AN AUDIT OF ANTIMICROBIAL TREATMENT PRACTICES AND LABORATORY DIAGNOSTICS IN FEBRILE PAEDIATRIC PATIENTS AT MZIMBA SOUTH DISTRICT HOSPITAL

MASTERS OF HEALTH SCIENCES ANTIMICROBIAL STEWARDSHIP

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An Audit of Antimicrobial Treatment Practices and Laboratory Diagnostics in Febrile Paediatric Patients At Mzimba South District Hospital

By

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(BSC MLS, HONS)

A Dissertation Submitted In Partial Fulfilment Of The Requirements For The Award Of Degree In Masters Of Health Sciences Antimicrobial Stewardship

22 March, 2022

DECLARATION

I, Happy Abraham Manda declare that this research paper is my original work which has not been submitted to any other institution for similar purposes. In this paper, where other people's work has been used, acknowledgements have been made accordingly.

By signing below, the supervisor certifies that this research paper is a true piece of the student's work and effort and has submitted with the approval of the supervisor.

Student legal name…….

Signature……

Date ……...……

CERTIFICATE OF APPROVAL

The Dissertation of **Happy Abraham Manda** is approved by the College of Medicine Research Committee

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DEDICATION

This dissertation is dedicated to, My Mother Anastanzia Mwamlowe and my Wife Bridget Msyali for their encouragement in the time of my study, you have made be to be what I am. My wife only God can reward your efforts and love.

ABSTRACT

Background: It is a recommendation clinician to use Standard Treatment Guidelines (STG) to come up with presumptive diagnosis or order laboratory tests to support the diagnosis. Adherence to STG alone is a global concern.

Objective: This study was to evaluate the antimicrobial prescribing practices among febrile paediatric patients in relation to Malawi Standard Treatment Guidelines (MSTG) and laboratory findings or usage at Mzimba South District Hospital (MSDH).

Methods: This was a retrospective cross-sectional study using mixed methods where quantitative and qualitative methods were employed. Three hundred and sixty case notes for paediatric patients admitted to the children's ward from January to December 2017 were assessed.

Findings: The common febrile illness diagnosed were malaria 194 (53.9%), sepsis 108(38.3%) and pneumonia 99(27.5%). The use of MSTG and laboratory investigations in prescribing was at 18.1% and 28.3% respectively. Despite the availability of MSTG and laboratory tests to guide antimicrobial prescribing practices, Amoxicillin was prescribed in 90%, Benzylpenicillin 85%, and Gentamicin 69% of febrile ill patients regardless of the malaria positive test results or the diagnosis. Artesunate and LA were prescribed in malaria negative patients in the final diagnosis of malaria at 49 (38.1%), sepsis 44 (40.7%) and pneumonia 19 (19.9 %).

Conclusion: The laboratory tests and MSTG had minimal support to antimicrobial prescribing practices at MSDH. Prescribers prefer the use of empirical treatment with a focus on broad spectrums and if in dilemma consult the seniors. We recommend establishment of antimicrobial stewardships to monitor antimicrobial use and advocate on MSTG use. Furthermore, we recommend strengthening microbiology facilities to support identification of microbe and antimicrobial susceptibility.

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AIDS	Acquired Immune Deficiency Syndrome
CBC	Complete Blood Count
COMREC	College of Medicine Research Ethics Committee
CHAM	Christian Health Association of Malawi
CPG	Clinical Practice Guidelines
DHO	District Health Officer
EID	Early Infant Diagnosis
FBC	Full Blood Count
HIV	Human Immunodeficiency Virus
LP	Lumbar Puncture
MEMLs	Malawi Essential Medicines Lists
MSDH	Mzimba South District Hospital
MRDT	Malaria Rapid Diagnostic Test
MSTGs	Malawi Standard Treatment Guidelines
PITC	Provider Initiated Testing and Counselling
RBS	Random Blood Sugar
STGs	Standard Treatment Guidelines
WHO	World Health Organisation

CHAPTER 1: INTRODUCTION

1.0 Introduction and Background of the Study

This chapter introduces the research overview and the research problem being investigated with a highlight of the knowledge gap that the research expects to fill. The research questions that guided the whole study and the research objectives are also outlined in this section.

1.1. Research Overview

Acute febrile illness is a common cause of paediatric hospital admission in Sub Saharan African countries and mainly these illnesses are due to malaria, viral and bacterial infections(1–3). Acute febrile illness is defined as a condition in a patient with a fever of temperature greater than 38°Cat presentation or a history of fever that persists for 2–7 days with no localizing source (4). Differentiating febrile illnesses is often challenging due to the similarity in symptoms such as the sudden onset of fever, headache and malaise and this may result in a missed diagnosis and inappropriate treatment(5,6). *Plasmodium falciparum* is one of the causatives and most prevalent agent of malarial febrile illness in Malawi (7) and can easily be confirmed by microscopy or rapid diagnostic tests in most health facilities. However, the diagnosis of non-malarial febrile illness due to invasive viral and bacterial diseases remain problematic as culture and sensitivity testing for bacteria is only available in few health facilities and take a considerable amount of time (ranging from 24 to 48 hours) for results to be released and provide guidance treatment. Furthermore, diagnostics for viral causative agents for febrile illness remain poor as only rapid serological tests are available especially for hepatitis and Human Immunodeficiency Virus (HIV)(3). Studies have shown that viral infection constitutes 76% of fevers of unknown cause(8).

1.1.1. Use of MSTG to standardise treatment

World Health Organisation (WHO) advocates the use of treatment guidelines in its effort to reduce the growing resistance in microorganisms of public health importance (9). All countries follow WHO guidelines to develop their STGs. Malawi first introduced its STGs called Malawi Standard Treatment Guidelines (MSTGs) in 1990 (10). STGs are prepared after consultations with highly specialised medical practitioners and include information on microbiology laboratory tests for medical conditions to assist clinicians when prescribing antimicrobials (11–13). According to the Merriam-Webster dictionary, antimicrobials are substances capable of destroying or inhibiting the growth of pathogenic microorganisms(14,15). Examples of antimicrobials are antibacterial as directed or effective against bacteria, antiviral as acting, effective or directed against viruses, antiparasitic and antifungal directed or acting on parasites and fungi respectively(15).The MSTGs which incorporates the Malawi Essential Medicines Lists (MEMLs) is aimed at standardising prescribing practices that enable more consistent and uniform availability of medicines and medical supplies across all levels of national health care systems(10). This standardising also, in part, incorporates the laboratory through EMLS which aims at standardising the laboratories to deliver quality services that have been incorporated in Essential Health Package(16). These systems help in quantification, procurement, and the supply of drugs and other medical resources to all hospitals in Malawi (11–13).

1.1.2. Importance of MSTG

It is thought that STGs if followed or adhered to properly could help to reduce problems hospitals face in terms of, resistance, cost of drugs, morbidity and mortality due to treatment failure and treatment adherence problems (12,17,18). It could also help in the rational use of medicine which requires patients to take medications appropriate to their clinical needs, in doses that meet their requirements, for an adequate time and at the lowest cost for them and

their community (9,19). Non-rational use of medicines is a huge global problem with serious consequences in terms of poor patient outcome, adverse drug reactions, increasing antimicrobial resistance and wasted resources(9,19–21). Malawi Government through the Ministry of Health has also developed other treatment guidelines for some diseases such as malaria, AIDS and Tuberculosis to make sure that the treatment of diseases is standardised in line with MSTGs (22–26).

1.1.3. Clinicians' adherence to STGs

Adherence to STGs is a global concern (19,27). Several barriers have shown to affect adherence to STGs in health workers (12,28,29). In sub-Saharan countries, the most common barriers are lack of resources in some hospital settings like laboratory reagents, drugs and x-ray resources (30,31). Another barrier is the complexity of some guidelines (20,31) such that clinicians prefer short guideline recommendations that are easy to understand. Production of simple and clear guideline recommendations that could address the complex problems seen in daily practice has been observed to be challenging. This is because STGs formats are in paperwork and are not summarised, electronified orhyperlinked to give more detailed information to serve the varying needs of physicians and patients (31). The question of to what extent STGs and laboratory tests are used by antimicrobial prescribers in the management of paediatric febrile illness has not been explored at MSDH. The goal of this project was to evaluate the antimicrobial prescribing practices in paediatric febrile illnesses in relation to MSTGs and laboratory findings or usage. In addition, the study was aimed to explore clinicians' perception on laboratory services to gain in-depth knowledge of prescription-related practices in Mzimba South district.

1.1.4. MSTGs and Antimicrobial prescribing practices

Antimicrobial agents refer to substances that destroy microorganisms or inhibit the growth of microorganisms to prevent their pathogenic actions(32). The use of antimicrobial agents in

treating the infection is not simple and it requires the clinician to use STGs and laboratory tests to come up with a drug of choice for a particular isolated organism or an assumed organism(10,33). In Malawi, almost 80% of health facilities do not perform routine microbiological culture and sensitivity testing due to a lack of personnel, equipment and financial resources (34). Antimicrobial therapy is mainly empirical and may lead to the emergence of antibiotic resistance and hence sub-optimal clinical outcomes (12,35–37). A standard way to use antibiotic is to target the infection-causing organism and this is achieved by culture and sensitivity in which the organism is isolated and susceptibility testing is done to determine the drug of choice (12,13,38). Studies on the attitude of Malawian clinicians on the use of laboratory tests have suggested that lack of good infrastructure, equipment, skilled laboratory personnel are reasons why patients are treated empirically(30). Some hospitals have microbiology departments but clinicians rarely order microbiology tests to support treatment prescribed (30). It could also help to reduce problems hospital face in terms of increased morbidity and mortality due to treatment failure, adherence problems, resistance and cost of drugs(39).

Problem Statement

Antimicrobials need to be prescribed and dispersed using STG to avoid irrational use and resistance development among organisms. An audit on clinicians' antimicrobial prescribing practices among febrile paediatric patients with respect to MSTGs and laboratory diagnostic outcomes have not been conducted at Mzimba District Hospital. The level of adherence to MSTGs by clinicians with respect to antimicrobial prescribing practices at Mzimba District Hospital is not known since no such study has been conducted at this hospital. There is a danger that the continual conduct of antimicrobial prescribing practices without following the

MSTGs may contribute to the irrational use and resistance development to antimicrobials among patients receiving unnecessary antimicrobials.

1.2. Overall Aim of the Study

This research aimed at finding out the extent to which MSTG and the laboratory support the antimicrobial prescribing practices among febrile paediatric patients. In addition, the study aimed to explore clinicians' perceptions on the use of laboratory tests with respect to antimicrobial prescribing.

1.3. Specific objectives

1. To determine the common febrile illnesses among paediatric patients admitted at MSDH
2. To determine the common laboratory tests done at Mzimba to support the diagnosis of febrile illnesses
3. To determine the paediatric antimicrobials commonly stocked at Mzimba District Hospital.
4. To quantify the proportion of rational and irrational antimicrobial treatment among paediatric patients with febrile infection in relation to MSTG and laboratory findings.
5. To explore clinicians' perceptions on the use of MSTG and laboratory investigations in the determination of antimicrobial drugs for treatment in paediatric febrile infections at Mzimba South District Hospital.

1.4. Research Questions

1. What are the common laboratory tests ordered and antimicrobials prescribed at MSDH to treat the cause of febrile conditions?
2. What is the common antimicrobial stocked at MSDH?

3. What are the proportions of the appropriateness of antimicrobial treatment among paediatric patients with febrile infection in relation to MSTG and laboratory findings?
4. How do clinicians at MSDH perceive the use of standard treatment guidelines and the use of laboratory tests in prescribing antimicrobial?

1.4.1. Justification

There is a need for an audit on clinicians' antimicrobial prescribing practices among febrile paediatric patients concerning MSTG and laboratory diagnostics outcomes to be conducted at Mzimba District Hospital. Antimicrobials are being dispensed in paediatric wards but the practice is not audited to determine how guidelines in prescribing the antimicrobials are followed to reduce irrational use of antimicrobial.

The perceptions and level of adherence to STGs by clinicians with respect to antimicrobial prescribing practices at Mzimba District Hospital are not known since there has been no such study to have been conducted at this hospital.

There is a need to know how clinicians perceive the use of MSTGs which could help to come up with proper way of developing these MSTGs to suit the clinicians' requirements.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

This chapter presents the literature review. Insights by experts that have been written on topics related to the research questions are outlined and reviewed in this chapter. It will give an account of how STG is used in treating febrile illnesses, adherence to STGs and consequences of not adhering to STGs.

2.1. Use of STG in treating febrile illnesses

There are so many ways of promoting rational drug such as the use of clinical guidelines development and use of national essential medicines list, the establishment of drug and therapeutics committees in districts hospitals, the inclusion of problem-based pharmacotherapy training in undergraduate curricula and supervision, audit and feedback(40). According to the Standard Treatment Guideline For Health Centers for Ethiopia, one of the ways isto develop STGs that do have an evaluation of the health problems and select appropriate therapeutic strategies which could be used in developing standards for antimicrobial treatment (41). Based on the right diagnosis, health workers may select more than one treatment for the patients depending on STG requirements(41). In Malawi, several STGs are in use for febrile conditions such as malaria, pneumonia and HIV/AIDS. Several studies have been conducted on the use of

STGs for various conditions both qualitative and quantitative(42). Treatment of Febrile conditions caused by viruses, bacteria, and fungi appear most in guidelines and are treated empirically(43). MSTG states that the prescriber must give antimalaria to all positive malaria cases starting with Artesunate or quinine before switching to LA if patients tolerate oral medication. It also states that before giving antimicrobial a prescriber must order culture and sensitivity to investigate the organism that causes febrile illness.

2.2. Adherence to Standard Treatment Guidelines

According to WHO,STG is a systematically developed statement designed to assistpractitioners and patients in making decisions about appropriate health care for specific clinicalcircumstances(44). The use of STGs could be beneficial to health care providers, health care officials, supply management personnel and patients(44). Astudy conducted in a rural paediatric hospital in Sierra Leone found that non-adherence to guidelines comprised the use of non-standard drug regimens, dosage variations, non-standard frequency of drug administration and treatment duration. The study found that cumulative adherence to guidelines for Lower Respiratory Tract Infection (LRTI) cases was only 14% and in this, 12% of patients had malaria. This study also found that the outcome for this non-adherence was potentially and significantly associated with an unfavourable hospital outcome, both for malaria and for LRTI cases due to incorrect drug regimen and duration of treatment(19).

In sub-Saharan countries, studies have shown that the most common barriers that influence non-adherence to STG are the lack of resources in some hospital settings like laboratory reagents, drugs, and x-ray films (9,29). Another barrier is the complexity of some guidelines (19,29) such that clinicians prefer short guideline recommendations that are easy to understand. Other reasons for non-compliance include time pressures, information overload and delays in the uptake of new protocols(45). Another study has shown that in pressurised health care systems with multi-disciplinary teams like doctors, medical assistants, clinical

technicians and clinical officers, there is the issue of fragmentation (loss of overview and ownership coupled with professional practice carried out in isolation care)(46). Fragmentation occurs when a large team of people are involved in the care of a patient which may result in uncertainty between different professional groups over their responsibility for various actions. This confusion may lead to resentment and subsequently disregard for policies and guidelines (46).

2.3. Adherence to STG on laboratory test

Non-adherence toSTGs has also be recorded in clinical laboratory practice.Amini-review onwhy clinical practice guidelines are not followed conducted bythe European Federation of Clinical Chemistry and Laboratory Medicine and European Union of Medical Specialists joint working group has shown that there are relatively few STGs written purely for laboratory medicine with partly laboratory tests included(45). The same mini-review also noted thatSTGs are often written without help from laboratory medicine specialists with the result that the laboratory aspects of Clinical Practice Guidelines (CPG) are difficult to implement in a way that ensures optimal use of laboratory tests(45).

2.4. Consequences of non-adherence to STGs

Non-adherence to STGs could lead to irrational use of antimicrobials. Irrational use of antibiotics can take many forms, including the use of too many medicines per patient (polypharmacy), the inappropriate use of self-medication(often with prescription-only medicines) in non-bacterial infections outside clinical guidelines, or with inadequate dosage or inappropriate route of administration such as overuse of injections when oral formulations would be more appropriate(47).The consequences of Non-adherence could betoo long to stay in the hospital as an inappropriate drug will be administered to patients which could not cure the cause of infection(19). It could lead to drug resistance as wrong medication may not be sensitive to the organism causing infection hence the organism will develop new mechanisms

for survival(48). Non-adherence could also lead to over expenditure on the procurement of antimicrobial because more drugs will be needed as prescribers will be switching from one drug to another(49). It may also have serious consequences in terms of poor patient outcome, adverse drug reactions and wastage of resources(19).

CHAPTER 3: METHODOLOGY

3.0 Research Methodology

3.1. Study design

This was a retrospective cross-section study **(see figure 1),** which employed a mixed-method design, where quantitative and qualitative data collection and analysis approaches were converged to understand the phenomenon under investigation.

3.2. Study setting, population, study and location

This study took place at MSDH using case notes of febrile patients admitted to the paediatric ward at MSDH. Mzimba is the biggest district in the northern part of Malawi and is divided into two parts (north and south). Mzimba South has a population of 688,301 served by MSDH and has 31 health centres and 9 CHAM hospitals. MSDH has a 212-bed capacity, admits on average 6000 paediatric patients per year of which 3600 (60%) are admitted due to febrile illnesses according to data from MSDH Health Information Management System (HIMS). The hospital has a laboratory for diagnostic services including full blood count (FBC), bacterial culture and sensitivity, serology, parasitology, viral load, Early Infants Diagnosis (EID) on HIV and Blood Transfusion Services.

3.3. Sample size

Sample Size calculation

A sample size of 360 cases was stratified by 30 cases per month for 12 months to give an insight into seasonal antimicrobial utilisation. This was calculated using Kish Leslie (50) from the prevalence of 35.4% of paediatric patients presenting with fever of temperature >38^0C(51). The following was the calculation:

$$n = \{z^2 (1- p)p\}/e^2$$

n = required sample size

z = level of probability that the true prevalence within the chosen level of required precision usually a standard of 5%

e= level of precision

Hence: $n = \{1.96^2(1- 0.345) \times 0.345\}/0.05^2 = 342$

The sample size was increased to 360 to the convenience of 30 case notes per month instead of 342.All 360 case notes were audited for laboratory tests and antimicrobial use. Clinicians, (n=30), were selected using a convenient sampling method from a total of 60 clinicians and interviewed using a questionnaire on perceptions of MSTG and laboratory tests.

Eligible case notes audited were for children aged 2 months to 14 years who presented with a fever of greater than 38^0C on admission (52). Case notes for all subjects with an obvious non-infectious cause for admissions such as trauma, surgery, or known malignancy and who did not receive antimicrobial during their hospital stay, were excluded from the study.

The clinicians who were interviewed on perceptions they had on MSTG and laboratory tests when prescribing antimicrobials were those who were currently practising. The study included

qualified clinicians and excluded the student's clinicians because they were on educational attachment and could not prescribe antimicrobial without a supervisor.

3.4. Data management

Data from returned filled excel sheets were checked for completeness upon getting back the excel questionnaire from the research assistants. Two research assistants filled the excel sheets in parallel and the third clinician acted as a tie-breaker to check the validity of the results. Corrections were made where necessary. These corrections were on things like the unintended omission of sex, age, inadvertently skip of a question and the febrile conditions antimicrobial prescribed in terms of drug spellings and arrangements.

Three hundred and sixty case notes were categorised according to months of admission to have an even distribution of seasonal disease burdens and also to see which ages are antimicrobial mostly prescribed. Each month had 30 case notes and was given a unique number for the month. Excel was used for data entry and in proper categorising of cases and IBM Statistical Package for Social Sciences software version 20 (IBM® SPSS®)was used for data analysis to determine the percentage of those that missed opportunities for laboratory investigations according to treatment guidelines against those that were treated according to STGs.

The drugs were put according to their classes using generic names to come up with antimicrobials that were commonly prescribed and why the clinicians could use such antimicrobial as priorities against the others.

3.5. Data analysis

Data were entered in Microsoft® Excel® 2016 and cleaned. As stipulated above, analysis was done using IBM® SPSS®. Core prescribing indicators were computed in line with the MSTG 2015. Theindicators were:probable and final diagnoses, ordered and attached laboratory tests results, number of antimicrobials per prescription and the percentage of patients prescribed

antimicrobial. Other indicators were the percentage of prescribed antimicrobials as per MSTG, the percentage of antimicrobials prescribed by generic name and the percentage of antimicrobial prescribed on discharge. The outcome of the patients' and common causes of febrile illnesses were also determined.

The descriptive analysis by crosstabulation was used in the data analysis. The outcome variable of interest was antimicrobial prescribing practice in relation to MSTG. Explanatory variables included in the analysis were patient age, gender, number of diagnoses stated by the prescriber, number of antibiotic medicines prescribed and malaria medicine prescription, the relationship between antimicrobial prescriptions and a number of common febrile illnesses diagnosed as probable and final. All conditions that had no febrile diagnosis despite having antimicrobial prescriptions and treatment given were not included in the analysis because they were not of interest to the study. Odds ratio (OR) and confidence intervals (95% CIs) for the febrile illness diagnoses, antimicrobial prescription and laboratory tests across categories of the explanatory variables were calculated.

3.6. Ethical consideration

The study was approved by the College of Medicine Research Ethics Committee **(COMREC**)-P.05/18/2526. All study case notes were obtained from the MSDH archive after obtaining permission from the District Health Officer (DHO) and a designated person was appointed to assign a unique number for confidentiality and anonymity purposes to all case notes. Consent was obtained from clinicians for an interview. The principal investigator audited the anonymised case notes assisted by a clinical officer or technician (a grade of non-physician clinician in Malawi).

1. The case notes were selected from the ward by a ward nurse and a data clerk. Masking tape was used to temporarily cover the patients' ID and then they were photocopied and

the original patient case notes were returned to the ward and the copies were put in envelopes according to months and handed over to the research team.

2. A pharmacist assisted in gathering data for antimicrobial that were available each month in the year of study.
3. A hospital statistician assisted in entering data and a laboratory officer or technician assisted in gathering data for the tests that were being performed in the year under study.
4. Data for reagents and antimicrobial stock status were done using a data collection tool for Pharmacy (Appendix VI) and obtained data from pharmacy stock cards and laboratory.
5. The principal investigator supervised the collection of data throughout the study period, did data cleaning and analysed the data to give meaningful information.

CHAPTER 4: RESULTS

4.0 Results

This chapter presents and discusses findings that were captured during the study. To provide answers to the research questions raised and to meet the research objectives relevant data was obtained and analysed. The findings have been divided into five sections.

1. The first section presents quantitative findings which address the demographic and seasonal distribution of febrile illness.
2. The second section which is the first objective is a determination of common febrile infections at MSDH,
3. The third section is the common laboratory tests that are ordered and performed at MSDH.
4. The fourth section is the determination of antimicrobial commonly stocked at MSDH.
5. The fifth section presents the proportion of appropriate and inappropriate antimicrobial treatment among paediatric patients with febrile infection in relation to MSTG and laboratory findings services respectively.
6. The sixth section presents the qualitative part, which addresses the clinician's perception of the use of standard treatment guidelines and the use of laboratory tests in prescribing antimicrobial.

Research framework

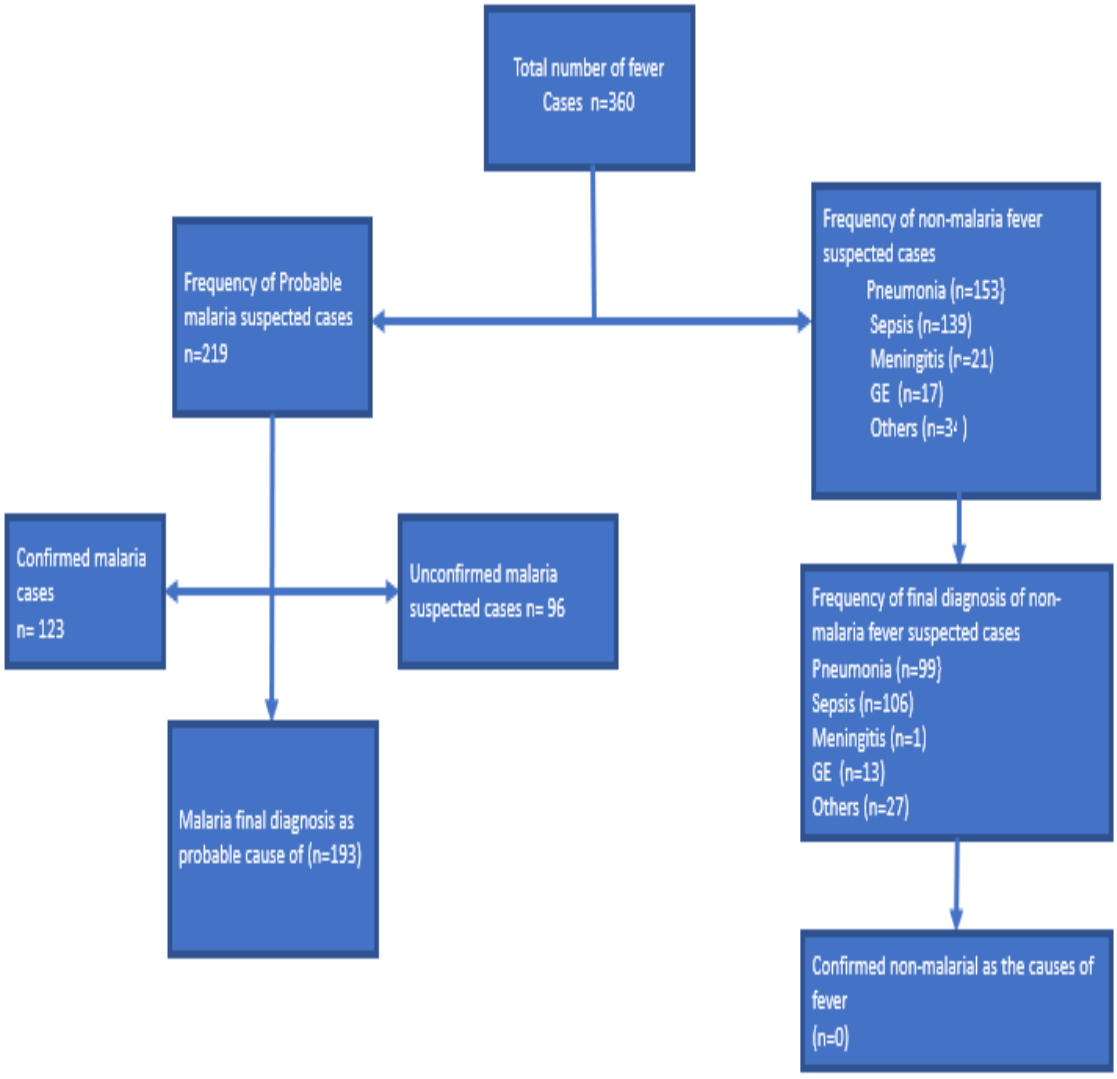


Figure 4-1: A research framework of the retrospective audit of antimicrobial prescribing practices at MSDH: n = number, GE = Gastroentelites

4.1. Demographics of paediatric febrile participants at MSDH

MSDH admits an average of 3600 per year paediatric patients with febrile illness according to the MSDH Health Information Management System (HIMS) of 2017. A simple random sample of 360 febrile illness case notes of paediatric patients which was then translated to 30 case notes in a month under the age of 14 years was investigated in the study. Of these 199/360 (55.60%) were males and 159/360 (44.4%) females (Table4.1). Three hundred and fifty patients got discharged, 6 died and 4 either absconded or had an unknown outcome. The death of 6/360 (1.7%) children were 1 male and 5 females. Four died from malaria, 1 from pneumonia and the rest died of three combined diagnoses of malaria, sepsis and meningitis.

Variables	**Category**	**N**	**Percentage**	**n/N**
Gender	Males (n=201)	201	55.6%	201/360
	Females (n=159)	159	44.4%	159/360
Age in months	0-12 13-24 25-36 37-48 49-60 >61	97 69 42 43 23 86	26.9% 19.1% 11.7% 11.9% 0.7% 23.9%	97/360 69/260 42/360 43/360 23/360 86/360
Probable Cause %	Malaria	219	44%	194/360
	Pneumonia	113	23%	113/360
	Sepsis	138	27%	138/360
	Others	30	6%	30/360
Final Diagnosis %	Malaria n=194	194	46%	194/360
	Pneumonia n=99	99	24%	99/360
	Sepsis n=108	108	26%	108/360
	Others	17	4%	17/360

Total Cases	360		100%	

Table 4.1: Summary of the characteristics of the cases and their clinical outcome

4.1.1. Malaria, Sepsis and Pneumonia were commonest causes of febrile illness in paediatric patients at MSDH

Diagnoses stated in patients' records were probable or final diagnosis. Probable cause, in this case, is reasonable ground to believe that a child is suffering from a febrile illness that could justify the prescribing of an antimicrobial before MSTG and any laboratory investigations to support the prescription. The final diagnosis is a certainty a prescriber has as to the cause of the febrile illness after all the consultations and the investigations are made usually written for patients in the course of treatment or on discharge. A prescriber could start with a presumptive diagnosis that would make him/her prescribe antimicrobial with de-escalation made in the course of treatment upon the laboratory investigations than on the discharge the prescriber could come up with a final diagnosis and prescribe a take-home antimicrobial according to the final diagnosis.

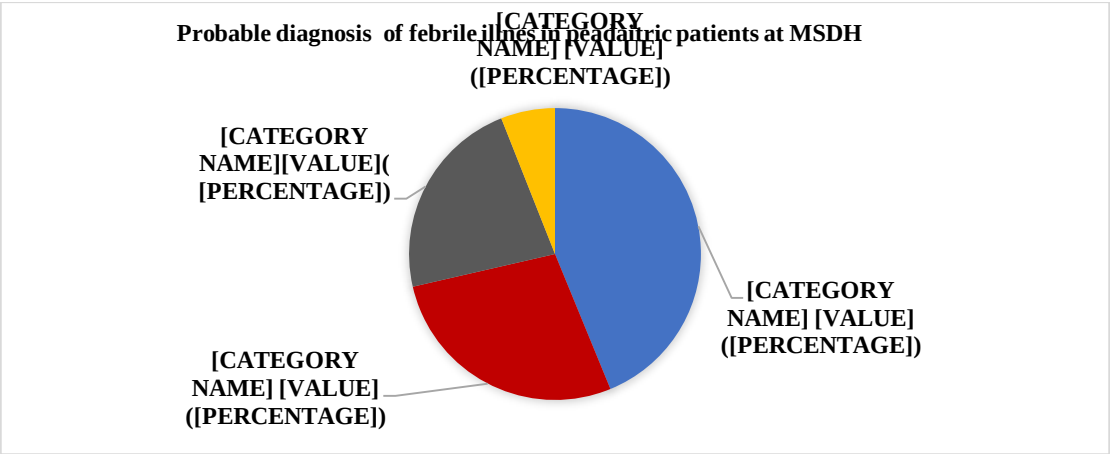


Figure 4-2a Probable causes of febrile illness in paediatric patients at MSDH

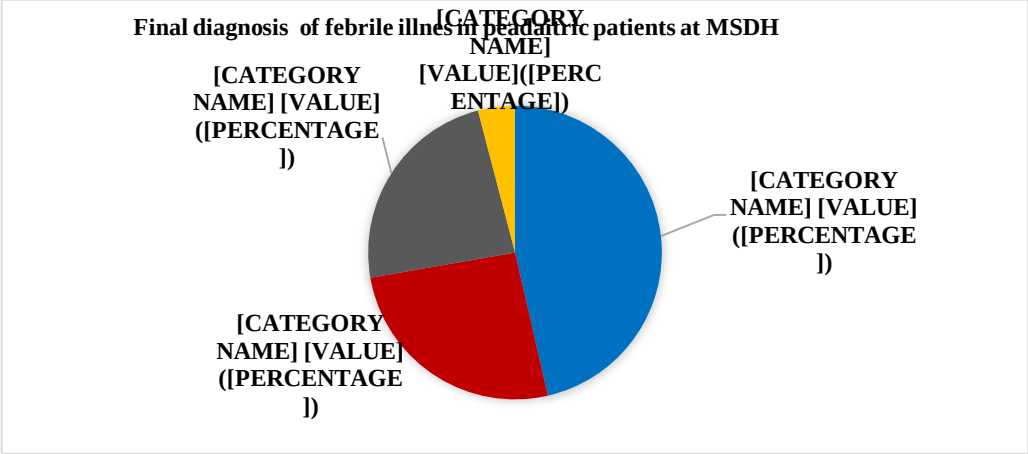


Figure 4-2b: Final diagnosis of febrile illness in paediatric patients at MSDH

Figure 4-2: Number of probable causes and final diagnosis of febrile illness at MSDH from case files. (4.2a) Probable causes of febrile illness in paediatric patients at MSDH (4.2b) Final diagnosis of febrile illness in paediatric patients at MSDH.

From figures, 2a and 2b, malaria, sepsis and pneumonia infections were the most probable common diagnoses by clinicians. Malaria cases were 219 (44%), severe pneumonia 113 (23.3%), and sepsis 138 (27%) and others like abscesses, burns and gastrointestinal illnesses were 30(6%). On final diagnosis malaria was the most common final diagnosis at194(46%), sepsis 108(26%) and Pneumonia 99 (24%) and others like abscesses, burns and meningitis were17 (4%).In summary, it was found that malaria was the most prevalent febrile condition in Mzimba South with sepsis being the second and pneumonia the third.

4.1.2. The burden of pediatric febrile illnesses was higher among under-fives

The disease burden was measured by age group to check the trend of febrile illnesses in children as they grow. The ages groups were categorized into 12 months (figure 4.3). The median age among children presenting with febrile illness was different.

1. The median age for malaria was 48 months,
2. sepsis was 30 months and
3. pneumonia was 12 months
4. indicating that these three febrile illnesses are common in under five children and attack children differently in their under five ages with pneumonia mostly attacking under 1 year children. Figure 3below illustrates how the febrile illnesses were distributed among paediatric age groups. All the median ages for the febrile illness fell below the age of 60 months.

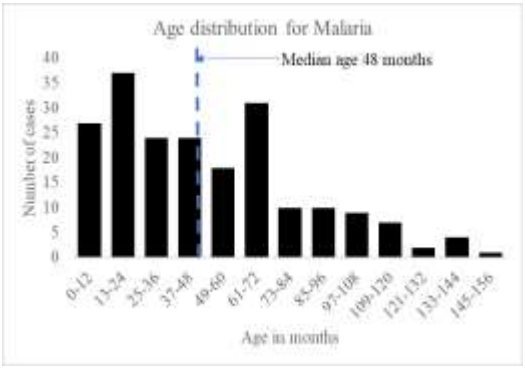


Figure 4.3a

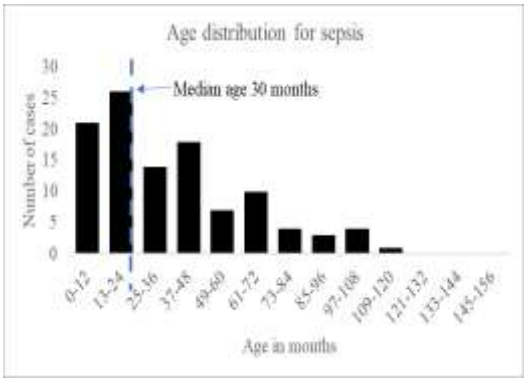


Figure 4.3 b

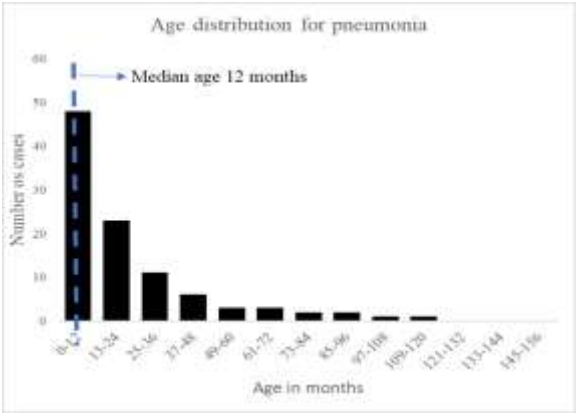


Figure 4.3c

Figure 4-3:Age distribution of febrile illnesses in paediatric patients at MSDH

4.1.3. The pattern of febrile illnesses by months

The frequency of febrile illness throughout the study was explored at monthly intervals to assess seasonality variations. Both probable and final cause of febrile illnesses were investigated.

1. Malaria had higher peaks from October to March.
2. A similar trend to malaria was seen in sepsis except for August which showed a fall in sepsis but higher peaks on malaria and
3. pneumonia a scenario that could not be explained by this study (Figure 4a and 4b). Pneumonia had higher peaks from April to July.

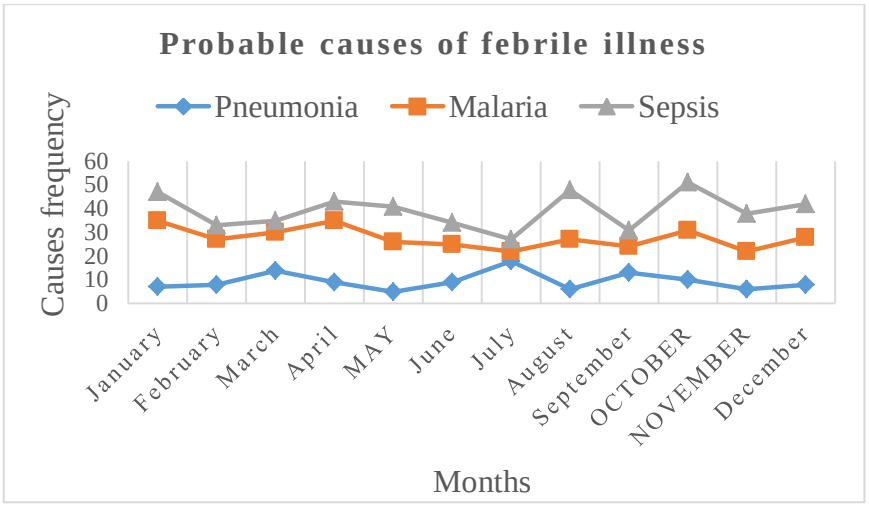


Figure 4a: Frequency of probable causes of febrile illnesses by month over the study period

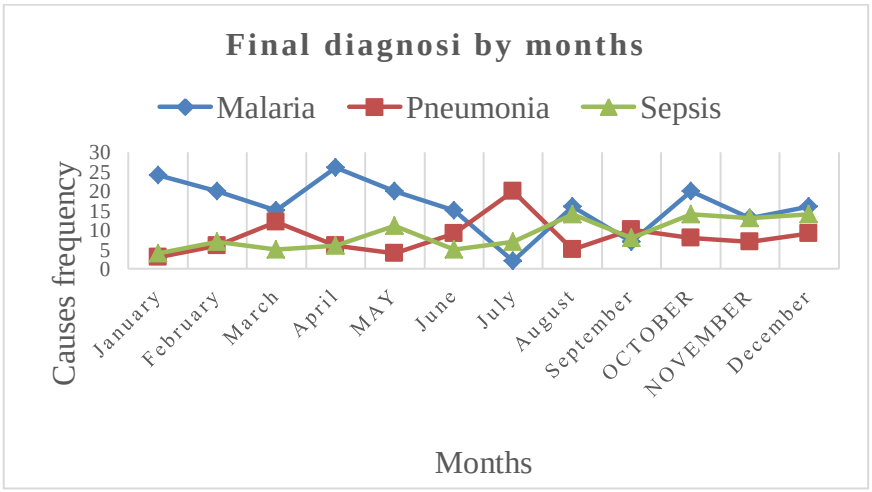


Figure 4b: Frequency of final diagnosis of febrile illnesses by month over the study period

Figure 4-4: Frequency of febrile illnesses by month over the study period

Similar trends to malaria were seen in sepsis in all months except for August, which shows a fall in sepsis but higher peaks on malaria and pneumonia a scenario that could not be explained by this study.

4.1.4. Overlapping of febrile illnesses at Mzimba South District Hospital

Differentiating febrile illness is difficult as all have a rise in body temperature. The challenge led to overlap in the diagnosis of febrile illness resulting from patients presenting withdifferent diagnoses.

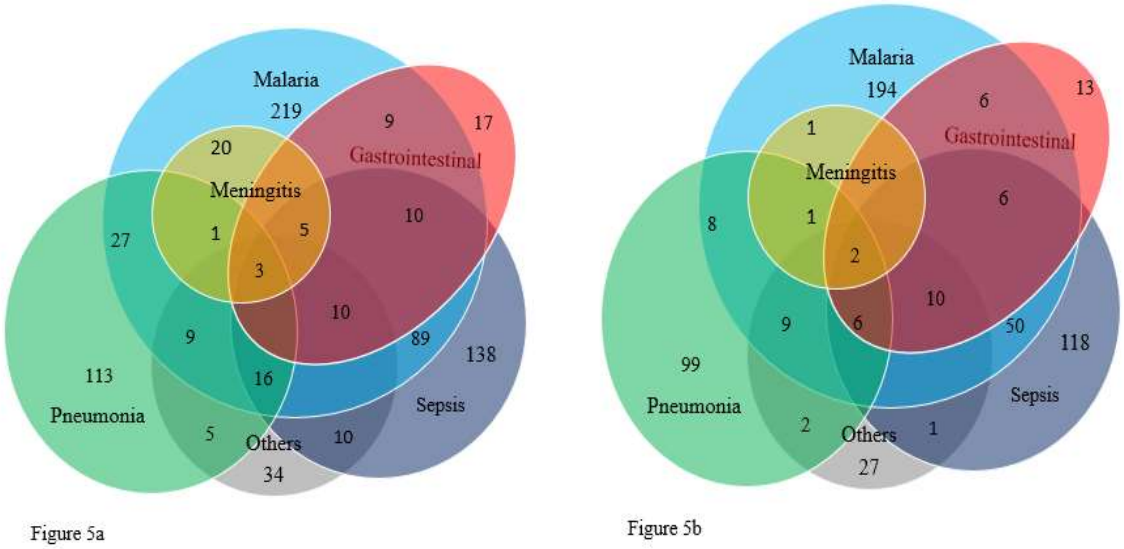


Figure 4-5: Overlapping of febrile conditions at MSDH.

Overlaps in the probable causes of febrile illness were determined in this study.The great overlap was seen on malaria and sepsis at 89(24.7%) in the probable cause of febrile illness(figure 4.5a)as well as in the final diagnosis at 50(13.9%)(figure 4.5b). This means that 50(13.9%) cases were diagnosed as sepsis/malaria at final diagnosis, 27(7.5%) as malaria/pneumonia 6 (1.7%) as pneumonia/sepsis in the final diagnosis overlap. From figure 4.5 above it could also be seen that at least differential diagnoses were being made as overlaps got reduced in all febrile illness in the final diagnosis.

There was a need to find the relationship between probable cause and final diagnosis in febrile illnesses to provide more evidence if differential diagnoses were made. A relationship of probable diagnosis to the final diagnosis of the illness was seen in this study **(Tables: 4.2, 4.3,4.4).**With odds ratio of 136.4, 95%CI (55.3-336.1) in malaria, 123 (53.1-287.5) in

pneumonia and 25.75, 95% CI (13.8-47.8) in sepsis you can that what was in the probable diagnosis was likely to come to a final diagnosis.

Table 4.2:Odds ratios for probable cause as malaria and final diagnosis of malaria at MSDH

		Final diagnosis		
		Malaria (%)	**Not Malaria (%)**	**Total**
Probable diagnosis	**Malaria (%)**	188 (85.8)	31(14.2)	219
	Not malaria (%)	6 (4.2)	135(95.7)	141
	Total	194	166	360
OR =136.4, 95% CI (55.3, 336.2)				

		Final diagnosis		
		Malaria (%)	**Not Malaria (%)**	**Total**
Probable diagnosis	**Malaria (%)**	188 (85.8)	31(14.2)	219
	Not malaria (%)	6 (4.2)	135(95.7)	141
	Total	194	166	360
OR =136.4, 95% CI (55.3, 336.2)				

Table 4a

		Final diagnosis		
		Pneumonia (%)	**Not Pnuemonia (%)**	**Total**
Probable diagnosis	**Pneumonia (%)**	91 (81.2)	22 (19.6)	112
	Not Pnuemonia (%)	8 (3.2)	239 (96.8)	247
	Total	99	261	360
OR =123.6, 95% CI (53.1, 287.5)				

Table 4b

		Final diagnosis		
		Sepsis	**Not sepsis**	**Total**
Probable diagnosis	**Sepsis**	92 (66.6%)	46 (33.3%)	138
	Not sepsis	16 (7.2%)	206 (92.8%)	222

Table 4.3: Odds ratios for probable as pneumonia and final diagnosis of pneumonia

		Final diagnosis		
		Pneumonia (%)	**Not Pnuemonia (%)**	**Total**
Probable diagnosis	**Pneumonia (%)**	91 (81.2)	22 (19.6)	112
	Not Pnuemonia (%)	8 (3.2)	239 (96.8)	247
	Total	99	261	360
OR =123.6, 95% CI (53.1, 287.5)				

Table 4.4:Odds ratios for probable as sepsis and final diagnosis of sepsis

		Final diagnosis		
		Sepsis	**Not sepsis**	**Total**
Probable diagnosis	**Sepsis (%)**	92 (66.6%)	46 (33.3%)	138
	Not sepsis (%)	16 (7.2%)	206 (92.8%)	222
	Total	108	252	360
OR= 25.75, 95% CI (13.8, 47.8)				

Taking all together, in practice at MSDH it was likely that the final diagnosis of febrile illness will be similar to probable diagnosis.

4.2. The common laboratory tests ordered and antimicrobials prescribed to treat the cause of febrile conditions

A medical laboratory is important in supporting the diagnosis of febrile illness. MSDH has a medical laboratory and to support the diagnoses, the clinicians had to order some tests. We looked at what tests were ordered in febrile illnesses to support the diagnoses. Malaria tests, Full Blood Count (FBC), Random Blood Sugar (RBS), and Provider Initiated Testing and Counseling(PITC) were the most ordered tests in febrile illnesses at MSDH. In 360 peadiatric patients enrolled, malaria test was the highest ordered testat289 (80.3%)seconded by FBC 214 (59.4%), PITC 145 (40.3%) and RBS 66 (18.3%). Calculations for *p*-valueswere done for the comparisons between febrile illnesses and the tests that were ordered (**tables 4.5, 4.5, 4.7)**. It is seen that Malaria tests, FBC and RBS indeed were the likely test to be ordered in all febrile illnesses *p-value <0.05*.

Table 4.5: Test commonly ordered for the final diagnosis of malaria

Laboratory Tests	The final diagnosis of malaria		
	Odds Ratio	95% CI	p-value
FBC	1.6	1.6 (1.0-2.5)	<0.000
MRDT/BF/MPS	19.24	19.2 (9.8-37.7)	<0.000
RBS	2.99	2.9 (1.6-5.5)	<0.000
PITC	0.42	0.42 (0.07-2.3)	0.308
LP	Not done	Not done	Not done
Urinalysis	2.18	2.183 (1.950-2.443)	0.125
Stool	0.86	0,855 (0.053-13.775)	0.912
GXM	5.89	5.89 (1.309-26.491)	0.009
Sickle cell test	0.85	0.854 (0.119-6.131)	0.875
LFT	0.86	0.854 (0.053-13.775)	0.912

Table 4.6: Test commonly ordered for the final diagnosis of pneumonia

Laboratory Tests	**The final diagnosis of pneumonia**		
	Odds Ratio	**95% CI**	**Odds Ratio**
FBC	0.49	0.498 (0.286-0.866)	<0.000
MRDT/BF/MPS	0.12	0.129 (0.062-0.267)	<0.000
RBS	0.27	0.297 (0.122-0.635)	0.001
PITC	1.32	1.325 (0.239-7.349)	0.74
LP	1.38	1.382 (1.286-1.474)	0.38
Urinalysis	2.63	2.633 (0.164-42.83)	0.47
Stool	Not done	Not done	Not done
GXM	0.18	0.18 (0.23-1.388)	0.06
Sickle cell test	1.38	1.385 (1.299-1.477)	0.21
LFT	1.38	1.382 (1.296-1.474)	0

Table 4.7: Test commonly ordered for the final diagnosis of sepsis

Laboratory Tests	**The final diagnosis of Sepsis**		
	Odds Ratio	**95% CI**	**Odds Ratio**
FBC	1.1	1.105 (0.678-1.801)	<0.000

MRDT/BF/MPS	0.3	0.304 (0.174-0.529)	<0.000
RBS	1.31	1.317 (0.740-2.341)	<0.000
PITC	0.46	0.462 (0.052-3.999)	0.472)
LP	2.34	2.346 (0.145-37.851)	0.536)
Urinalysis	2.34	2.346 (0.145-37.851)	0.536)
Stool	Not done	Not done	Not done
GXM	0.57	0.571 (0.158-2.067)	0.388
Sickle cell test	2.35	2.358 (0.328-16.964)	0.38
LFT	3.37	3.377 (2.879-3.962)	0.03

Key = BF: Blood Film for Malaria test, FBC: Full Blood Count, GXM: Grouping and Crossmatching for blood transfusion, LFT: Liver Function Test, LP: Lumbar Puncture, MPS: Malaria Parasites, MRDT: Malaria Rapid Diagnostic Test, PITC: Provider Initiated Counselling and Testing, RBS: Random Blood Sugar, CI: Confident Interval

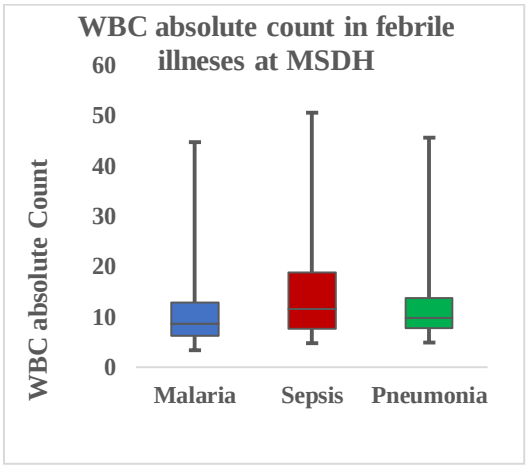
Culture and sensitivity are critical tests in the determination of antimicrobial prescribing. The laboratory was equipped with all necessary antimicrobial disks, unfortunately, no culture and sensitivity data were recorded because in the year of study no clinician ordered the tests for the differentiation of the cause of febrile illness.

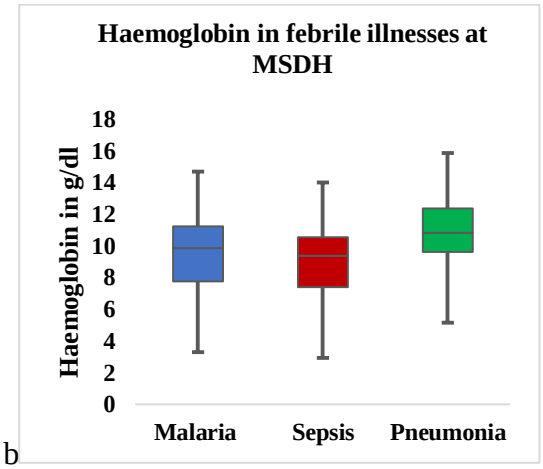
4.2.1. Haematological tests

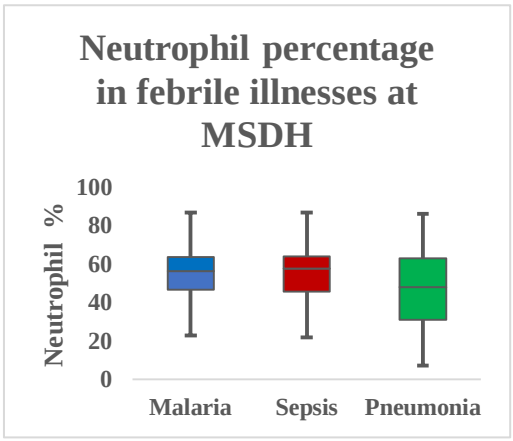
The full blood count is the single most common investigation performed in most medical patients for various conditions. If interpreted carefully in relation to the clinical history, could assist in the diagnosis and management of febrile conditions. The presence of abnormalities in the FBC could alert clinicians to the many acute infections. Arise in WBC absolute counts with the differentials of neutrophil and lymphocyte absolute counts may indicate a bacterial or viral infections. The WBC rise was seen in sepsis with an upper quartile of $20x10^3/\mu l$ than in malaria and pneumonia. WBC absolute counts may not give enough information without differential absolute counts of WBC parameters. It is expected to have a rise in absolute neutrophil count in bacterial infection and a rise in lymphocytes in viral infections. Unexpectedly all the febrile illness had almost similar neutrophil absolute counts, with slight rise in sepsis median count of$5.2 \times 10^3/\mu l$and mean of $9.8510\ ^3/\mu l$. As lightly higher

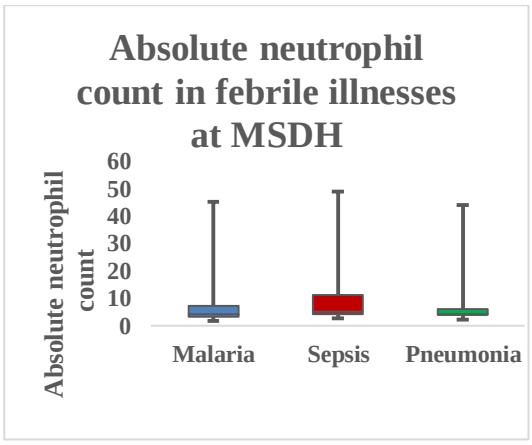
lymphocytes percentage,36.5%, happened to be in pneumonia with a slight rise lymphocytes absolute median count, 3.5 x 10 ³/µl, in sepsis.

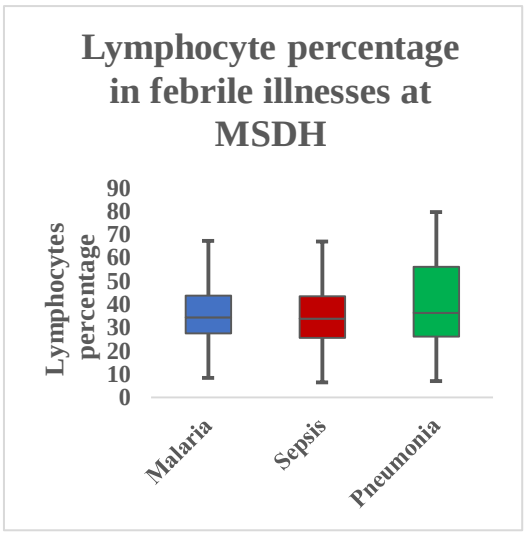
Haemoglobin another important parameter to show anaemia as organisms tend to survive on iron or whole haemoglobin reducing iron levels in blood was analysed in this study. In all febrile illness the lowest haemoglobin value was 3.0 g/dl indicating anaemia and possible presence of organisms in all febrile infections. The highest haemoglobin count was 11.1 g/dl. Platelets rise in febrile infection after activation by immune system. The lowest platelet count in all illnesses was 19x10³/µl with as higher as1000x10³/µl.A higher median platelet count was seen in sepsis, 331.1 x 10 ³/µl indicating possible infection as platelets rise in most infections. Figure 4.5shows how graphically the FBC could look.

a 

b 

c 

d 



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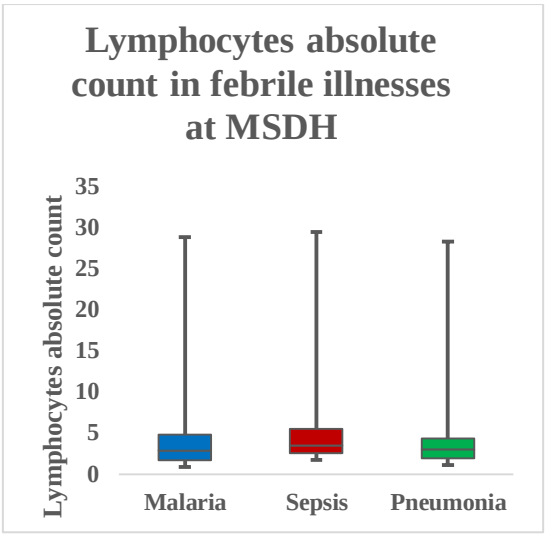

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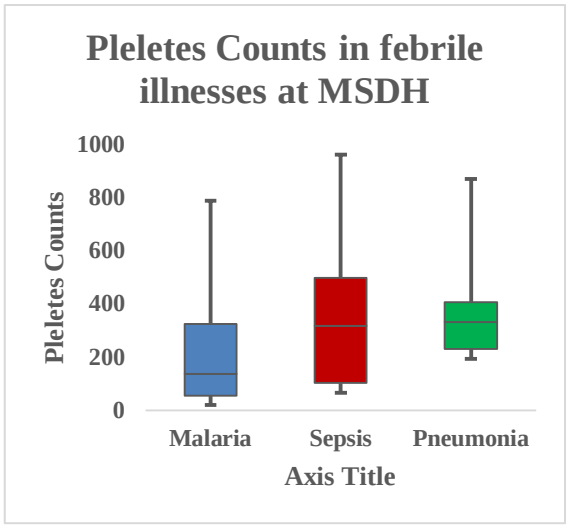

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Figure 4-6: FBC results in febrile infection in paediatric patients admitted to MSDH:

(a) is WBC Absolute count, (b) haemoglobin estimate, (c) Neutrophil percentage, (d) Neutrophil absolute count, (e) Lymphocyte percentage, (f) Lymphocyte absolute count and figure (g) is platelet absolute count

4.2.2. Malaria tests results

Apart from the haemotological tests, malaria tests were also the most ordered test in the diagnosis of febrile illness to support the antimicrobial prescribing (table 4.8).

Table 4.8: Summary of malaria results in all febrile illnesses at MSDH

Malaria tests results in final diagnosis of febrile illnesses					
Malaria		Sepsis		Pneumonia	
Total	Positive	Total	Positive	Total	Positive
194	112 (57.7%)	108	19 (17.5%)	99	9 (9%)

Misdiagnosis is possible in febrile illness if proper test is not conducted to differentiate the aetiology of the fever. All 360 paediatric patients, 194 had probable diagnosis of malaria, 112 (57.7%) came positive giving a probable misdiagnosis of 82 cases as malaria patients.Of108 patients of final diagnosis sepsis 19 (17.5%) came positive of malaria and 9 (9%) of 99 pneumonia cases came malaria positive, giving a misdiagnosis of 19 and 9 patients as malaria and sepsis respectively.

4.3. Antimicrobial prescribed in paediatric illness in the year 2017

The febrile illnesses must be treated in a patient according to the presenting signs and symptoms with support of MSTG and the laboratory tests for differential diagnosis. If the differential diagnosis is not made all probable causes could be treated in a patient until the discharge. The proportions of antimicrobials prescribed to each febrile illness were calculated. The proportions of the antimicrobial use to MSTG was observed to be at 28.3% meaning that 71.7% of antimicrobial prescribing do not follow guidelines (table 4.9).

Table 4.9below shows how likely were the antimicrobial prescribed in febrile illnesses

Table 4.9:Antimicrobial prescribed in relation to febrile illness

Antimicrobial prescribed	**Malaria**		**Sepsis**		**Pneumonia**	
	Odds ratio (CI)	**p-value**	**Odds ratio (CI)**	**p-value**	**Odds ratio (CI)**	**p-value**
Benzylpenicillin	0.443 (0.218 - 0.900)	0.022	1.600 (0.736-3.479)	0.232	1.969 (0.842-4.600)	0.112
Amoxicillin	0.548 (0.338 - 0.889)	0.014	1.9 (1.091-3.310)	0.022	3.864 (1.961-7.612)	0.001
Gentamicin	0.254 (0.161- 0.400)	0.001	0.847 (0.528-1.377)	0.490	6.186 (3.372-10.253)	0.001
Ampicillin	1.267 (0.571-2.811)	0.561	0.508 (0.187-1.377)	0.176	0.917 (0.375-2.241)	0.849
Ciplofloxacilin	0.285 (0.029-2.732)	0.244	1.1435 (1.340-1.537)	0.188	0.878 0.090-8.538)	0.910
Artesunate	39.826 (20.558 -77.154)	0.001	0.791 (0.499-1.537)	0.319	0.131(0.078-0.220)	0.001
Lumefantrine/Artemether	35.309 (19.164-64.951)	0.001	0.868 (0.550-1.370)	0.543	0.124 (0.073-0.212)	0.001
Metronidazole	0.426 (0.185 - 0.984)	0.041	1.024 (0.564-1.872)	0.929	0.777 (0.303-1.996)	0.600
Ceftriaxone	0.591 (0.280 -1.245)	0.163	1.791 (0.838-3.774)	0.129	1.086 (0.482-2.448)	0.882

Contrimoxazole	0.855 (0.533 -13.775)	0.912	2.346 (0.145-37.851)	0.536	0	0
Nystatin	0.282 (0.029-2.732	0.244	7.171(0.737-69.736)	0.048	0	0
TEO	2.183 (1.950-2.443)	0.125	2.346 (0.145-37.851)	0.536	0	0
Erythromycin	1.006 (.994 -1.018)	0.279	0	0	3.663 (3.094-4.337)	0.104
Praziquantel	1.012 (.995-1.030)	0.125	0	0	0	0
Following of MSTG *	1.398 (0.898-2.226)	0.157	0.734 (0.438-1.23)	0.240	0.492-1.192	0.186

*Glay highlights indicate antimicrobial that were significant to prescribing***No MSTGswere followed in theprescribing of the drugs p>0.05*.

1. A great relationship was seen between
    a. antimalarial, LA and Artesunate, to malaria prescribing (Table 4.9).
    b. Sepsis had a relationship to amoxicillin prescribing(*p* 0.022).
    c. Another relationship on antimicrobial prescribing was seen to pneumonia on gentamicin and amoxicillin ($p<0.05$).
2. No relationship was seen in antimicrobial prescribing to MSTG ($p>0.05$) for all febrile illness.

4.3.1. Antimicrobial commonly stocked at MSDH for paediatric patients

To treat the infections the MSDH has to stock common antimicrobial that could be readily available for clinicians to meet the essential medical list required by the district hospital.

1. There were no stockouts of essential drugs at MSDH pharmacy and their sensitivity discs in the laboratory
    a. except for Ampicillin which had stockouts for 8 months and Amoxiclav for 4months (table 4.10).

Table 4.10: Antimicrobial stocked at MSDH in 2017

Antimicrobial	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec

Benzylpenicillin	1	1	1	1	1	1	1	1	1	1	1	1
Ceftriaxone	1	1	1	1	1	1	1	1	1	1	1	1
Ampicillin	0	0	0	1	1	1	1	0	0	0	0	0
Amoxicillin	1	1	1	1	1	1	1	1	1	1	1	1
Amoxiclav	0	0	0	0	0	1	1	1	1	1	1	1
Gentamicin	1	1	1	1	1	1	1	1	1	1	1	1
Ciplofloxacilin	1	1	1	1	1	1	1	1	1	1	1	1
Bactrim	1	1	1	1	1	1	1	1	1	1	1	1
Nystatin	1	1	1	1	1	1	1	1	1	1	1	1
Tetracycline Eye Ointment	1	1	1	1	1	1	1	1	1	1	1	1
Flucoxacillin	1	1	1	1	1	1	1	1	1	1	1	1
Erythromycin	1	1	1	1	1	1	1	1	1	1	1	1
Lumefantrine/Artemether	1	1	1	1	1	1	1	1	1	1	1	1
Artesunate	1	1	1	1	1	1	1	1	1	1	1	1

†1 = Yes (antimicrobial was available in that month)

††0 = No (antimicrobial was out of stock in that month)

Beta-lactam and aminoglycosides antibiotics and antimalarials were the most common antimicrobial stocked at MSDH (table 4.11).

Table 4.11:Antimicrobial disks stocked at MSDH Laboratory in 2017

Antimicrobial class	**Name of antimicrobial discs**
Quinolones	Ciprofloxacin, Nalidixic acids
Sulphonamides	Sulphamexazole Trimethoprim
Penicillin	Benzylpenicillin, Amoxicillin, Ampicillin, Penicillin V, Floxacillin
Macrolides	Erythromycin

Cephalosporines	Cefuroxime, Cefotaxime, Ceftriaxone
Tetracyclines	Tetracycline, Doxycycline
Aminoglycosides	Gentamicin, Kanamycin, Neomycin, Streptomycin, Amikacin
Others	Bacitracin, Methicillin

The antimicrobial stocked in pharmacy had some relationship to antimicrobial prescribed. Penicillins, aminoglycosides, and antimalarials had relationships to antimicrobial prescribing in febrile illnesses in the paediatric ward at MSDH (table 4.10).

4.4. The proportion of rational and irrational antimicrobial treatment among paediatric patients with febrile infection in relation to MSTG and laboratory findings.

Rational and irrational use of antimicrobials is expected where there is non-differentiation of febrile illnesses(9). In this study, there were high proportions of prescriptions of antimicrobial in all febrile illnesses (table 4.12).

Penicillin was the most preferred antibiotics in all febrile illnesses,

LA and Artesunate were the preferred antimalarials. There was a high proportion of benzylpenicillin(>80%) in all febrile cases as an antibiotic prescribed regardless of the illness and

amoxicillin as the second preferred especially on discharge(>89%). Gentamicin was preferred much in pneumonia cases (68%). Antimalarial were also seen prescribed in sepsis with artesunate at 58% and LA at 57% also in pneumonia artesunate at 28% and LA at 24%.

Table 4.12: Proportions of antimicrobials prescribed in febrile illness

Antimicrobial	**Probable causes of febrile illness diagnosis**	**Final Diagnosis of febrile illness diagnosis**

	Malaria	Pneumonia	Sepsis	Malaria	Pneumonia	Sepsis
Benzylpenicillin	85%	92%	90%	85%	93%	92%
Amoxicillin	69%	90%	78%	68%	89%	82%
Gentamicin	23%	66%	35%	23%	68%	34%
Ampicillin	8%	10%	5%	8%	7%	5%
Ciplofloxacilin	1%	0%	1%	1%	1%	0%
Artesunate	89%	34%	64%	93%	28%	58%
Lumefantrine/Artemether	86%	30%	61%	91%	24%	57%
Metronidazole	6%	5%	65%	5%	6%	7%
Ceftriaxone	9%	10%	9%	7%	9%	12%
Contrimoxazole	1%	9%	1%	1%	0%	1%
Nystatin	1%	0%	3%	0%	0%	3%
TEO	0%	0%	1%	0%	0%	1%
Erythromycin	0%	1%	1%	0%	1%	0%
Praziquantel	0%	0%	0%	1%	1%	0%

The antimicrobial to be prescribed was according to its availability at MSDH. The results have shown that the most stocked antimicrobial at MSDH was also the most prescribed (see table4.10). Ceftriaxone was available in all months but was less prescribed, the reason unknown to this study. Other drugs were available but less prescribed.

4.4.1. Antimalaria prescribing

Malaria tests could help to isolate malaria cases from other febrile illness. Guidelines indicate that antimalarial drugs must be prescribed depending on laboratory results or discontinued if results malaria results are negative. Malaria tests results were evaluated for proportions on type febrile illness to antimalarial prescribing (Table 4.13).

Table 4.13:Malaria positive tests results and antimalaria prescribing practices in febrile illnesses at MSDH

	Malaria positive tests result infebrile illnesses					
	Malaria		**Sepsis**		**Pneumonia**	
	Total malaria suspects	**Malaria positives**	**Total sepsis suspects**	**Malaria positives**	**Total pneumonia suspects**	**Malaria positives**
	194	112 (57.7%)	108	19 (17.5%)	99	9 (9%)
Antimalarial prescribed						
	Total† prescribed	**Inappropriate prescribing††**	**Total prescribed**	**Inappropriate prescribing**	**Total prescribed**	**Inappropriate prescribing**
Artesunate	181	69(38.1%)	63	44 (40.7%)	28	19 (19.9 %)
Lumefantrin Artemether	176	63(33.%)	61	42 (38.9%)	24	15 (15.2%)

†Total proscribed means total patients that received antimalarials for the febrile illness

††Inappropriate prescribing means total febrile illness suspected patients minus malaria positive patients and received antimalarials

Of all paediatric patients, 194, with presumedmalaria,112 (57.7%) were malaria positive and received LA. Interestingly 69 (38.1%) presumed malaria patients were malaria negative and unnecessarily received LA according to the malaria guidelines that emphasisingly recommend LA in malaria positive patients only. In sepsis, 19 (17.5%) were malaria positive and received LA and 42 (38.9%)malaria negative received LA unnecessarily. Artesunate was received in all febrile illnesses almost equivalent to LA(**table 4.13**).

4.5. Clinicians' perception of the use of MSTG and the use of laboratory tests in prescribing antimicrobial

It is a recommendation to use treatment guidelines in prescribing antimicrobials to avoid unnecessary antimicrobial prescribing practices and reduce antimicrobial resistance burdens. Clinicians have to adhere to the prescribing protocols stipulated in the treatment guidelines. A team of 30 clinicians were enrolled in the study for the perception of the use of MSTG and laboratory results. Of the 30 clinicians, 4 were females and 26 were males with an average working experience of 4 years (table 4.14).

Table 4.14: shows the demographic distribution of prescribers at MSDH.

		Frequency	Percentage
Total prescribers	Males	26	87%
	Females	4	13%
Medical Officers	Males	0	0%
	Females	1	3%
Clinicians	Males	26	26%
	Females	4	4%
Level of qualification	Medical Officer	1	3%
	Clinical Technician	18	60%
	Clinical	6	20%
	Medical Assistants	4	13%
Working experience in Years	1 year	4	13%
	2 years	8	27%
	3 years	1	3%
	4 years	4	13%
	5 years	5	17%
	6 years	1	3%
	9 years	2	7%
	10 years	1	3%
	11 years	1	3%
	12 years	1	3%
	15 years	1	3%

All clinicians had at one time worked in the paediatric ward and prescribed an antimicrobial to paediatric patients. Table 4.14 shows the results of clinicians' response to the use of MSTG and laboratory in prescribing antimicrobial.

Table 4.14 Clinicians response to MSTG and Laboratory use

	Responded Yes	**Responded No**	**Total**
Do use of MSTG in antimicrobial prescribing	4 (13.33%)	26 (86.66%)	30
Do you use of laboratory results in prescribing	6 (20%)	24 (80%)	30
What alternative to MSTG do you use: (1) Consult seniors	12 (40%)	18 (60%)	30
What alternative to MSTG do you use: (2) Use of clinical presentation	17 (56.66%)	13 (43.4%)	30
Knowledge of culture and sensitivity	29 (96.67%)	1 (3.33%)	30
Knowledge of antimicrobial discs	7 (23.33%)	23 (76.66%)	30

On the use of laboratory,17 (56.66%) responded that the patient's clinical condition was the most important factor that influenced the decision to initiate antimicrobials. Twelve (40%) responded that they consulted seniors if they were in dilemma and

only 4 (13.33%) responded to have used MSTG.6 (20%) prescribers responded to have relied on laboratory results. On why not to use MSTG the respondents gave the reasons as guidelines were too loose on antimicrobial prescribing, too many guidelines for febrile conditions and guidelines were clear on antibiotics but not on lab tests. Another response was that guidelines take too long to be updated. On the knowledge of culture and sensitivity,29 (96.67%) responded that they do know the test but7 (23.33) responded that do not know that the antimicrobial in pharmacy could have sensitivity disks in the laboratory.27 (90%) responded

that laboratory results took longer to reach them so they just prefer empirical treatment. Figure 4.6 shows how the respondents could overlap in their decision making during the prescribing of antimicrobials.

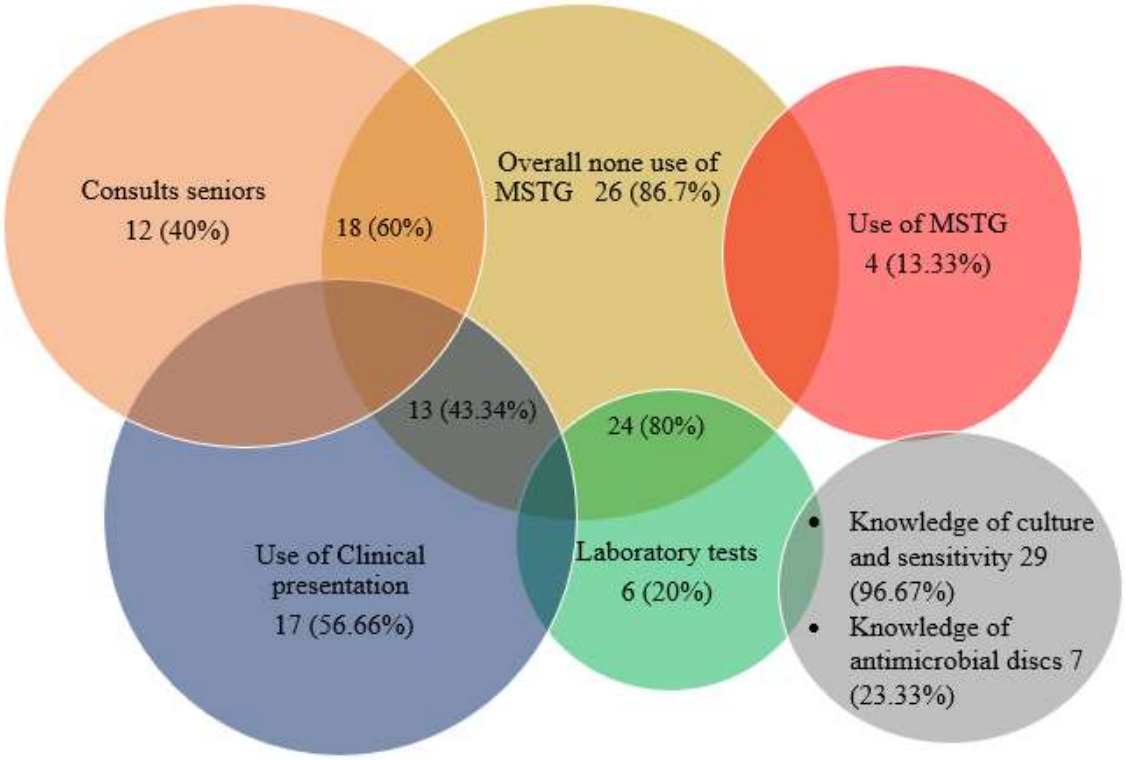

Figure 4-7: An overlap in the clinical response to MSTG use and laboratory tests

The overlap was seen when the respondents were in dilemma. 18(60%) could respond that either they could not use guidelines or they consult seniors, 24(80%) could not use nor Laboratory tests. The general use of MSTG was 33.33% while the clinical presentation was 56.66%. Of the prescribers, 96.67% knew culture and sensitivity 23.33% knew the availability of antimicrobial discs used in culture and sensitivity.

CHAPTER 5: DISCUSSIONS, CONCLUSIONSAND RECOMMENDATIONS OF STUDY RESULTS

5.0 Discussions and Conclusion

5.1. Discussions

Data on audits for antimicrobial prescribing practices in Malawi hospitals is scarce. This audit study at Mzimba South District Hospital on antimicrobial prescribing practices revealed that laboratory tests and MSTG gave minimal support to antimicrobial prescribing practices. The major reasons, MSTG give room to the empirical treatment of febrile illness before laboratory tests but not for the discontinuity of them after laboratory results and a long time to update the guidelines. Another reason is loose (no restrictions) guidelines on antimicrobial use and laboratory tests, the prescribers have very little reliance on the laboratory and MSTG.

The study audited a a total of 360 febrile illness case notes of paediatric patients aged a month to 14 years. Of these 199/360 (55.60%) were males and 159/360 (44.4%) females (Figure 1). Three hundred and fifty patients got discharged, 6/360 (1.7%) died which is lower compared to 6.7% for Malawi child mortality rate in 2017(53) and 4 either absconded or had an unknown outcome but had presumptive diagnoses. Four died of malaria, 1 died of pneumonia and the rest died of three combined diagnoses of malaria, sepsis and meningitis.

The most affected paediatric age group by febrile illnesses was below 60 months with a median age of 48 months in malaria, 30 months in sepsis and 12 months in pneumonia. Febrile illnesses were more prevalent below the median age.

Systemic infections by any cause produce fever or febrile illness. Effective management of febrile illness in Malawi is a prerequisitefor clinicians to be familiar with STG and Laboratory tests that allow the determination of aetiological agents of illness and antimicrobial susceptibility pattern. In paediatrics, MSTG categorises fever of >38-degree Celsius as persistent if more than 5 days or recurrent if more than 1 episode within 5 days and to look for meningitis, septicaemia, occult bacterial infection, TB, fungal, parasitic, viral and neoplasm as

causes(10). The study at Queen Elizabeth Central Hospital found that Tuberculosis (TB), lower respiratory tract infection, malaria and gastroenteritis were the most diagnosed as a cause of febrile illness(54). In this study malaria, sepsis and pneumonia infections were the most common diagnoses as the cause of febrile illnesses at MSDH in paediatric patients requiring tools for proper differentiation and give proper antimicrobial due to their similarity in their clinical presentations.

Studies have shown that STGs help to reduce both morbidity and mortality rates for pneumonia and malaria and a cost-saving tool for hospitals(55). For this study, the overall use of MSTG on antimicrobial prescribing was found to be at 28.3% depicting minimal use of MSTG prescribing practices. MSTG includes key information on the selection, prescribing, dispensing and administration of medicines designed as a digest for rapid reference for prescribing and dispensing. Malawi Essential Drugs List (MEDL) are those drugs that satisfy the priority health care needs of the population. The MSTG and MEDL currently in use were last revised in 2015 and disease control programs have come up with new treatment protocols such as malaria, nutrition and tuberculosis, requiring reviews and incorporation to the MSTG.

Coinfection is possible in febrile condition between malaria and pneumonia (44). Studies have shown that there is also possibility of overlaps in the similarities of clinical presentation of febrile illnesses in the local clinical conceptualisation as well as in the biomedical model(56)(57). WHO recommends the initiation of antibiotics in severe febrile illnesses after blood culture sample is taken and to discontinue if bacterial infection is excluded(58). A 30% clinical overlap between malaria and Severe Acute Respiratory Infection (ARI) with 23% receiving dual treatment was seen in a study by Kingsley N. Ukwaja et. al. which suggest a possible misdiagnosis of malaria in pneumonia(59). In this study, the overlap was seen on malaria and sepsis at 50(13.9%), 27(7.5%) on malaria and pneumonia and 6 (1.7%) on pneumonia and sepsis at the final diagnosis suggesting the need of MSTG for differentiation.

It was also more likely that probable cause of the illness will become a final diagnosis on discharge, with odd ratios of with odds ratios of greater than 20 in all febrile infection.

None adherence to MSTGs could cause irrational use of antimicrobials. All antimicrobials have target organisms they could treat. It could be a waste of resources if the treatment is applied to the wrong pathogen that is resistant to the antimicrobial if the pathogen is not the actual cause of the illness. MSTG guides prescribers to take a sample for laboratory diagnosis of the cause of the febrile illness before starting the treatment. A medical laboratory tests aid in the diagnosis, treatment, prevention of diseases and antimicrobial stewardship by providing patient-specific culture and susceptibility data and other tests to optimise antimicrobial management(60). A study by Kundai et. al. found that in Malawi clinicians often doubt the quality of laboratory results with 53% doubt on malaria tests(30).In this study it was found that the overall laboratory uses before prescribing antimicrobial was 18.1%. Eighty-one per cent are treated empirically without the use of a laboratory. The most tests that were ordered for the diagnosis of febrile illnesses were malaria tests, FBC and RBS. FBC could suggest possible infection but could not be used for the proper choice of antimicrobial to use. Surprisingly, MSTG does not stipulate use of the FBC test for febrile infection.

The findings of this study showed that beta-lactam and aminoglycosides antibiotics and antimalarials were the most common antimicrobial stocked at MSDH. MSTG recommends blood culture to find the cause before starting treatment and is the similar recommendation byguidelines for the management of severe sepsis and septic shock reviewed by the International Sepsis Forum (ISF)(61). Despite the availability of blood culture bottles and sensitivity discs, surprisingly, no blood culture and sensitivity data were recorded because in the year of study, which suggested that no clinician requested the tests. This is a worrisome to medical practice and it means resistance to antimicrobial is not monitored with likelihood that

resistant organisms are circulating in the community, giving a chance to community-acquired infections resistant to common antimicrobials usually available in hospitals.

According to the National Heart, Lung, and Blood Institute (NHLBI) pneumonia is a bacterial, viral, or fungal infection of one or both sides of the lungs(62). Malawi Paediatric Handbook describes severe pneumonia as an infection of the lung tissue having many causes including, viruses, bacteria, mycoplasma and Pneumocystis carinii. According to MSTG, management depends on the classification of pneumonia using clinical signs than culture and sensitivity or any laboratory test (34). In children over 2 months, if suspected of severe pneumonia, admit to hospital and give benzylpenicillin switch to oral antibiotics like amoxicillin or Cotrimoxazole if the child tolerates oral antibiotics(63).From the findings of this study proportion of pneumonia as a cause of fever was 99 (33.3%) and 92 (93%) had benzylpenicillin. Benzylpenicillin combined with gentamycin is recommended by MSTG in only children less than 2 months. Surprisingly, according to the findings of this study, 67 (68%) pneumonic patients regardless of age had this combination gentamicin is either overused or misused in patients above 2 months of age.

In this study,19 (19.9%) of febrile pneumonic patients were given antimalarial Artesunate and 15(15.2%) received LA despite only 10 (10%) were malaria positive depicting antimalarial misuse in pneumonia. MSTG also states that a febrile paediatric patient is supposed to be admitted and givena synergy of benzylpenicillin and gentamycin with quinine as empirical treatment and be amended accordingly based on blood culture and sensitivity results(63). ISF recommends empiric combination therapy not to be administered for more than 3–5 days and de-escalation to the most appropriate single therapy to be performed as soon as the susceptibility profile is known. An alternative to benzylpenicillin, ampicillin should be administered then switch to amoxicillin if oral antibiotics are tolerated. If still febrile after 72 hours maintain benzylpenicillin/ampicillin(61,63). Surprisingly Benzylpenicillin was

prescribed to 68 (93.2%) of septicaemia suspected patients, gentamycin 27 (37%) implying that empirical combination of gentamycin and Benzylpenicillin was done in only 37 % of septicaemia suspected patients suggesting that drug synergism was not followed or drugs were inappropriately used. Amoxicillin, another penicillin, was administered to 78% of patients mainly after tolerating oral medication and was seen to be given mainly on discharge regardless of infection. Overuse of penicillin may induce mutations in the genes for porins responsible for drug entry into the cell resulting in resistance to penicillins as in Pseudomonas aeruginosa (64)(65). Pseudomonas is common in hospitals and if overuse of penicillins continues may lead to the spread of resistant Pseudomonas organisms into the community(65).

Antimalarials are made to treat plasmodium species that cause malaria. From the findings of this study, both antimalarial and antibiotics were prescribed for malaria patients. One hundred and ninety-four(53.4%) patients were tested for malaria, 112 (57.7%) came positive and 181 (93 %) received antimalarial, Artesunate. This suggests that Artesunate was inappropriately used in the treatment of 69 (38.1%) malaria negative cases. Hundred and seventy-five (90.7%) patients received LA. As predicted, there was LA misused in the treatment of 63 (33%) malaria negative cases. Giving antimalaria to malaria negative patients may leave some residues to antimalarials in them. There is evidence of residual antimalarial activity to be present during the post-treatment periodwhich could serve as a selective filter preventing infection by sensitive parasites but allowing infection by resistant parasites(66). The remaining resistant organisms to antimalarials spread into the community increasing morbidity and mortality from malaria. Prescribers need to be aware of this phenomenon and need to use antimalarials carefully with laboratory confirmation.On another note benzylpenicillin was prescribed in 58 (52.1%) malaria positive patients suggestive of receiving benzylpenicillin unnecessarily. Amoxicillin was prescribed in 54 (39.7%) malaria positive suggestive of amoxicillin misuse. Gentamicin was prescribed in 6 (12.9%) of malaria another antimicrobial misuse. It should be

added that gentamicin work synergistically with penicillins, the fear is when gentamicin is overused and resistance develops to it in organisms that were susceptible to penicillin, then these organisms may not be treated with penicillins hence high mortality rate due to gentamicin resistant organisms(67).

There was a need to find the perceptions in prescribers on the use of STGs. Reviews have shown that prescribers have different perceptions on the use of STGs and laboratory results(31,48,68).A team of 30 clinicians were enrolled in the study for the perception of the use of MSTG and laboratory results. All these clinicians had at one time worked in the paediatric ward and prescribed an antimicrobial to paediatric patients. On the use of laboratory, 17 (56.66%) responded that the patient's clinical condition was the most important factor that influenced the decision to initiate antimicrobials. Twelve (40%) responded that they consulted seniors if they were in dilemma and only 4 (13.33%) responded to have used MSTG which is very worrisome. Six (20%) prescribers responded to have relied on laboratory results which is less compared to the findings of a study by Kundai et al. which found it to be at 30% suggesting that MSDH laboratory is less used during prescribing of antimicrobial(30). The study in Pakistan also found that majority of prescribers were of the view that patient-related factors, unavailability of STGs for reference, lack of awareness of prescribers regarding STGs and lack of enforcement of STGs were the main factors contributing to lack of adherence to STGs in the management of febrile illness(29). The result of this study on why not to use MSTG the respondents suggested that guidelines were too loose on antimicrobial prescribing, too many guidelines for febrile conditions and guidelines were clear on antibiotics but not on laboratory tests. On the knowledge of culture and sensitivity, 29 (96.67%) responded that they do know the test but 7 (23.33) responded that do not know that the antimicrobial in pharmacy could have sensitivity disks in the laboratory this could answer as to why culture and sensitivity was not requested at MSDH. A study by Kundai et al. has shown that 87% of

prescribers doubt laboratory test results in their prescribing(30) which is consistent to this study, 27 (90%) responded that laboratory results took longer to reach them so they just prefer empirical treatment which could also be a factor for doubting the credibility of these results. It was observed that the use of laboratory to inform prescribing was minimal.

5.2. Study limitations

The findings are, however, subject to some limitations.

1. The study was facility-based done at only one hospital; this may affect the generalization of the results to the general population of paediatric wards of other hospitals in other districts of Malawi. Future studies would do well if they would include different districts in Malawi and include other guidelines apart from MSTG. This is because diseases burdens are not the same in the district of Malawi.
2. The study did not triangulate the information on other treatment guidelines apart from MSTG. There must be a study to look at the impact of other STGs that are used in Malawi on antimicrobial prescribing for febrile illnesses.
3. The study did not explore why clinicians do not order culture and sensitivity despite availability at MSDH. The must be a study to look at in-depth why clinicians do not microbiological tests apart from the reasons stipulated in this study.

5.3. Conclusions

This study has concluded that laboratory tests and MSTG have very minimal support in antimicrobial prescribing at MSDH that resulted in the inappropriate and irrational use of antimicrobials. Although tests like malaria, PITC, FBC and RBS available at MSDH also preferred by prescribers have very little information and do not give an option to the antimicrobial type to use. This study has revealed that culture and sensitivity tests important in antimicrobial prescribing were not ordered despite its availability at MSDH. The prescribers prefer the use of empirical treatment with the use of a broad spectrum and if in dilemma, the

use of consulting seniors is paramount. This use of broad-spectrums has led to the irrational and inappropriate use of penicillin family and macrolides drugs which are mostly available at MSDH. The study has also revealed that antimalarials are also irrationally and inappropriately used in febrile illness treatment due to a lack of proper tests to differentiate the cause of fevers. Good clinical practice will always follow guidelines and ignorance of clinical guidelines is not an excuse for good clinical practice. Where materials are available better use them or ignorant will misuse them to produce worrisome results. Loose guidelines on antimicrobial use with too long updating time caused the clinicians to resort to empirical treatment as stipulated. An example is quinine and chloramphenicol treatment for sepsis and malaria respectively is found in MSTG but not in the current prescribing practice.

5.4. Recommendations

Based on the findings of this study the following recommendations have been suggested:

1. Advocacy on the use of MSTG and laboratory tests to support antimicrobial prescribing practice. MSTG give direction to what antimicrobial to use for a particular suspected infection and to do laboratory tests to support that diagnosis.
2. Prescribers prefer rapid tests to detect organisms. Apart from mRDT for malaria, there must be other rapid tests for bacteria and viruses, which in this study showed that in all febrile illness mRDT and PITC as rapid tests were ordered especially on admission.
3. Hospitals must have very strong microbiology laboratories and prescribers need to be sensitized on the use of culture and sensitivity for the de-escalation of antimicrobials.
4. Ministry of Health needs to supervise the use of MSTG and laboratory tests on antimicrobial prescribing in government hospital of which MSDH is an example.
5. There is a need to conduct some refresher training for the prescribers on the use of MSTG in hospitals. This may help to improve adherence to MSTG.

6. MSGT should not take too long to be reviewed and updated as medicine is dynamic and treatment changes because researches on treatment to febrile illness are being conducted every day to find ways of improving patient's outcome.
7. There is a need to establish antimicrobial stewardship teams to monitor the use of antimicrobial in hospitals.

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APPENDICES

Appendicx I: Consent for a clinician

My name is Happy Manda. I am a Masters student at the University of Malawi, College of Medicine, and I am researching "An evaluation of antimicrobial treatment in paediatric and adolescent patients with acute febrile illness with or without Laboratory confirmation" at Mzimba South District Hospital. I would like you to fill this questionnaire. You were selected as a possible participant in my study because you are one of the antimicrobial prescribers at Mzimba District hospital and you have at one time utilised the Laboratory. I ask that you to read this form and ask any questions you may have before agreeing to be in the study.

The questionnaire would take about half an hour of your time, and I would like you to fill it with your permission. Your contribution is valuable in improving the diagnostic services in

Malawi. There are no particular risks anticipated in this study as the questions are non-controversial and not personal.

I plan to use the information to compare with the gap that will be found from the evaluation of Laboratory tests on febrile infections in children. The only signature is required in this questionnaire and will not be shared with anyone to preserve confidentiality.

Your participation is voluntary and compensation of K2000.00 will be offered for time spent. If you change your mind about participating, you may stop answering the questions at any time.

Please feel free to contact me at Mzimba District Hospital P, O, Box 131 Mzimba or COMREC secretariat, College of Medicine, Private Bag 360 Chichiri, Blantyre 3 if you have any questions, concerns or comments about the project.

Thank you!

Statement of consent

_____ (signature and date) I have read the above information. I have asked questions and have received answers. I consent to fill the questionnaire in Happy Manda's study.

Appendices II: Clinician perception questionnaire

What is your gender? [Male/female]

_____

What is your current position?

_____

How long have you practised in this position?

_____

At what hospital/health care department do you work?

_____

_____

How long have you worked at this hospital/health care centre?

Do you always get in contact with the Laboratory staff when needed? [yes/no]

Are you satisfied with the communication between you and the Laboratory staff? [1= Very satisfied, 2= Satisfied, 3=Unsatisfied, 4 = Very unsatisfied]

If no, give the reason above?

_____

Does the Laboratory give satisfaction in solving clinical dilemma on which antimicrobial to use? [1= Very satisfied, 2= Satisfied, 3=Unsatisfied, 4 = Very unsatisfied]

Do you prescribe antimicrobial to patients presenting with a fever above 38 ^{0}C? Yes/No

Do you use guidelines when treating patients? (Yes/No)

Are you satisfied with the standard treatment guidelines in your prescribing? [1= Very satisfied, 2= Satisfied, 3=Unsatisfied, 4 = Very unsatisfied]

In support during your antimicrobial prescribing, has the Laboratory provided you with:

• Information on which tests are available at the Laboratory? [Yes/no]

• Information on the clinical use of each test? [Yes/no]

• Instructions for sample collection? [Yes/no]

• Instructions on how to pack the samples for transport from you to the Laboratory? [Yes/no]

• Information on how the result will be reported? [Yes/no]

When you request a Laboratory test, do you know when you can expect the result? [yes/no]

Does your Laboratory do microbiological tests? Yes/No

Can the Laboratory always perform all the tests you think are necessary to support antimicrobial prescribing? [yes/no]

Is the capacity of the Laboratory in your opinion sufficient to deal with the number of requests? [yes/no]

What is the average time that you have to wait for the Laboratory results as the patient is on presumptive treatment?

Are you, in general, satisfied with the Laboratory services? [yes/no]

–

If the Laboratory has not provided you with enough information on what other opinions do you seek to support your diagnosis?

_____

__

Do you know culture and sensitivity? [yes/no]

Do you have information onavailable antimicrobial in the pharmacy? [yes/no]

If yes, how do you use these antimicrobials according to their availability?

_____

__

Do you know that antimicrobial available in pharmacy must have available discs for them in Laboratory for culture and sensitivity? [yes/no]

If yes does your Laboratory perform culture and sensitivity to antimicrobials? [yes/no]

_____

If no, how do you prescribe antibiotics?

_____

After you have completed the questionnaire please return it to the researcher.

Thank you very much!

Appendix III: Chichewa version of Consent

Dzina langa ndine Happy Manda Ndili wophunzira ku yunivesite ya Malawi, College of Medicine, ndipo ndikufufuza za “Kangwiritsidwe ntchito a mankhwala ophera tizilombo m'matenda oyambitsa kutentha kwa thupi mwa a ana ndi achinyamata omwe Ali ndi matenda pogwiritsa kapena kusagwiritsa chithandizo cha Laboratory" pa Mzimba District Hospital. Ndikupemphani kuti muyankhe mafunso ali mumusimu. Inu mwasankhidwa monga gawo lothandizira pa phunziro langa chifukwa ndinu m’modzi mwa olemba omwe amapha tizilombo m’thupi la munthu ndipo nthawi ina mumagwiritsapo ntchito labotale. Ndikukupemphani kuti muwerenge bwino lomwe ndipo ndikufunseni mafunso omwe mungakhale nawo musanavomereze kutengapo mbali.

Mafunsowa angatengere pafupi theka la ora la nthawi yanu, ndipo ndikufuna kuti inu muwamalidze kuyankha ndi chilolezo chanu. Kudzipereka kwanu kungakhale kofunika popititsa patsogolo ntchito zothandizira pofufudza chiyambi cha matenda mu Malawi. Palibe zoopsa zapadera zomwe tikuyembekeza mu kafukufukuyu popeza mafunsowa saliwosagwirizana komanso sali sakutsatamunthu. Ndikukonzekera kugwiritsa ntchito mayankho anu poyerekeza ndi kusiyana komwe kudzapezeka kuchokera ku kuyesa kwa matenda oyambitsa kutentha a mwa ana ndi achinyamata. Kungosayina chizindikiro chanu chokha mufunsoli nde chofunika ndipo sichigawidwa kwa wina aliyense posunga chinsinsi. Kuchita kwanu ndi kudzipereka kwanu kuyembekezereka kukhaLA ndi chiwongoLA dzanja cha K2000.00 chomwe chiperekedwe pa nthawi yomwe ingatayidwe. Ngati mutasintha malingaliro anu pokhudzana ndi kutenga nawo mbali, mukhoza kusiya kuyankha mafunso nthawi iliyonse.

Chonde masukani pondifunsa ine kapena mthandizi wanga ngati muli ndi mafunso, nkhawa kapena ndemanga pokhuzana ndi za kafukufukuyu.

Zikomo.

Ndondomekoya chilolezo _____ (sayinani kapena dindani chaLA ndi tsiku) NdakhaLA ndikuwerenga zapamwambazi. Ndafunsa mafunso ndipo ndaLAndira mayankho. Ndikuvomereza kuyankha mafunsowa mu phunziro LA Happy Manda.

Appendix IV: Chichewa Version of the clinician satisfaction questionnaire
Mafunso okhutiritsidwa kwa madotolo

Kodi ndinu yani, mwamuna kapena mkazi? [Mwamuna / mkazi]

_____

__

Kodi mumangwira ntchito ngati ndani?

_____

3. MwakhaLA mukungwira ntchito nthawi yayitali bwanji?

_____

4. Mumagwira ntchito mbali iti ya pa chipataLA chino?

_____

Mwagwira ntchito nthawi yayitali bwanji pa chipataLA chino?

_____

Kodi mumalumikizana ndi ogwira ntchito ku LAbotale nthawi zonse ngati mukufunikira kutero? [Inde/ayi]

Kodi mumakhutitsidwa mukulumikizana kwanu pakati pa inu ndi antchito a LAbotale? [Inde/ayi]

8. Ngati ayi, chikukwa ninji simukhutitsidwa?

_____

9. Kodi labotale imakuthandizani kuyankha mafunso amene mumakumana nawo polemba mankhwala? [Inde/ayi]

10. Kodi mumalembela mankhala opha tizilombo kwa odwala?

_____

Kodi mumasatira ndondomekomeko ya malangizo polembera odwala? (Inde/ayi)

12. Nanga mumatha kutsatira malangizo a momwe mungalembele mankhwalawa?

_____

__

13. Pothandizira pa malembedwe a mankhwala ophera tizilombo toyambitsa matenda, labotale imakuthandizani:

• Pokuuzani za mayezedwe ndi zoyesera zake pa laboratale? [Inde / ayi]

Kangwiritsidwe ntchito ka zotsatira za kuyeza

_____

_____

M’mene mungatengere zokayesa ku Laboratory

_____

_____

M’mene mungayikire ndi manyamulidwe ake kupititsa kokayesa

_____

_____

Momwe zotsatira zakuyesa zingagwiritsidwire ntchito

_____

_____

Kodi mukatumiza zokayesa mumadziwa nthawi yomwe mungayembekezera kulandira zotsatira?

_____

_____

Kodi laboletale yanu imaona tizilombo toyambitsa matenda?

_____

_____

Kodi mukuwona kuti laboletale yanu ingakhoze kuyeza matenda kukuthandiza momwe mungalembere mankhwala opha tizilombo?

_____

_____

Kodi Laboratory imakuthandizani zonse zoyeza kuti mulembere mankhwala opha tizilombo mwa odwala? [Inde/Ayi]

M'mene mukuonera Laboratory yanu ili ndi kuthekera kukwaniritsa zoyeza zonse? [Inde/Ayi]

Ndi nthawi yotalika bwanji yomwe mumadikira zotsatira zisanatuluke kuti mumusinthire mankhwala odwala?

Kodi, ponena mwatchutchutchu ndinu okhutitsidwa ndi Laboratory yanu? [yes/no]

If the Laboratory has not provided you with enough information what other opinions do you seek to support your diagnosis?

_____

—

Mumadziwa kudzala tizilombo ndi kuyeza mankhwala ophera tizilomboto? [Inde/Ayi]

Mumakhala ndi kudziwa mankhwala ophera tizilombo omwe akupeza ku malo osungira mankhwala? [Inde/Ayi]

Ngati ndi inde mumagwiritsa bwanji ntchito malingana ndikupezeka kwake?

_____

—

Mukudziwa kuti mankhwala ophera tizilombo akupeza ku malo osungira mankhwaLA amakhalanso ndi timadisiki take tothandiza kudzala tizilombo ndi kuyeza mphamvu mankhwalawo? [Inde/Ayi]

Ngati inde, nanga Laboratory yanu imatha kudzaLA tizilombo toyambitsa matenda inde kuona mankhwala omwe angapha tizilombo? [Inde/Ayi]

Ngati ayi, mumalembera bwanji mankhwala ophera tizilombo odwala?

_____

–

Appendices V. **Data collection tool for patients**

No.	Admission status	Temperature ^{0}C	Probable Cause	Laboratory investigations are done but not followed according to STGs	Laboratory investigations followed according to STGs	No Laboratory investigations requested but treated with antimicrobial	No Laboratory investigations are done but requested	Required Laboratory tests to have been done	Patient Outcome	Guidelines followed Y/N
1										
2										
3										
4										
5										
6										
7										
8										
8										
10										

Month …….. of 2017

Feb= febrile, afeb=afebrile

Appendices VI: **Data Collection Tool for Pharmacy**

Availability of antimicrobial in pharmacy for Mzimba South District Hospital

Antimicrobial	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Benzylpenicillin												
Ceftriaxone												
Amp												
Amox												
Ccol												
Cip												
Bac												
Nal												
Pen V												
Ery												

, Benzylpenicillin=Benzylpenicillin, Ceftriaxone= Ceftriaxonetriaxone, Amp= Ampicillin, Amox = Amoxycillin, Ccol = Chloramphenicol, Cip = Ciprofloxacillin, Bact= Cotrimoxazole, Nal=Nalidixic Acid, Ery=Erythromycin, Pen V= Penicillin V,

Appendices VII:Data Collection Tool for Laboratory

Availability of reagents in Laboratory for Mzimba South District Hospital to support antimicrobial prescribing

Test	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
MRDT												
FBC												
Culture and Sensitivity												
Urinalysis												
AAFB												
India Ink												
Cryptococcal antigen												
C Reactive protein												
Field Stain A and B												
Giemsa stain												
Gram's Stain												

MRDT=Malaria Rapid Diagnostic Test, Crypt=Cryptococci, AAFB=Acid Alcohol Fast Bacilli

Appendices VIII: Library certificate

KAMUZU UNIVERSITY
OF HEALTH SCIENCES

Library

MEMORANDUM

To: Acting Executive Dean, Postgraduate Studies and Research

From: Assistant Librarian

Date: 21th March, 2022

Re: SUBMISSION OF Happy Abraham Manda MPH DISSERTATION

This is to inform you that I have reviewed a **Masters of Health Sciences Antimicrobial Stewardship** dissertation for **Happy Abraham Manda**. I confirm that he has made the necessary corrections as advised.

Please assist him accordingly.

Yours sincerely,

FELIX CHISONI (MR)

FOR: ACTING UNIVERSITY LIBRARIAN

CC: **Happy Abraham Manda**

APENDICES IX: COMREC certificate

CERTIFICATE OF ETHICS APPROVAL

This is to certify that the College of Medicine Research and Ethics Committee (COMREC) has reviewed and approved a study entitled:

P.05/18/2526 - An audit of antimicrobial treatment practices and laboratory diagnostics in febrile paediatric patients at Mzimba South District". Version V dated 22/09/2018 by Mr. Happy Manda

On 07-Jan-19

As you proceed with the implementation of your study, we would like you to adhere to international ethical guidelines, national guidelines and all requirements by COMREC some of which are indicated on the next page for your study

07-Jan-19

Dr. YB. Mlombe - Chairperson (COMREC) — Date