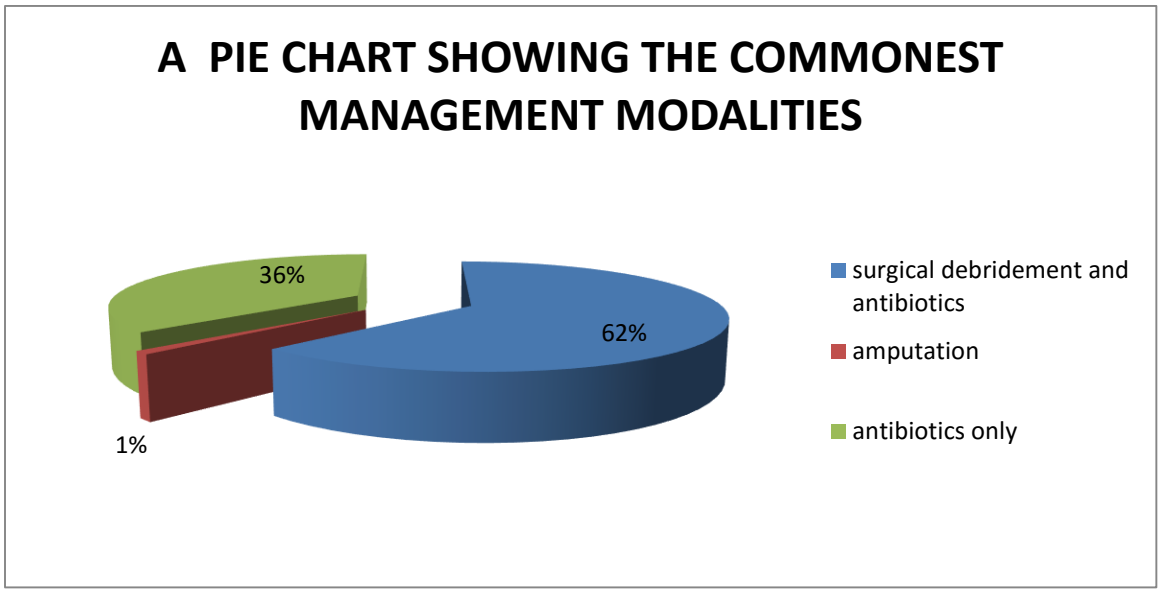
Figure 6



85% of patients were diagnosed by x-ray, 2% MRI, 5% blood culture and 5% CRP and ESR, and 3% CBC as a base line investigation.

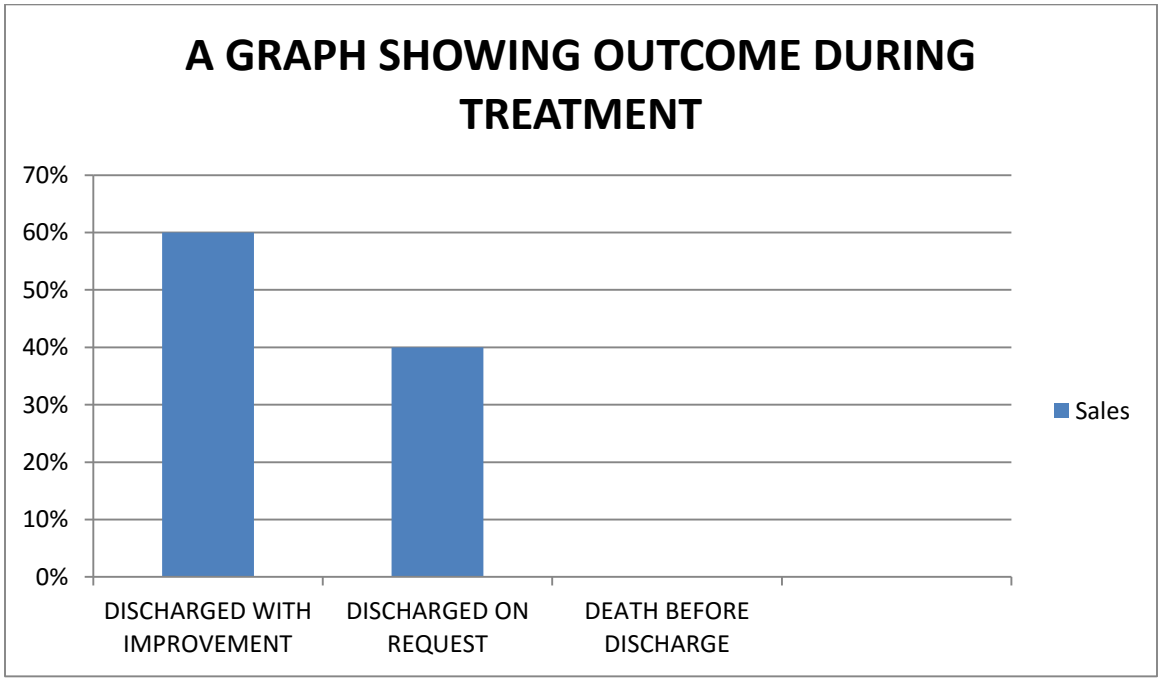
4.6 COMMON MANAGEMENT MODALITIES AND COMPLICATIONS

Figure 7



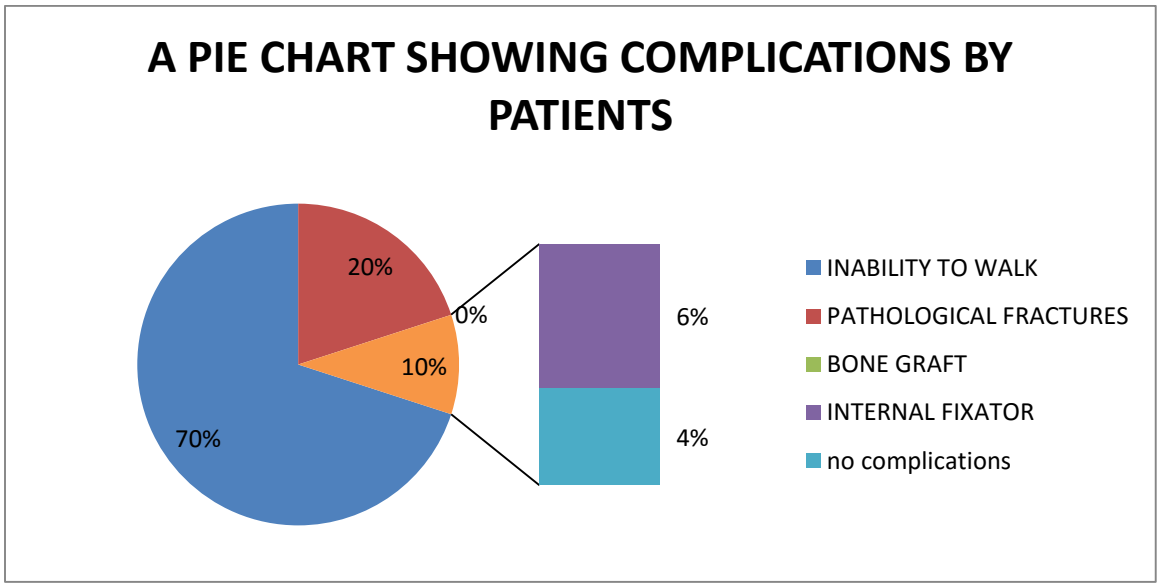
62% surgical debridement and antibiotics, 36% antibiotics only and 1% amputations.

Figure 8



60% of patients discharged with improvement on treatment, 40% discharged on request and 0% death before discharge.

Figure 9



70% of had inability to walk, 20% pathological fractures, 6% internal fixators,4% had no complications and 0% bone grafts.

CHAPTER FIVE

5.0: DISCUSSION OF THE FINDINGS, LIMITATION, CONCLUSION AND RECOMMENDATIONS.

5.1: INTRODUCTION

This chapter presents the summary and discussion of the findings from the study conducted on risk factors and socio-economic burden of chronic osteomyelitis among patients admitted on surgical ward of KIUTH. The findings of this study have been analyzed in the previous chapter while the limitation and recommendations are outlined in this chapter. The objectives of the study were;

(ii) To determine the risk factors associated with chronic osteomylitis in patients admitted on surgical ward in KIUTH

(ii) To assess the socio-economic burden of chronic osteomylitis to patients admitted on surgical ward in KIUTH

(iii) To determine the commonest management modalities of chronic osteomyelitis amongst patients admitted on surgical ward in KIUTH.

5.2. SUMMARY AND INTERPRETATION OF THE FINDINGS.

The summary and interpretation of the findings are covered under the above objectives, biodata, risk factors and socio-economic burden plus the commonest management modalities used in management of chronic osteomyelitis among patients admitted on surgical ward of KIUTH.

5.2.1: BIODATA OF PATIENTS.

Out of 400 patients whose files were reviewed 240 (60%) were aged 16-30years having the highest number among those admitted with chronic osteomyelitis hence being the age bracket most vulnerable to chronic osteomyelitis, followed by those with 0-15 years of age who were 70(17.5%), those between 31-60 years of age were 60(15%), 61-90 years of age were 30(7.5%) and none of the patients was above 90 years of age. This agrees with the research conducted by

(k.Sullivan, 2013) which showed a mean age of presentation at 18 years with average range of presentation of 1 month to 84 years.

285 (71.5%) were males and female were 115 (28.75%) giving a ratio of 2:1 respectively hence males were more affected than females.

265(66.25%) were single, 115 (28.75%) were married and 20(5%) divorced hence singles ranked to be highly affect by chronic osteomyelitis.

310(77.5%) out of 400 patients lived in rural areas while 70(22.5%) lived in urban centers indicating that chronic osteomyelitis affected more of people living in rural areas than those in urban areas , this agrees with the researched conducted by (k.Sullivan,2013) 68% of the patients came from villages(rural areas).

5.2.2: RISK FACTORS AND SOCIO-ECONOMIC BURDEN OF CHRONIC OSTEOMYELITIS

Figure 1 of a pie chart presentation on level of education demonstrated that 60% of the patients were primary dropouts, 15% secondary, 5% tertiary and 20% didn't go to school at all hence level of education greatly affects ones knowledge about the disease, how to prevent it and also seek medical care on time which influences the outcome of disease , with primary dropouts being affected more than the rest of the groups followed by illiterates and the chances of being affected decreases with increase in level of education. This is attributed to awareness and urgency in seeking medical advice.

Figure 2 presents the occupational status of patients whose files were reviewed with 70% unemployed, 25% self employed, 3% civil servants and 2% students. This reveals that chronic osteomyelitis has a high incidence in unemployed people and least affecting civil servants whose standards of living are thought to correspond to reduction in the risk of them being affected.

Figure 3 demonstrates that URTI contributed 43% of all cases of chronic osteomyelitis attaining the highest number of patients, followed by trauma with 25%, HIV/AIDS 10%,previous surgery 8%,poor hygiene 7%, walking barefooted 5%,DM 2% and SCD being the least with 0.05% .In

comparison to (Sliver, 2016), frontal sinusitis are the leading cause of cranial osteomyelitis, 19.9% of foot infections in DM involved bone according to (Lavery et al., 2009), 27% were secondary to trauma (k.Sullivan,2013), 8% of the patients with SCD had osteomyelitis due to salmonella infection (George, Briggs, & Ihezie, 2011), and strains of fusobacterium were identified to cause vertebral osteomyelities as a result of poor hygiene (Khatoon & Hunter, 2015).

Figure 4 presents the duration of hospital stay in relation to the socio-economic burden of chronic osteomyelitis to patients with 50 %(200) of the patient hospitalized for three months , 35% hospit toalized for one month and 10% hospitalized for six months and those who stayed for more than six months had a least score of 5%. Patients hospitalized and discharge after three months included those who had the capacity to pay hospital bills, and those who greatly improved on treatment as diagnosis was made early and started on treatment, while patients who were discharged in one month time most of them couldn't manage to sustain themselves in hospital due to increasing hospital bills they couldn't meet and a few were due to improvement on treatment ,patients who were hospitalized for six and above months was due to delayed diagnosis as patients took time at home before they came to hospital, while others were not complying to treatment. This is compared to the article by (Stanley et al., 2010), in which bone and joint infections showed to induce major financial cost, with patient's life deteriorating in a short period of time due to inability to raise funds for treatment .

Figure 5 presents the ranges of total amount of money charged from patients on discharge at KIUTH demonstrating that 58% of the patients were charged between 131.6 -263.2US dollars, 30% were charged 52.6-131.6US dollars,10% of patients were charged 263.2 -789.5US dollars and 2% > 789.5US dollars. Comparing the occupational status of patients, with most of them being unemployed it was very difficult for them to acquire the amounts of money needed for treatment which affects the outcome at the end of management, this aggress with the research conducted by (Gomes, Pereira, and Bettencourt 2013).

5.2.3: COMMON DIAGNOSTIC MODALITIES USED AT KIUTH.

Figure 6 presents the common diagnostic modalities used in KIUTH to diagnose chronic osteomyelitis among patients admitted on surgical ward demonstrating 85% of patients were diagnosed using x-ray films, 5% blood culture with staphylococcus aureus in adults and children taking a lead with 95% being positive followed by haemophilus influenza 5% more common in

children, salmonella species was found in all patients SCD , 2% MRI and 5% CRP and ESR with CBC used as a baseline investigation in 3% of patients. Since most of the patient couldn't afford highly sensitive diagnostic modalities like MRI rather opting for x-rays films which can show bone changes after 3weeks affected the prognosis of the disease. This aggress with the research finding done by (Ferguson and Sandu 2012)

5.2.4 COMMON MANAGEMENT MODALITIES AND COMPLICATIONS

Figure 7 presents commonest management modalities used in patient admitted on surgical ward of KIUTH with 62% of the patient undergoing surgical debridement followed by antibiotics for 6weeks, 36% were treated on antibiotics only for six weeks and 1% of the patients limbs were amputated secondary to chronic osteomyelitis. Cloxacillin, flucamox and ceftriaxone were found to be the common drugs used on ward. This is in line with research conducted by (Lima et al., 2014) in which patient were noted to have been treated with antibiotics of the same class for six weeks and surgical intervention that is sequestrectomy.

Figure 8 presents the outcome during treatment where 63% of the patient were discharged with improvement on treatment and fit for discharge, 37% were discharged on request as they couldn't sustain themselves in hospital with the increasing medical bills, and 0% death occurred before discharge.

Figure 9 presents the complications that occurred to patients following chronic osteomyelitis which indicates that 70% of the patient is unable to use limbs affected once again, 20% of patient go pathological fractures, 6% of patients their bones are stabilized by internal fixators in order for them to use their limbs, 4% had no complications noted and 0% had bone graft. 70% who are un able to walk can never have the same life they had before the incident and this impacts directly to their families and their personal life as compared to those with pathological fractures and internal fixators who can with difficult try their way out to survive. This is in line with research by (Schmitt, 2017) which established that patient who were not quickly and properly management had permanent deformity and amputations done in some of the patients.

5.3: LIMITATIONS OF THE STUDY

- Incomplete records were anticipated since data in case files were not intended for the current protocol.
- The study looked at cases only without their comparator controls to ascertain the presumed risk factors. Consecutive recruitment without random sampling could lead to selection bias

5.4 CONCLUSION.

- Chronic osteomyelitis is still a socio-economic burden whose effects are catastrophic and irreversible there for there is need for effective and urgent preventive and curative measures to be put in place to avoid complication among patients.

5.5: RECOMMENDATIONS.

- Since it has been noted that many of the patients come from rural areas, not employed and can't manage to clear up hospital bills once affected by chronic osteomyelitis , the government through ministry of health should focus on educating people about all the risk factors and how they protect or prevent themselves from it
- In order to have early detection of disease and avoid adverse complications among patients like permanent inability and amputations, the government through ministry of health should equip hospital with diagnostic modalities which are capable of detecting chronic osteomyelitis at an early stage.
- Since chronic osteomyelitis is a highly demanding condition in terms costs during management, the government should collaborate with private hospitals to offer free service to all patients being diagnosed since most of the cannot afford to cover up the hospital bills .
- In regards to avoid tendencies of incomplete results and bias, the future studies should be case control studies to ascertain Level of significance of current demonstrated risk factors for chronic osteomyelitis

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Appendix I: Work plan

ACTIVITY	2017	2018							
	Nov-Dec	Jan	Marc	April	May	Jun	July	Aug & Sept	Nov
1.Topic Identification	■								
2. Proposal writing		■	■						
3. Proposal submission for review				■					
4. Sample analysis and Data collection					■	■			
5. Data analysis						■	■		
6.Report writing								■	
7.Report submission									■

Appendix ii: Approval letter for data collection

KAMPALA INTERNATIONAL UNIVERSITY – WESTERN CAMPUS

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OFFICE OF THE DEAN
FACULTY OF CLINICAL MEDICINE & DENTISTRY

02/01/2018

TO WHOM IT MAY CONCERN

RE: KALINZI DEO (BMS/0085/133/DU)

The above named person is a fifth year student at Kampala International University pursuing a Bachelor of Medicine, Bachelor of Surgery (MBChB) Programme.

He wishes to conduct his student research in your community.

Topic: Risk factors and socio-economic burden of chronic osteomyelitis among patients admitted on surgical ward in KIU-Teaching hospital

Supervisor: Dr. Lule Herman

Any assistance given will be appreciated.

02 JAN 2018

Prof. Ssebuufu Robinson
DEAN FACULTY OF CLINICAL MEDICINE & DENTISTRY

Appendex iii: Budget

NO	ITEM	AMOUNT
1	INTERNET FEES	100,000#
2	PRINTING	60,000#
3	LABOUR IN DATA COLLECTION	50,000#
4	PENS	20,000#
5	PAPERS	7000#
6	TRANSPORT	30,000#
TOTAL		267,000#

Appendix IV: Questionnaire

SECTION A: BIOGRAPHIC DATA

Patient Information

Age:……

Sex:…….

Area of residence: Rural areas ☐ urban areas ☐

Marital status: Single ☐ Married ☐ Divorced ☐

SECTION B) RISK FACTORS (Tick appropriately)

1. What is your level of education?

Primary ☐ ☐ Secondary ☐ Tertiary ☐ None

2. What is your occupational Status:

☐ Civil Servant ☐ Self-Employed Unemployed ☐

Others (Specify) :……..

3. Risk factors for chronic osteomylitis?

a. Trauma ☐

b. Walking barefooted ☐

c. Previous surgery ☐

d. History of malignancy ☐

e. Sickle cell disease ☐

f. poor hygiene ☐

g. HIV/AIDS ☐

h. Index admission or recurrent admissi ☐

i. Upper respiratory infections ☐

Others (Specify):……..

MANAGEMENT MODALITIES

4. Diagnostic modalities used?

   Blood culture and sensitivity ☐ X-ray ☐ MRI ☐ others specify ☐ ESR /CRP ☐ CBC ☐

5. Commonest management modalities used in patients admitted on surgical ward?

   Antibiotics ☐ surgical debridement ☐ Amputation ☐

   Others (Specify):……

SOCIO-ECONOMIC BURDEN

6. What was the exact duration of stay in hospital…….

   One month ☐ three months ☐ six months ☐ > six months ☐

7. Amount of money charged at discharge ……

8. Socio-economic burden uncounted?

   Inability to walk ☐ pathological fractures ☐ bone graft ☐ external fixation ☐ No complications ☐

9. Definitive out come?

Discharged with improvement ☐ discharged non request ☐ death before discharge ☐