# CO-EXISTENCE OF URINARY TRACT INFECTION AND MALARIA AMONG CHILDREN UNDER FIVE YEARS: A CASE OF MUHIMBILI NATIONAL HOSPITAL, DAR ES SLAAM

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**DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR DEGREE OF MASTERS OF ENVIRONMENTAL STUDIES IN HEALTH OF OPEN UNIVERSITY OF TANZANIA**

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## CERTIFICATION

The undersigned certify that he has read and hereby recommend for acceptance by the Open University a dissertation titled: ***"Co-Existence of Urinary Tract Infection and Malaria Among children Under Five Years: A Case of Muhimbili National Hospital Dar es Salaam.Tanzania,*** in partial fulfillment of the requirements for the degree of Master of Science in Environmental Studies –Health Stream of the Open University of Tanzania.

…….

Prof. Emmanuel S.P. Kigadye

**(**Supervisor)

……

Date

## COPYRIGHT

## DECLARATION

I**, Albert Clement Ntukula,** do hereby declare that this dissertation is my own original work and that it has not been presented and will not be presented to any other university for a similar or any other degree award. I also, declare that all sources that I have used or quoted have been indicated and acknowledged by means of complete references.

……

Signature

……

Date

## DEDICATION

Dedicated to my lovely wife Ulumbi for her love help and high standards as reader. My son Wills who is not only my son but also my best friend for his love and patiency. To the memory of my lovely Mother the late Celine Rahaba Ntukula who put a foundation of education for me.

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## ABSTRACT

Across tropical Africa, febrile children are treated for malaria either with or without confirmation thus resulting in failure to diagnose and treat other co-morbidities like urinary tract infections (UTI) and upper respiratory tract infection (URTI) that may coexist with malaria. This cross-sectional study examined coexisting malaria with UTI and further assessed the antimicrobial susceptibility pattern of the isolated organisms among children aged less than 5 years presenting with fever and malaria. Thick and thin blood films were used for the diagnosis of malaria and urine samples were collected in sterile, widescrewed-mouth, leak proof containers for culture and sensitivity. Organisms isolated were identified and tested for their antimicrobial sensitivity patterns using the Kirby-Bauer disc diffusion method. Prevalence of malaria with coexisting UTI was 3.3% with majority (58.0%) of the participants being female. Age was associated with malaria and UTI co infection prevalence of co-infection being 24-36 age group. *Escherichia coli* (50%) *Staphylococcus aureus* (25%),*Klebsiella species*(16.70%) *and Proteus species* (8.3%) were isolated.Co-infection of malaria and UTI was present in febrile children under five years in Muhimbili National Hospital. Non detection implies that such hidden morbidity would be untreated. Health care personnel should rule out UTI when managing febrile children less than five years with malaria.

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## LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| ALU | Artemether-Lumefantrine |
| ACT | Artemisinin Combination Therapy |
| AST | Antibiotic Susceptibility Test |
| BA | Blood Agar |
| BS | Blood Slide |
| CLED | Cystine Lactose Electrolytes Deficiency |
| ED | Executive Director |
| MH | Mueller Hinton |
| MNH | Muhimbili National Hospital |
| NBG | No Bacteria Growth |
| NMC | National Malaria Control |
| NP | New Pediatric Complex |
| RTI | Respiratory Tract Infection |
| UTI | Urinary Tract Infection |
| WHO | World Health Organization |

# CHAPTER ONE

# 1.0 NTRODUCTION

## 1.1 General Introduction

For decades, majority of African children under the age of five years have been presumptively treated for malaria once they present with fever (Rougemont *et al.*, 1991; Kallander *et al.*, 2004; English *et al.*, 2009). This might be due to the fact that malaria has been a global problem.

Public health studies have established that more than 50% of African children who present with fever to healthcare centers do not have malaria infection (Gething *et al.*, 2010). In countries where presumptive diagnosis has become a standard practice, various challenges in treatment and management arise as the origin of febrile illness may be due to other causes such as bacterial and viral infections and not exclusively malaria (Kallander *et al.*, 2004).

Co-existence of urinary tract infection (UTI) with these febrile illnesses especially malaria has been reported by several authors across the African continent (Akpede and Skyes, 1992; Okwara *et al.*, 2004; Okunola *et al.*, 2012). In Nigeria, 9% of children under the age of five years had malaria coexisting with UTI (Okunola *et al.*, 2012). It is difficult to accurately assess the incidence of UTIs, because they are not reportable diseases (WHO 2000; Berg *et. al.* 2004). The prevalence of UTI in Africa and particularly in Tanzania is not well known, this is due to the non specific presenting symptoms (Akpede and Skyes, 1992).

Children with fever are a majority in the various emergency rooms all over the world, and especially in the tropical countries (Akpede and Skyes, 1992). Most children of under five years in sub-Saharan Africa will be treated for malaria, whether confirmed or not (Akpede and Skyes, 1992). It therefore follows that some of the morbidities other than malaria may go unnoticed. The co-morbidities with malaria that may have similar presentation among under-fives therefore are difficult to detect, and diseases like respiratory tract infections (RTI) and urinary tract infections (UTI) are left to debilitate affected children (Carroll, *et al.,* 1994). The exact burden of UTI co-existing with malaria in Tanzania remains ill defined. This study looked at the co-existence of UTI in under- fives year with a primary diagnosis of malaria from MNH.

The study indicated that UTI is a silent comorbidity in children aged less than 5 years with malaria and there is a need to evaluate these children in order to prevent the longterm morbidity of chronic renal diseases such as blood pressure, renal scaring and renal failure **(**Benardo.*et.al*., 1997). The results of this study will be valuable in the management of childhood diseases and in the reduction of morbidity and mortality in children.

### 1.2 Statement of the Problem

UTI is a leading cause of morbidity in children, especially those less than five years old. Malaria is the leading cause of morbidity and mortality, particularly in sub-Saharan Africa (Okwara 2004). UTI is known to co-exist with these common childhood diseases. Diagnosis of malaria is commonly based on clinical features only as most fever would almost invariably be managed for malaria without recourse to

identifying the underlying cause or ascertaining its coexistence with other morbidities, including UTI. Thus, cases of UTI and other morbidities could be missed.

## 1.3 Objective of the Study

The main objective of the study was: To determine the co-existence of urinary tract infection and malaria among children under five year attending at Muhimbili National Hospital.

### 1.3.1 Specific Objectives

(i) To determine the prevalence of UTI cases among under five children who are currently treated for malaria.

(ii) To establish the most common pathogens of UTI among under five children.

(iii) To assess antibiotics susceptibility test to the specific isolate pathogen

## 1.4 Significance of the Study

Although frequently encountered and well researched, diagnosis and management of UTI continue to be a controversial issue with many challenges for the clinician. Prevalence studies have shown that UTI may often be missed on history and physical examination, and the decision to screen for UTI must balance the risk for missed infections with the cost and inconvenience of testing. Interpretation of rapid diagnostic tests and culture is complicated by issues of contamination, false test results, and asymptomatic colonization of the urinary tract with nonpathogenic bacteria. The appropriate treatment of UTI has been controversial and has become more complex with the emergence of resistance to commonly used antibiotics.

This study will provide an up-to-date and some useful baseline information about diagnosis and management for the clinician and academicians, and identify the main areas of improvement in co-existence of UTI in children under five years with primary diagnosis of malaria and hence will give the proper treatment and management.

### 1.5 Hypotheses

(i) The prevalence of UTI is high in under five children with malaria at MNH

(ii) *E. coli* is the most common pathogen causing UTI in under five children with malaria at MNH

(iii) UTI pathogens are most susceptible to the specific antibiotic tested.

### 1.6 Ethical Consideration

Permission to conduct this study was requested from the Executive Director (ED), MNH, using a letter of introduction from the Open University of Tanzania. Also explanation concerning the purpose of this study was given to the ED and other in charges of the respective units. All information obtained in this study will remain confidential.

# CHAPTER TWO

# 2.0 LITERATURE REVIE

## 2.1 Historical background of UTI, Malaria and UTI and Malaria co Existence and Misdiagnosis

Urinary tract infection (UTI) is one of the most common diseases, occurring from the neonate up to elderly age group (Forbes 2002). It is a bacterial disease that infect the urinary system, that is kidneys, ureters the bladder and the urethra Women tend to get more bladder infections than men, this is probably because women have shorter urethras, so it is easier for the germs to move up to their bladders (Eugene, 2004). Having sex can make it easier for germs to get into the urethra also the use of contraception (Nester.*et al* 2004). Urinary tract infections (UTI) in young children have been associated with serious long-term complications such as renal scarring, hypertension and renal failure (Stamm and Hooton, 2002). The presenting symptoms of UTI in children are non-specific. If UTI is not suspected, a urine sample is not obtained, UTI cannot be diagnosed. There is evidence that the diagnosis is often missed (Habte *et al*, 2009).

Urinary tract infection (UTI) is a problem that is frequently encountered by pediatric healthcare providers (Anoukoum *et al*., 2002) Over recent decades, the importance of UTI has been increasingly recognized, in particular the role of UTI as an occult cause of febrile illness in young children (Freedman, 2007). The evolving state of knowledge about pediatric UTI leaves many questions and controversies. The epidemiology of UTI during childhood varies by age and gender (Shaw *et al*, 1998). Screening studies in emergency departments suggest that up to 5% of children under

the age of 5 presenting with fever have UTI, and over half of these would have been given alternative diagnoses such as otitis media, upper respiratory tract infection and pneumonia had the urine not been screened as part of the study (Larcombe, 1999).

Malaria is a vector borne disease both in terms of geographical distribution, incidence morbidity and mortality it causes (NMC, 2008).Its estimated that about 90% of the 300 to 500 million clinical cases each year which result into1.5 to 2.7 million deaths occur in sub Saharan Africa(WHO, 1993). Pregnant woman and children under 5 years old are most at risk of severe malaria (WHO, 1993).

In Africa, malaria is a big problem that affects socio-economic and political factors which may accompany high death rate (WHO, 1995). In southern Sahara desert, Malaria is responsible for about10% of hospital admission and about 30% of outpatient consultation, imposing direct cost on both government and patients (WHO, 1995).

Fever presenting in children less than five years of age in malaria endemic areas will almost always be treated as cases of malaria (Akpde, 1992). However fever is a common feature to other childhood illnesses including RTI and UTI (Pappas, 1991). Malaria is known to co-exist with these other morbidities including UTI (Okwara *et al,* 2004). Undiagnosed and poorly treated UTI can lead to immediate and long term sequelae. Reliance on clinical features for the identification of presence of the co-morbidity could be quite tasking in the absence of discriminatory features (Gordon, 1990). Furthermore, UTI is known to co-exist with these common childhood diseases

such as Malaria, Respiratory tract infection and Pneumonia. (Bauchner *et al.,* 1984) Therefore, the child presenting in such facilities with fever would almost invariably be managed for malaria without recourse to identifying the underlying cause or ascertaining its coexistence with other morbidities, including UTI (Foxman, 2002). Also, when malaria and UTI co-exist, the features manifested by the child would most likely be interpreted as malaria, and it is unlikely that the child with positive smear for malaria will be investigated further for UTI or other morbidities.

Therefore, the prevalence of these co-morbidities would be under-estimated and under-reported (Berg *et al*., 2003). UTI has been reported in patients with malaria, and prevalence rates of up to 13.3% have been reported in children with malaria aged three months to 12 years (Okwara *et al.,* 2004.Biyikli *et al.,* 2004).

## 2.2 Prevalence of UTI in Children Under Five Years

Urinary tract infections (UTIs) are common in kids (Forbes 2002). By the time they're five years old, about 8% of girls and 1-2% of boys have had at least a symptomatic, culture-confirmed UTI. (Forbes 2002). The prevalence of UTI in febrile infants is greater in less than five years worldwide (Bernador *et al.,* 1997).

Urinary tract infections affect about 3% of children in the United States every year (Forbes 2002). UTIs account for more than one million visits to pediatricians' offices every year (Forbes, 2002). The true prevalence of UTI in acutely ill children presenting in UK and Africa in general practice is therefore not well known (Stamm, 2001). There is limited information on clinical epidemiology of UTI children in Dar es Salaam.

## 2.3 Prevalence of Malaria in Children Under Five Years

Approximately 5% of the world's population is infected with malaria (Akpede and Skyes, 1992). Malaria remains one of the major threats to under five children public health and economic development in Africa (WHO, 2003). It is estimated that three million death results from malaria throughout the world, with Africa having more than 90% of this burden (Breman *et al.*, 2004).

Malaria is the major cause of outpatient and inpatient of children less than five years of age at health facilities in Tanzania (WHO, 2000). The high burden of malaria in Tanzania is due to the fact that, every year 14-18 million new malaria cases are reported (MOH, 2011). The annual incidence rate is 400-500/1,000 people and this number doubles for children less than five years of age (MOH, 2011). There are 100,000-125,000 annual deaths due to malaria, 70,000-80,000 in under-fives (Mercia *et al.,* 2004). Dar es Salaam is one of the regions with high prevalence of malaria in Tanzania.(NMC 2008). It's reported that the burden of malaria and the consequence of the disease in the population is high with an overall prevalence of 39.2% among under- five children (MOH, 2011).

## 2.4 Diagnosis of UTI

### 2.4.1 Urine Collection and Laboratory Diagnosis of UTI

A morning mid stream urine sample is preferred for UTI diagnosis in which urine is collected in a sterile screwed mouth container **(**Chessebrough, 1984). The examinations generally is based on microscopic examination of a wet film of uncentrifuged urine to determine whether the polymorphs (pus cells) are present in a numbers indicative of infection in the urinary tract, and the culture of urine to

determine whether it contains a potentially pathogenic bacterium in numbers sufficient to identify it as the causal infecting organism (significant bacteriuria) (Marray *et al.,* 2003. Eugene *et al*, 2004).

Some polymorphs are usually present in the urine of healthy uninfected persons and it is only if their number is clearly greater than the normal values that the finding of pus cells is indicative of urinary tract infection **(**Forbes, 2002). The film is observed with the high power field (HPF) (x40) dry objective of the microscope **(**Chessebrough, 1984). The significant bacteriuria count that is suggestive for UTI pathogen is leucocytes >5HPF **(**Chessebrough, 1984).

Organisms isolated is identified and tested for their antimicrobial sensitivity patterns using the Kirby-Bauer disc diffusion method. The antibiotic discs to use are ciprofloxacin, gentamycin, nitrofuranton, ampicillin, amikacin, sulphurmethoprim, erythromycin, amoxicillin cloxacillin, Vancomycin, Penicillin and Impenum. The sensitivity of the disc is determined by measuring the zone size after overnight incubation aerobically at $37^0$c (Chessebrough, 1984).

### 2.4 UTI and Malaria Co-Existence to Under Five

Co-infection of malaria and UTI is not a new phe-nomenon. There is generally under-reporting and underestimation of these conditions in children especially as fever, a symptom, is common in both infections (White, 1989; Musa-Aisien *et al.*, 2003; Okunola *et al.*, 2012). However, the magnitude of the problem of UTI co-existing with malaria, particularly in malaria-endemic areas, is uncertain. The consequences of missed diagnosis and inadequate treatment of UTI have been

reported by several authors (Bauchner, 1987). The need to identify cases of UTI, either alone or in co-existence with other morbidities, cannot be over-emphasized.

## 2.5 UTI Control and Treatment

Antibiotic medicine and home care are effective in treating and controlling most of the urinary tract infections (UTIs) in children (Okwara *et al.,* 2004). The main goal of treatment is to prevent kidney damage and its short- and long-term complications by eliminating the infection quickly and completely (Benardo *et al.,* 1991). Early evaluation and treatment are very important. The number of days a child will need to take these medicines depend on the type of antibiotic (Okwara *et al.,* 2004). Children present with non-specific symptoms and signs making the diagnosis of UTI in children challenging, furthermore obtaining urine specimen for confirming the diagnosis of UTI is difficult resulting in presumptive treatment of these patients (Shaw *et al.,* 1998). Effective and appropriate treatment depends on clinician's high index of suspicion which is influenced by knowledge of the prevalent bacteriological uropathogens and antimicrobial susceptibility pattern in the specific area of practice (Musa-Aisien *et al*, 2003 Shaw et al., 1998). It is recommended that children admitted with fever should be evaluated for UTI and if urine confirmed for germs then sensitivity should guide the choice of antimicrobials in their treatment **(**Mackie and McCartey, 1989).

## 2.6 Malaria Control and Treatment

The major determinants related to malaria control include; The parasite with its many biological options and genetic diversity, the vector with tremendous differences in behaviors and transmission capacity, the human host with biological behavior,

political and social ramification, the environment such as altitude, temperature, rainfall and global warming (Bakshi *et al.,* 2004; *Fogg et al.,* 2004) It is also important to correctly identify vector species in nature and to target vector control to coincide with blood feeding and resting behavior of the vector species *(*Fogg *et al.,* 2004).

The role of plasmodium development in the mosquito depends primarily on temperature, hence these relationships play a great role in parasite survival and parasite growth, impacting both the probability and intensity of transmission (Bakshi *et al.,* 2004; Fogg *et al.,* 2004). Also personal knowledge about environmental issues and the relationship between the environment and vector control are vital (NMC, 2008). Treatment of malaria follows two strategies, clinical cure and radical cure (Bakshi *et al.,* 2004; Fogg *et al.,* 2004). A clinical cure is accomplished when symptoms are revealed, in case of malaria, symptoms cease because asexually reproducing parasites are eliminated from peripheral circulation.

However this treatment does not mean that all parasites have been eradicated from the body. Prompt treatment is recommended for all symptoms of the disease, within 24 hours if possible (Bakshi *et al.,* 2004; Fogg *et al.,* 2004). Early treatment will shorten the duration of malaria and prevent complications (Bakshi *et al.,* 2004; Fogg *et al.,* 2004). To avoid resistance, the best available treatment, artemisinin-based combination therapy (ACT) should be used (WHO, 2009). ACT is used to reduce the chances of *P. falciparum* becoming resistant to either drug (WHO, 2009). Appropriate drugs should be given in adequate dosage and correctly administered

during the period of time recommended (Van Vugt *et al*., 1999). Coartem has become the national medicine of choice to treat malaria in Tanzania, known as ALU.

Radical cure is the elimination of all parasites from the body including secondary tissue schizonts (Bakshi *et al.,* 2004; Fogg *et al.,* 2004). Various strains of *P. falciparum* and *P.vivax* have become resistant to chloroquine. Successful treatment of these infections requires the use of alternative antimalarias such as combination of pyrimethamine and sulfadoxine (SP) or Quinine **(**Bakshi *et al.,* 2004; Fogg *et al.,* 2004).

Children attending at MNH are referred from lower Health facilities. Febrile children have been investigated for malaria, and once confirmed they are treated according to WHO guideline. For those febrile without diagnosed malaria initially are treated empirically following WHO recommendations. Recommended first line antibiotics for the treatment of UTI include Amoxillin and Cotrimazole (WHO, 2005).

# CHAPTER THREE

# 3.0 METHODS AND MATERIALS

## 3.1 Methodology

### 3.1.1 Study Area

MNH was selected purposively as a study area. It's a National referral hospital, a focal point of our country which is found in Dar es Salaam region, Ilala district. Dar es Salaam is located in the east coast of Tanzania. Is the largest city of the country and is the commercial city. Dar es Salaam has an area of 1393 $Km^2$(city profile for Dsm 2004), which composes three districts namely Ilala; Kinondoni and Temeke. The population of Dar es Salaam is about 4.4 million people, according to the 2012 census, Dar es Salaam is the most populated city in Tanzania. The population of children under five years in Dar es Salaam is about 33.3% of the total population according to 2012 census.

### 3.1.2 Study Design

The study was a cross sectional, which was conducted in both inpatient and outpatient pediatric clinic. The study involved both quantitative and qualitative research design.

### 3.1.3 Study Population

The study population was under five year children (inpatient and outpatient) who were positive for malaria. The children were then examined for UTI. Checkup was done at Central Pathology Laboratory at MNH.

### 3.1.4 Urine Collection

Urine was collected in the screwed mouth sterile container and sent in the laboratory within one hour of collection for investigation, if delayed the specimens were stored in the refrigerator for not more than 12 hours.

### 3.1.5 Urine Laboratory Examination

Mid stream urine (MSU) sample was collected from patients. All urine samples were examined within one hour after collection. The specimen was examined uncentrifuged and subjected to culture in the Cystine Lactose Electrolyte Deficiency (CLED) and Blood Agar (BA) media, then to the Microscopy. CLED is the medium that favour growth of gram negative microbes such as *E.coli, Klebsiella* species, *Proteus* and *Psedomonus* species. BA favour the growth of gram positive microbes such as *Staphylococcus* species. A calibrated coiled wire loop of 1 micron were dipped in the urine sample and inoculated in the both media and incubated overnight.

The growth of colonies was examined and counted if only was pure growth (not contaminated). A colony count of $10^5$ used as a criterion for interpreting and reporting results as urinary tract pathogens. Other reporting was non-significant growth if was less than $10^3$, or mixed growth if more than one organism grew (Chessebrough, 1984.Mackie and McCartey, 1989).

For pure grow of $10^4$ more identification was done by gram staining method to examine if its gram positive or negative, also biochemical test such as Indole, Oxidase, Catalase and Coagulase test were used to identify specific microbe responsible for causing such a particular infection. *E. coli* tested positive for indole

and negative for oxidase, *Klebsiella* tested negative for both indole and oxidase, *Psedomonus* tested positive for oxidase but negative indole, whereas *Proteus* test negative for both indole and oxidase but had a distinctive characteristic of swamming on BA (Mackie and McCartey, 1989).

Examination of urine microscopically was done by determining white blood cells in the urine. The urine was centrifuged and the deposit was examined in the microscope under 10 or 40 magnification, the leucocytes counted above WBC was noticeable as a pathogens **(**Chessebrough, 1984).

### 3.1.6 Study Period

The study carried out for four months from February to June 2014.

### 3.1.7 Sample Size

Children who enrolled in the study ware sampled to get the sample size of 366 patients by purposively sampling method. The sample size was calculated using the formula below which mostly depended on the prevalence of malaria.

$N=z^2p\ (100-p)/e^2$

Where by:

N=total number of participant

Z=1.96 confidence interval

E=marginal of error which correspond to the level of precision of results desired (0.05)

P=prevalence. In this study, the estimate of prevalence of malaria in under five years children=39.2.

$N=1.96^2 x\ 0.392\ (1-0.392)/0.05^2$

N=366

### 3.1.7 Sampling Method

It was a purposive sampling study that was carried out at the New Pediatric Complex ward (NPC), at MNH. Urine sample were obtained from a patient that had primarily diagnosed for malaria or were treated for malaria. UTI was confirmed based on the culture.

#### 3.1.7.1 Inclusion Criteria

Children with age between 6-59 months were investigated, because at this age it is very possible to understand if the child is having any abnormality, also is easy to collect the urine in asceptic manner. Children presented with fever, nausea, vomiting, body malaise. Children presented with difficult in micturation

#### 3.1.7.2 Exclusion Criteria

Children with the following features were excluded

(a) Exposed to antibiotics within ten days preceding the evaluation;

(b) History of urinary tract structural abnormalities as determined from their medical records or patients whose symptoms suggested abnormalities of the urinary tract;

(c) Male subjected with recurrent UTI;

(d) Urologic manipulations such as catheterization carried out within 72 h preceding the evaluation;

(e) Pre-existing conditions known to be associated with immunosuppression, such as protein-energy malnutrition, sickle cell anemia, malignancies, Human Immunodeficiency Virus infection/acquired immunodeficiency syndrome; and

(f) Ultimate management for other morbidities instead of malaria and/or UTI, such as bronchopneumonia.

For each child, a detailed history was obtained with emphasis on fever, symptoms referred to the urinary tract infection (i.e., dysuria, loin pain, abdominal pain,) and use of antibiotics and previous urologic manipulations.

### 3.1.8 Data Analysis

Data analysis was done using Statistical Package for Social Sciences (SPSS) 20 version. For objective 1 and 2 cross tabulation used to find the associatin and correlation. For objective 3 percentage was used. Datasheet was used for data analysis. Means and Standard deviations (with ranges) percentages and proportions were calculated. The descriptive analysis of demographic status was obtained (age and sex). Clinical information was degree of parasitemia and the confirmed microbe isolated. The prevalence of UTI in these sub-groups was compared. Degrees of association was assessed using the Chi squared test, and *P*-values less than 0.05 was regarded as significant.

#### 3.1.8.1 Pre-test

Tools used for data collection was tested to ten known samples of urine from MNH Central Pathology Laboratory museum. These samples had similar characteristics as

to those targeted in the study. The aim of the pre-test was to test whether the tools provide the information required.

### 3.1.9 Limitation of the Study

The sample size was 366, however 10 of it were mixed growth of Gram Positive Cocci(GPC) and Gram Negative Rod(GNR), Bacillus or Coliforms contamination, so needed a repeat. The investigator couldn't manage, this because:

(i) The selection of study unit was based on availability during the period of data collection, to recollect the sample the patient were already discharged so it was impossible.

(ii) The collection of information mainly based on the respondent opinion on the subject matter, therefore there might be an error due to exaggeration of some information.

# CHAPTER FOUR

# 4.0 RESULTS

## 4.1 Introduction

This chapter presents the results collected in the course of this study at MNH in Dar es Salaam region. The study was designed to investigate the Co-existence of UTI and Malaria to children under five years, a hospital based descriptive- cross section study design, which was conducted in both inpatient and outpatient at New pediatric clinic.

## 4.2 Prevalence of UTI Cases Among children Under Five years who were Treated for Malaria

### 4.2.1 Prevalence of UTI According to Age

As shown in the Table 4.1 25-36 months is the group that were more affected with UTI.There were 8 children (66.7%), followed by 6-24 months 3 children (25%) and lastly 37-59 months comprising 1 child (8.3%).

**Table 4.1: Prevalence of UTI According to Age**

| Age (in Months) | Frequency | Percent |
|---|---|---|
| 6-24 | 3 | 25.0 |
| 25-36 | 8 | 66.7 |
| 37-59 | 1 | 8.3 |
| Total | 12 | 100.0 |

Source: Reseach data (Ntukula, 2014)

The percentage of participants with no bacteriuria predominated across all the age groups with the most from 6-24 months 252 children (71.2%), followed by 25-36

months 64 children, (18.1%) and the least within the 37-59 months 38 children (10.7%) (Table, 4.2b).

**Table 4.2(a): Participant without UTI by Age**

| Age (in Months) | Frequency | Percent |
|---|---|---|
| 6-24 | 252 | 71.2 |
| 25-36 | 64 | 18.1 |
| 37-59 | 38 | 10.7 |
| **Total** | **354** | **100.0** |

Source: Reseach data (Ntukula,2014)

**Table 4.2(b): No UTI to Participants that were Treated for Malaria**

| Age (in Months) | Frequency | Percent |
|---|---|---|
| Nbg | 324 | 91.5 |
| Nsg | 20 | 5.6 |
| Mg | 4 | 1.1 |
| Contamination | 4 | 1.1 |
| Coliform | 2 | .6 |
| **Total** | **354** | **100.0** |

Source: Reseach data (Ntukula, 2014)

NB:Nbg=No bacteria growth,Nsg=No significant growth, Mg=Mixed growth.

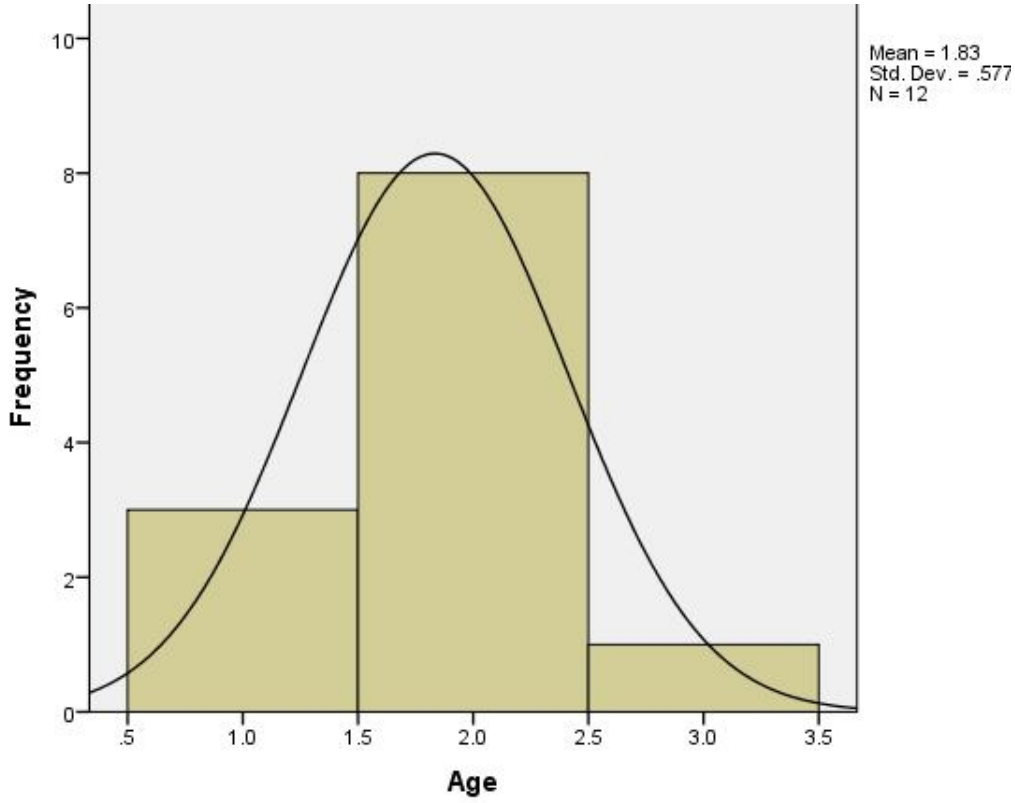


**Figure 4.1: Prevalence of Bacteria According to Age**

Source: Reseach data (Ntukula, 2014)

### 4.2.2 Prevalence of UTI According to Sex

More females had UTI than males.7 females (58.3%) and 5 males (41.3%) Table 4.3.

**Table 4.3: Prevalence According to Sex**

| Gender | Frequency | Percent |
|---|---|---|
| Male | 5 | 41.7 |
| Female | 7 | 58.3 |
| **Total** | **12** | **100.0** |

Source: Reseach data (Ntukula, 2014)

### 4.3 Common UTI Pathogens Isolated

#### 4.3.1 Most Common Pathogens

*Escherichia coli* was the predominant isolate among the study participants (Table 4.4) with the frequency of 6(50%), followed by *S.aureus* 3(25%), then *Klebsiella spp* 2(16.7%) and last was *Proteus* 1(8.3%).

**Table 4.4: The Common UTI Pathogens Isolated**

| Pathogens | Frequency | Percent |
|---|---|---|
| *Escherichia coli* | 6 | 50.0 |
| *Staphylococcus aureus* | 3 | 25.0 |
| *Klebsiella species* | 2 | 16.7 |
| *Proteus species.* | 1 | 8.3 |
| **Total** | **12** | **100.0** |

Source: Reseach data (Ntukula, 2014)

#### 4.3.2 Pathogens Isolated According to Age

*E.coli* also was the predominant isolate in the age cohort (Table 4.5) with the majority of 25-36 months having 5 isolates (83.33%), 6-24 months with 1 isolate (16.35%). No *E.coli* in 37-59 months. *S.aureus* had 3 isolates, 2 in the 6-24 months (75%) and 1(25%) in the37-59 months. *Klebsiella* spp had 2(100%) isolates both within the age group of 25-36 months. *Proteus* spp had 1 isolates (100%) female of 25-36 months.

**Table 4.5: Pathogen Isolated According to Age**

| Pathogen | Age (months) | Frequency | Total |
|---|---|---|---|
| *E.coli* | 6-24 | 1 | 1 |
| | 25-36 | 5 | 5 |
| Total | | 6 | 6 |
| *S.aureus* | 6-24 | 2 | 2 |
| | 37-49 | 1 | 1 |
| Total | | 3 | 3 |
| *Klebsiella spp* | 25-36 | 2 | 2 |
| Total | | 2 | 2 |
| *Proteus spp* | 25-36 | 1 | 1 |
| Total | | 1 | 1 |
| **Total** | | **12** | |

Source: Reseach data (Ntukula, 2014)

**Table 4.6: Correlation of Age and Bacteria**

| | | Bacteria | Age |
|---|---|---|---|
| Bacteria | Pearson Correlation | 1 | .102 |
| | | | .753 |
| | N | 12 | 12 |
| Age | Pearson Correlation | .102 | 1 |
| | | .753 | |
| | N | 12 | 12 |

Source: Reseach data (Ntukula, 2014)

### 4.3.3 Pathogens Isolated According to Sex

*Escherichia coli* was the predominant isolate among the study participants (Table 4.7), it was more among the females 4 (66.66%) than males2 (33.33%), Males with more strains of *Staphylococcus aureus.*3 (100%) *Klebsiella species* and *Proteus species* were among the females only, 2(100%) and 1, (100%) respectively.

**Table 4.7: Pathogens Isolated According to Sex**

| Pathogen | **Sex** | | Total |
|---|---|---|---|
| | **M** | **F** | |
| *E.coli* | 2(33.33%) | 4(66.66%) | 6(50%) |
| *S.aureus* | 3(100%) | 0(0%) | 3(25%) |
| *Klebsiella spp* | 0(0%) | 2(100%) | 2(16.66%) |
| *Proteus spp* | 0(0%) | 1(100%) | 1(8.33%) |
| | 5(41.66%) | 7(58.33%) | 12(100%) |

Source: Reseach data (Ntukula,2014)

**Table 4.8: Correlation of Bacteria and Gender**

| | | Bacteria | Sex |
|---|---|---|---|
| Bacteria | Pearson Correlation | 1 | .200 |
| | | | .533 |
| | N | 12 | 12 |
| Sex | Pearson Correlation | .200 | 1 |
| | | .533 | |
| | N | 12 | 12 |

Source Reseach data (Ntukula,2014)

### 4.4 UTI co-morbidity with Malaria

#### 4.4.1 Co-morbidity by Age

**Table 4.9: UTI co Morbidity with Malaria by Age**

| Variables | Present(n=12) | Absent(n=354) | P.value |
|---|---|---|---|
| **Age(in months)** | | | 0.10 |
| 6-24 | 3(25.0%) | 252(71.18) | |
| 25-36 | 8(66.66%) | 64(18.20) | |
| 37-59 | 1(8.33%) | 38(10.73%) | |
| **Total** | **12(3.28%)** | **354(96.72%)** | |

Source: Reseach data (Ntukula, 2014)

#### 4.3.2 Co-morbidity of UTI and Malaria by Sex

Table 4.10 shows the co infection of malaria and UTI in which females are most infected.

**Table 4.10: UTI co Morbidity with Malaria by Sex**

| Variables | Present(n=12) | Absent(n=354) | |
|---|---|---|---|
| **Gender** | | | P.value |
| **Male** | 5(41.33%) | 160(45.20%) | 0.20 |
| **Female** | 7(58.66%) | 194(54.80) | |
| **Total** | 12(3.28%) | 354(96.72%) | |

Source: Reseach data (Ntukula,2014)

### 4.5 Antibiotic Susceptibility Test

All the isolates (*E. coli, S.aureus Klebsiella spp and Proteus spp*) were highly sensitive to Ciprofloxacin (CIP), Septrine(Sxt) and Nitrofuranton (Nit) with sensitivities ranging from 66.7% to 100%.Gentamicin(Ge) and Penicillin(Pe) were

the list sensitive to all organisms showed sensitivity ranging from 0-33.3%. NIT used only for GNR, while Penicillin (Pe),Vancomycin (Va) and Impenum (Imp)were used for GPC only.

Ciprofloxacin and Septrine were sensitive to 10(83.33%) isolates.Of those ten isolates 4 were *E.coli,*3 *S.aureus,*2 *klebsiella spp* and 1 *Proteus spp*.Amikasin was sensitive to 6(85.71%) isolates of which 4 were *E.coli,*1 *Klebsiella spp* and *Proteus spp* respectively. Gentamycin was sensitive to only 2(16.77%) isolates both are *E.coli.* Nitrofuranton was sensitive to 8(88.88%) isolates, 6 were *E.coli* and 1 *klebsiella spp* and *Proteus spp* respectively. Ceftriaxon(CTX) was sensitive to 4(33.33%) isolates, 2 were *E.coli* and 1 *S.aureus* and *Klebsiella spp* respectively.

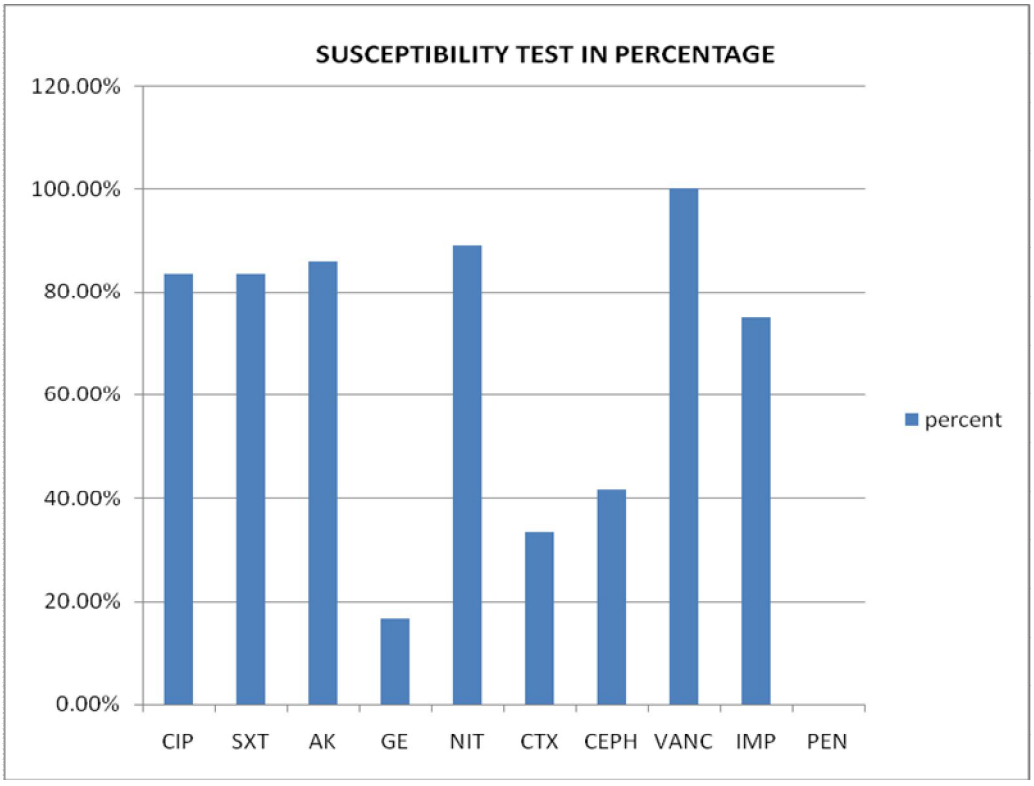


**Figure 4.2: Shows the Antibiotics Susceptibility in Percentage**

Source: Research data (Ntukula, 2014)

Cephalothin was sensitive to 5(41.7%) isolates of which 3 were *E.coli* 1 *klebsiella spp* and 1 *S.aureus*.Vancomycin was sensitive to 3(100%) isolates of *S.aureus*.Impenum was sensitive to 2(75%) of *S.aureus*.Penicillin was resistant to all *S.aureus*.

Where:CIP=Ciprofloxacin,SXT=Septrine,AK=Amikacin,GE=Gentamycin,NIT=Nitrofurantoin,CTX=Ceftriaxone,CPH=Cephalothin,VANC=Vancomycin,IMP=Impenun and PEN=Penicillin.

# CHAPTER FIVE

# 5.0 DISCUSSION

## 5.1 Introduction

Co-infection of malaria and UTI is not a new phenomenon. There is generally under-reporting and underestimation of these conditions in children especially as fever, a symptom,which is common in both infections (White, 1989; Musa-Aisien *et al.*, 2003; Okunola *et al.*, 2012). This study determined the prevalence of coexisting malaria with UTI, identified the predominant causative agent and also assessed the antimicrobial susceptibility pattern of the isolated organisms among children under 5 years with malaria in Muhimbili National Hospital. The prevalence of malaria and UTI co-infection in this population was 3.3% with *Escherichia coli* as the predominant isolate, also females are the majority for being co infected with malaria and UTI. The isolates were mostly sensitive to ciprofloxacin and nitrofurantoin and mostly resistant to Penicillin and gentamicin.

## 5.2 Prevalence of UTI by Age

The distribution of UTI among the age cohorts is shown in Table 4.5. 3 of the 12 children (25%) aged 6- 24 months had UTI in comparison with8 (66.66%) and 1(8.33%) of 25-36 and 37-59 respectively.25-36 month group is predominating for UTI(Table5). However, between 24 months and 48 months children, due to their developing immune system, are exposed to all manner of infectious agents which makes them susceptible to common infections including UTI (Okunola *et al.*, (2012). Age was not associated with bacteriuria (p=0.102), Table 6. Also, probably because

at that age the children are trying to depend on themselves, it is the age of toilet teaching, they craw, walk around and playing in different environments sometimes without parental care. Originally there appeared to be a difference in outcomes with infection occurring under the ages of 2 to 5 years based on studies which found a higher incidence of renal scarring in this age groups (Berg *et al.,* Gleenson *et al.,* 1991).

In fact some studies have shown that neonates and infants may actually have a decreased incidence of scarring and abnormalities compared to older children (Biyikli *et al.,* 2004). In other studies show that the prevalence of UTI among subjects with malaria was higher in children less than 24 months old, and this observation is comparable to the other report. This trend may be ascribed to the fact that the younger child has some immuneincompetence that predisposes them to increased incidence of infection, including UTI (Gorelick *et al.,* 2000).

Also from Table (2b), a total of 324(88.52%) children had malaria only and completely no bacteria growth 20(3.825%) patients had no significant growth of bacteria, that is the colon forming unit(cfu) was equal or less than $10^3$/ml·In MSU this is not likely to be significant quantity of potential pathogen.A threshold of ≥100,000 CFU per ml in a voided specimen is the standard to define a positive urine culture **(**Chessebrough, 1984**)**.

Total of 4(1.09%) patients had Mixed growth of GPC and GNR, also 2(0.54%) had contamination of Coliforms. Total of 4(1.09%) patients had a contamination of *Bacillus.* All these may be due to poor specimen collection by the parents or

guardians or by the use of contaminated containers, or even a true infection. Distinguishing true infection from contamination in cultures with this level of growth may be aided by a repeat culture if the patient has not been treated by signs of acute infection such as the presence of pyuria (Forbes *et al.,* 1998 Chessebrough, 1984). Very unfortunately it was not possible to get a repeat fresh sample from the patients because they were already discharged.

### 5.3 Prevalence of UTI by Sex

Of the 12 patients, 7 were females (58.33%) and 5 were males (41.77%)(Table 7). There was no significant gender difference in the prevalence of UTI ( $P$ = 0.20),Table 8.The slightly difference is probably because women have shorter urethras, and close to the anus, so it is easier for the germs to move up to their bladders. Also there is no correlation of sex and bacteria specificity on causing UTI,ie any bacteria can cause UTI in a favourable environment.(Okwara *et al.,* 2004).

### 5.4 The Most Common Pathogens isolated based on participant Age

*Escherichia coli* was the predominant of the isolates in the age groups (Table 4.5) with the majority of 25-36 months having 5 isolates(83.33%),6-24 months with 1 isolate(16.35%).No *E.coli* in 37-59 months.The predominance of *E.coli* has been reported also from other studies (Forbes, 2002) though there some few studies indicated the predominance of *Staphylococcus aureus* (Osegbe *et al.,* 1991,Biyickli *et al* 2004).The predominance of *Escherichia coli* in this study could imply that there is a predisposition to gram-negative infections in children with malaria.

However, this is an area that will require further investigation. *Staphylococcus aureus* had 3 isolates,2 in the 6-24 months(75%) and 1(25%)in the37-59 months. *Klebsiella spp* had 2(100%) isolates both within the age group of 25-36 months.*Proteus spp* had 1 isolates (100%) of 25-36 months.

### 5.5 The Most Common Pathogens Isolated Based on Participant Sex

*Escherichia coli* was the predominant isolate among the study participants (Table 4.7). It was more among the females 4(66.66%)compared to 2(33.33%) of men.*S.aureus* was the predominant isolate among the males with the incidence of 3(100%). *Klebsiella spp* was 2(100%)among the females only, also *Proteus spp* was 1(100%) only the female. There is no relationship of bacteria causing UTI and gender,any bacteria can cause UTI to any sex when the condition allow (Okwara *et al*., 2004).

### 5.6 Co-morbidity of UTI and Malaria According to Age

The prevalence of co infection reported in this study is 3.3%. children aged 26-37 being the majority among the age cohort. Co-infection of malaria and UTI in children has been reported by several studies conducted across the World and particularly in African continent (Musa *et al.*, 2003; Okwara *et al.*, 2004; Okunola *et al.*, 2012). Okwara *et al.* Biyikli *et al* 2004 reported 13.3% in Kenya among children aged 3 months to 12 years). The higher value in Okwara's study may be accounted for by the fact that a disproportionately higher number of young infants were included in that study. An earlier study by Musa *et al*.2003 and Biyikli *et al* 2004 in Benin City reported a prevalence of 6% in their sub-population with malaria, a figure that is still higher than what is recorded in this study.

### 5.7 Co-morbidity of UTI and Malaria According to sex

12 out of 366 children (3.3%) examined had growth of a single bacterial pathogen. Girls were slightly more than boys to have a co morbidity of malaria and UTI.Females were 7(58.66%) compared to males 5(41.33%) The study corraborates the findings as documented in other reports that malaria in children can co-exist with UTI (Gleenson *et al.,* 1991), and among boys, uncircumcised infants had an eightfold higher risk. However, the spectrum of organisms found among this cohort is similar to what is obtainable for the general population, implying that malaria co-existing with UTI is not due to any special group of organism(s).(Osegbe *et al.*, 1991).

# CHAPTER SIX

## 6.0 CONCLUSION AND RECOMMENDATION

Co-infection of malaria and UTI was present in 3.3% of febrile children under five years in Muhimbili National Hospital. Approximately one in every thirty children under five years of age managed for parasitologically proven malaria had concomitant UTI which could only be detected through extra efforts. Non-detection implies that such hidden morbidity would be untreated. *Escherichia coli* was the predominant cause of the UTI and the isolates were highly resistant to penicillin and Gentamycin but susceptible to ciprofloxacin, Septrine and nitrofurantoin. Health care personnel should rule out UTI when managing febrile children less than five years with malaria.

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# APPENDICES

## Appendix 1: Questionnaire

**Interview schedule for data collection of children under five years attending medical services for co-existence between malaria and UTI at MNH,**

**SECTION A: INTRODUCTORY PART**.

1. Interview number……
2. Date of interview…….
3. Time of interview……

You are free to answer these questions. You are allowed to ask any question where not clear. The interview is aiming at collecting data (information) about the co-existence between Malaria and UTI diagnosis. All information given will be treated as confidential.

**SECTION B: QUESTIONS.**

The questions will be asked to the parents or guardians of the children. Tick the correct answer.

1. How old is the child?

a). 6-24months

b) 25-36months

c) 37-59months

2. Is he/she getting fever

a).Yes

b).No

3. Is he/she getting difficult in urination?

a).Yes

b).No

4. Has he/she been investigated for malaria?

a)Yes

b) No

5. Has he/she been investigated for UTI?

a)Yes

b) No

a) Has he/she been treated for malaria?

b)Yes

b) No

7. Has he/she been treated for UTI?

a)Yes

b) No

8. Is he/she having any urinary tract structural abnormality?

a)Yes

b) No

Thank you very much for your cooperation.

**Appendix 2: Consent Form**

**CO-EXISTENCE OF UTI AND MALARIA AMONG CHILDREN UNDER FIVE YEARS AT MNH**.

**Foreword**

My name is Albert Ntukula,Masters student from OUT.I am currently conducting a study on Co-existence of UTI and Malaria attending at MNH.

## Research description:

The study will take about eight months from November 2013 to June 2014. The findings from this study will bring the baseline useful information that will bring the improvement on diagnosis of co-morbidities in under five years and therefore proper management.

I ask for your participation in the study on behalf of a child because she/he is among the patients admitted at MNH that is regarded as a group at risk. If you agree to participate in this study you will be requested to provide sample specimen for the study through laboratory investigation.

**Benefits:**

If you agree to participate you will have the following benefits;

1. You will know if you are co-infected with UTI and Malaria as not previously identified.

2. You will be managed according to the treatment guidelines if you have it.

**Risks:**

No risk can occur during your participation in urine specimen collection.

**Confidentiality:**

All information obtained from you will be treated as confidential, and will be used for the intended purposes of this research.

**Compensation:**

I do not expect any harm to you as a result to your participation in the study, however, if it accidentally occurs there will be no compensation.

**Voluntary Participation and Withdrawal:**

You have the right to participate or not in the study without giving any reason for your decision,and you are free to terminate your participation at any time in the course of the study.

**Contacts:**

If you have any question about this study you are free to contact the principal investigator:Albert Ntukula(0716127128) or albert.ntukula@yahoo.com.If you have any question/concern about your rights as a participant you may contact Professor Emmanuel Kigadye, OUT, Po Box 23409 DSM. Tel no 0754 373756

**Documentation:**

If you agree to participate, please sign this informed consent form.

I……..,have read and understood the contents of the informed consent form and questions have been answered adequately. I therefore consent for participation in this study.

Signature of the interviewee……Date……

Signature of the interviewer…….Date……