CLINICIANS' KNOWLEDGE, ATTITUDE AND PRACTICE IN PREVENTION OF RHEUMATIC HEART DISEASE IN BOMET COUNTY, KENYA

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A Thesis Submitted to the Institute of Postgraduate Studies of Kabarak University in Partial Fulfillment of the Requirements for the Award of Master of Medicine in Family Medicine Degree

KABARAK UNIVERSITY

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The thesis entitled **"Clinicians' Knowledge, Attitude and Practice in Prevention of Rheumatic Heart Disease in Bomet County, Kenya."** and written by **Annette Marcella Onyango** is presented to the Institute of Postgraduate Studies of Kabarak University. We have reviewed the thesis and recommend it be accepted in partial fulfillment of the Master of Medicine in Family Medicine degree award requirements.

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DEDICATION

I dedicate this to myself and other healthcare workers at the forefront in the fight to reduce prevalence of Rheumatic Heart Disease in Africa and the world.

ACKNOWLEDGEMENTS

I am grateful to Almighty God for His sustenance and protection also to Mr. Malenje Boniface and Dr. David Oyoo for their support with data analysis and review of data tools and to Chepalungu Sub County, Bomet County Medical Officers, Clinical Officers and Nursing Officers.

ABSTRACT

Rheumatic Heart Disease (RHD), a complication of Beta-Hemolytic Streptococcal infection of the throat and skin is one of the leading causes of cardiovascular mortality among young adults in the world. RHD's prevalence is disproportionately high in Sub Saharan Africa (SSA). As a result, there is increased global pressure for SSA countries to embrace primary, secondary and tertiary prevention strategies. Provision of the available, accessible and affordable monthly benzathine penicillin injection is key as a secondary prevention intervention. However, critical healthcare gaps exist that render the prevention strategies ineffective and perpetuate the continued RHD endemicity in SSA countries like Kenya. Thus, the objective of this study was to evaluate the Knowledge, attitude and Practices of Clinicians in preventing Group A *Streptococcus* throat Infection Progression to Rheumatic Heart Disease in peripheral facilities within Bomet County, Kenya. A cross-sectional survey targeting 98 health care practitioners comprising medical officers(2), clinical officers(26) and nursing officers(70) attending to children in peripheral facilities in Bomet County was conducted over a period of four (4) months. Data was collected using a questionnaire focusing on demographics and assessments of knowledge, attitude and practice. Tables and charts are used to demonstrate the demographic data. The analysis involved use of frequencies and percentages for categorical variables and means with standard deviation for continuous variables. The majority of the participants had good knowledge, attitude and practice. However, key aspects of knowledge, attitude and practice scored poorly across the cadres, and these areas inform patient management. There was notable poor knowledge of the diagnostic tests for bacterial pharyngitis as well as the duration of antibiotic prophylaxis, only 4%of the participants responded correctly. Only 42% and 44% of participants knew the correct treatment for carditis and the elements of the Jones Criteria respectively. Medical officers were more likely than clinical and nursing officers to agree that there is a relationship between overcrowding and low socioeconomic status and RHD prevalence. In conclusion, while the study reveals generally positive attitudes and practices towards Acute Rheumatic Fever and Rheumatic Heart Disease management among healthcare professionals in Bomet County. It also highlights significant knowledge gaps, particularly among nursing officers. These findings underscore the need for continued medical education and the potential benefit of establishing standardized protocols for ARF and RHD management across all levels of healthcare facilities. The strong support for public health initiatives suggests that healthcare professionals would be receptive to such interventions. The recommendations arising from this study include expansion of the study to other counties or regions to get a more comprehensive picture, an investigation of the reasons behind the knowledge gaps and attitude differences to inform targeted interventions and an evaluation of the impact of educational interventions on KAP scores over time.

Keywords: *Rheumatic Heart Disease, Acute Rheumatic Fever, Group A Streptococcus Infections, Bacterial pharyngitis, Knowledge, Attitude, Practice*

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ABBREVIATIONS AND ACRONYMS

GAS	- Group A *Streptococcus*
ARF	- Acute Rheumatic Fever
RHD	- Rheumatic Heart Disease
SSA	- Sub Saharan Africa
LMICs	- Low and Middle Income Countries
NSAIDs	- Non Steroidal Anti Inflammatory Drugs
ACEIs	- Angiotensin Converting Enzyme Inhibitors

OPERATIONAL DEFINITIONS OF TERMS

Clinicians- People who provide clinical services by reviewing, making diagnoses and writing prescriptions for patients in the peripheral facilities.

Peripheral facilities- Are healthcare facilities that in the Kenyan Healthcare System form the first point of entry to care for patients; they include level 2, level 3 and level 4 facilities.

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Rheumatic Heart Disease (RHD) arises from Acute Rheumatic Fever (ARF) which is an autoimmune inflammatory process triggered by untreated or undertreated Group A *Streptococcus* (GAS) throat infections (Auala et al., 2022). *GAS* throat infections, ARF and RHD often affect children and young adults aged between 3-15 years from poor socioeconomic backgrounds that are associated with overcrowding, malnutrition, poor health seeking behavior and lack of basic healthcare services as well as lack of awareness of the disease (Kumar et al, 2020).

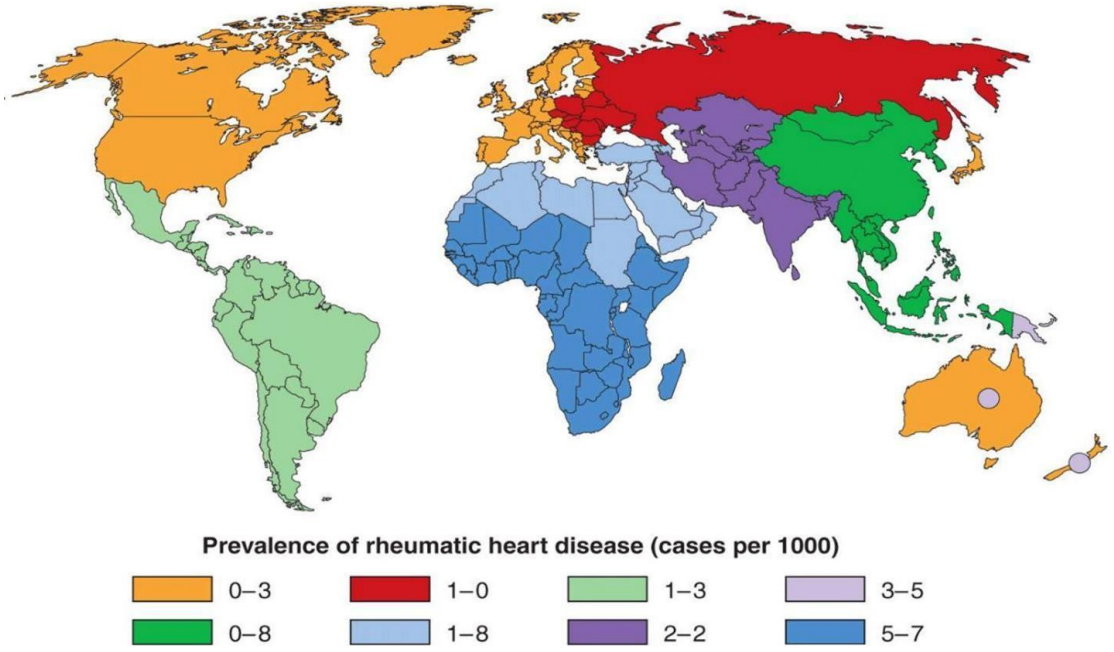
Globally, approximately 40 million people are currently living with RHD, with significant morbidity and mortality from the same disease. Additionally, RHD is thought to cause approximately 305,000 deaths annually and 11.5million disabilities (Bimerew et al., 2021).

In Sub Sahara Africa, the cardiovascular disease burden due to RHD ranges between 14% and 40%, affecting approximately 5-7 per 1000 children compared to 0.5 per 1,000 children in developed countries (Kumar et.al, 2020). In East Africa, the prevalence is estimated to be at 1.79%; about 18 cases per 1000 children, a number that is considered higher than figures from countries that are considered high income (Melaku et al, 2021). In Kenya, the prevalence of throat infections from GAS, based on a study at the Pediatric emergency unit at Kenyatta National Hospital in 2018 is at 38.4% (Kunga et al, 2018). Countries are classified based on endemicity patterns which are determined by the mortality estimates due to RHD from Global Burden of Disease Study 2015 by Watkins et al. A threshold of 0.15 deaths per 100,000 population among children 5-9

years is considered endemic, with Kenya being among the countries in that description (Watkins et al, 2015). RHD is known to cause severe morbidity and mortality to affected children leading to delay in; school enrollment, school drop outs, prolonged hospital stays from heart failure, and mortality from heart failure complications. This affects daily living activities of those affected and also lowers quality of life. The prevention of RHD is therefore key in improving lives of the general population. The figure below shows the global prevalence patterns of Rheumatic Heart Disease.

Figure 1

Prevalence of Rheumatic Heart Disease



Source: Antunes, (2020)

To this end, several prevention strategies have been developed to try and reduce the global burden of Rheumatic Heart Disease including primordial, primary, secondary and tertiary prevention methods.

Primordial strategies include Improving living conditions by reducing overcrowding, providing access to quality education and employment, and ensuring access to health

services; reducing poverty which is a social determinant of health that can impact the incidence of RHD; and improving environmental health by providing access to resources that improve hygiene and sanitation such as hand hygiene, cough hygiene among others. Primary prevention strategies include early identification, correct diagnosis and appropriate and timely treatment of patients with GAS throat infections (Dougherty et al., 2023).

Early identification by parents and guardians of children can be improved through health education activities. Correct diagnosis by use of appropriate scoring tools like the Centor Score (Department of Medical Microbiology, Faculty of Medicine and Health Sciences, University Putra Malaysia, Selangor, Malaysia et al., 2022), and laboratory tests such as rapid diagnostic kit and throat swab cultures drive appropriate use of antibiotics which is key in treatment of throat infections from GAS.

Secondary Prevention strategies include early identification of ARF and RHD, initiation of Secondary prophylaxis with Benzathine Penicillin Injection, and regular monitoring of patients to assess their surgical needs (Auala et al., 2022). Tertiary prevention strategies include following up patients who have developed heart failure, valve replacement for patients with valvular involvement from Rheumatic disease, and continuation of monthly Benzathine Penicillin injections (Watkins et al., 2016).

According to the 2017 Abuja Communique on eradication of RHD in African Union States, one of the key strategies that lends to the primary and secondary prevention strategies was in decentralizing diagnostic services and appropriate technical expertise for diagnosis and management of ARF and RHD to the lower levels of care. The Kenya National Guidelines on Management of Cardiovascular Diseases is one of the resources recommended for use in the country to help in the prevention of RHD. Despite the

increase in awareness of prevention strategies and their integration into various practice guidelines of several countries, the prevalence of RHD is still high, making an assessment of the knowledge, attitude and practice of clinicians towards its prevention imperative. Understanding this is part of improving access to primary healthcare; a key recommendation of the WHO global resolution on Rheumatic Heart Disease.

Limited studies have assessed the knowledge, attitude and practice of clinicians in preventing Rheumatic Heart Disease, especially in Sub Saharan Africa (SSA), where the disease burden is high. As yet, there has not been any known study among clinicians in Kenya that has assessed their knowledge, attitude and practice in preventing Rheumatic Heart Disease. A Knowledge, Attitude and Practice study among Clinicians in Sudan showed an average knowledge base (Osman et al., 2015), while another done among final year medical students in Cameroon showed mixed results with concerns of study integrity (Chelo et al., 2020). A study among parents and guardians in Zambia had them reporting that children were treated for sore throats without skilled assessment (Musuku et al., 2017). To address the foregoing limited assessment in SSA and Kenya, this study aims to evaluate the knowledge, attitude and practice of clinicians in prevention of Rheumatic Heart Disease at peripheral facilities in Chepalungu Sub County, Bomet County, Kenya. The table below summarizes some of the studies on Knowledge, attitude and practice among health care workers globally and their outcome.

Table 1

Summary of studies of Knowledge, Attitude and Practice on Rheumatic Heart Disease

Study	Design	Population	Outcome	Country
Tellawy et al., (2021), Saudi Arabia	Cross sectional	Parents	Moderate overall knowledge of RHD	Sakaka, Saudi Arabia
Techane et al., (2022), Ethiopia	Cross sectional	Nurses working in a cardiac center	Good knowledge	Addis Ababa, Ethiopia
Chelo et al., (2020), Cameroon	Cross sectional	Final year medical students	1 in 4 had good knowledge of RHD	Country
Isezuo et al., (2023), Nigeria	Cross sectional	Primary Health Care Workers	Inadequate knowledge, Poor practice, poor attitude	Sokoto, Nigeria
Osman et al., (2015), Sudan	Cross sectional and Interventional	Medical Officers, Pediatric House Officers, Registrars	Pre intervention; Average level Post Intervention: Good level	Khartoum, Sudan

1.2 Problem Statement

Most Rheumatic Heart Disease cases can be prevented by several strategies including prompt diagnosis of Group A *Streptococcus* throat infections and institution of prompt and appropriate treatment. In addition, prompt identification and appropriate treatment of Acute Rheumatic Fever also helps to prevent Rheumatic Heart Disease. Finally, institution of primary prophylaxis for Rheumatic Heart Disease prevention and active case finding are other tools healthcare workers can employ to reduce prevalence. Primary care health providers are the forefront of this and are often the first to come into

contact with patients in low tier care facilities.

Studies conducted among pediatricians in Sudan and among medical students in Cameroon suggest that the knowledge, attitude and practices of clinicians in preventing Rheumatic Heart Disease were, at best, average. This was evidenced largely by the analysis showing the laxity in diagnosing and appropriately treating Group A *Streptococcus* throat infection, delay in initiation of primary prophylaxis to prevent progression of Rheumatic Heart Disease and lack of continued active case finding.

Given the high morbidity and mortality from Rheumatic Heart Disease as well as the high prevalence of Rheumatic Heart Disease several factors can be extrapolated as possible causes. To begin with, this could possibly be arising from lack of access to updated guidelines on diagnosis of Group A *Streptococcus* and Acute Rheumatic Fever as well as lack of knowledge of other diagnostic tools that can be used to evaluate and diagnose Group A *Streptococcus* throat infections such as the Centor score. In addition, lack of laboratory tests or even knowledge of the appropriate laboratory tests to prescribe could be another contributing factor to late presentations of patients with advanced Rheumatic Heart Disease.

Further, there are differing prescription practices for the treatment of Group A *Streptococcus* throat infections with some clinicians avoiding antibiotics until there are laboratory results to warrant their use, while other clinicians under-prescribing or making wrong prescriptions of antibiotics to cover Group A *Streptococcus* throat infections. Other clinicians catch the cases late after conversion to Acute Rheumatic Fever and or Rheumatic Heart Disease and thus referring to a higher center of care where access may then be influenced by other social determinants of health. This results in high cases of children with preventable Rheumatic Heart Disease and as result increased morbidity and mortality from its complications. Failure to address this would

lead to continued morbidity and mortality of children with Group A *Streptococcus* throat and young adults with Rheumatic Heart Disease.

In light of the foregoing, and considering the high disease burden noted in Kenya and East Africa, an evaluation of the knowledge, attitude and practice of clinicians in prevention of Rheumatic Heart Disease will be key in helping us identify areas that can be strengthened in primary prevention especially when it comes to Group A *Streptococcus* diagnosis and treatment, primary prophylaxis delivery and active case finding. The high numbers of people affected by Rheumatic Heart disease suggests there is a high transition rate of Group A Streptococcus infections to Rheumatic Heart Disease. This calls on us to evaluate what clinicians' knowledge, attitude and practices towards Rheumatic Heart Disease and its prevention is as it could be contributory to the problem.

This study will help to empower nurses, clinical officers and medical officers by making them more aware of Group A *Streptococcus* throat infections and the risk of progression from that to Acute Rheumatic fever and on to Rheumatic Heart Disease. It will also help them be better advocates of strategies aimed at preventing Streptococcal infections and their transmission to others.

1.3 Justification of the Study

The prevalence of Subclinical Rheumatic Heart Disease in Sub Saharan Africa is at 2.1% (Chillo et al., 2023), whereas the prevalence of Group A *Streptococcus* throat infections in Kenya is at 38.4% and at 9.5% in Bomet County (Murugami et al., 2021). Untreated, these figures could keep increasing further increasing the risks of disease progression from Group A *Streptococcus* throat infections to Acute Rheumatic Fever and on to Rheumatic Heart Disease. The importance of this study is to inform gaps that exist in knowledge, attitude and practice of primary health care providers towards prevention of

Rheumatic Heart Disease that would be drivers of such high disease burden. Failing to identify those gaps and address them through various subsequent strategies would keep the morbidity and mortality of Rheumatic Heart Disease at the same high rates that are currently being experienced.

The research was in a prospective cross sectional study design because it offered an accurate assessment of knowledge due to currency, snapshot of attitude and practice as is and without challenges of recall bias that would have arisen in a retrospective design. It involved individual questionnaires being administered to sampled primary care providers at peripheral care facilities within Chepalungu Sub County, Bomet County, Kenya.

The study design analyzed responses on Knowledge, Attitude and Practices of clinicians on prevention of Rheumatic Heart Disease that were then presented through tables, charts and graphs.

1.4 Study Objectives

1.4.1 Main Objective

To assess the knowledge, attitudes, and practices of clinicians in the prevention of Rheumatic Heart Disease at peripheral facilities in Bomet County, Kenya, from May 2024 to August 2024.

1.4.2 Specific Objectives

i. To evaluate the knowledge of clinicians in Bomet County, Kenya, regarding diagnosing and managing Group A *Streptococcus* and Acute Rheumatic Fever among children aged 5-15years at peripheral facilities in Bomet County, Kenya between May 2024 to August 2024.

ii. To assess the attitudes of clinicians in Bomet County, Kenya, towards the diagnosis and management of Group A *Streptococcus* and Acute Rheumatic

Fever among children aged 5-15years in peripheral facilities in Bomet County, Kenya between May 2024 to August 2024.

iii. To identify the practices of clinicians in peripheral facilities within Bomet County, Kenya, in implementing Acute Rheumatic Fever and Rheumatic Heart Disease control programs integration into primary health care between May 2024 and August 2024.

1.5 Research Questions

i. What is the knowledge of Clinicians in preventing Rheumatic Heart Disease among children aged 5-15 years attending Outpatient clinics at peripheral facilities in Bomet County, Kenya?
ii. What is the attitude of Clinicians in preventing Rheumatic Heart Disease among children aged 5-15 years attending Outpatient clinics at peripheral facilities in Bomet County, Kenya?
iii. What is the practice of Clinicians in preventing Rheumatic Heart Disease among children aged 5-15 years attending Outpatient clinics at peripheral facilities in Bomet County, Kenya?

1.6 Significance of the Study

This study will be relevant to clinical service providers as it will show gaps that may be present in their knowledge, attitude and practice of Rheumatic Heart Disease. It will also help to understand the relationship between knowledge, attitude and practice. The information gained from the study will help to build capacity for the clinical service providers and improve their health provision skills to especially address the burden of Rheumatic Heart Disease.

The study will also be vital to facility administrators as it will help to identify gaps in the service provision chain that promote the prevalence of Rheumatic Heart Disease. These could be areas such as procurement and availability of diagnostic test kits for Group A Streptococcus pharyngitis, the procurement and availability of treatment guidelines for cardiovascular diseases, and the procurement and availability of registers for acute rheumatic fever and rheumatic heart disease.

To the County, data generated from the study aims to ensure the health service providers are well trained and equipped with the right tools to make prompt diagnoses of Group A streptococcus, acute rheumatic fever and rheumatic heart disease. The study also aims to empower the County health management teams to include rheumatic heart disease as one of its deliverables during support supervision. This will ensure health service providers do what is to be done to reduce the burden of Rheumatic Heart Disease. The national ministry of health will also benefit from this study because information generated from it will help to advance policy making towards prevention of Rheumatic Heart Disease. It will also provide a basis for financial support towards strategies that promote and evaluate prevention of Rheumatic Heart Disease.

The researcher aimed to provide the information generated from the study to those concerned through power point presentations, write up of summaries and through face to face meetings. Continuous medical education was another medium to be used to disseminate the data gathered.

1.7 Limitations of the Study

The study has some limitations that should be considered. The small sample size of medical officers (only 2) limits the generalizability of findings for this group. This limitation was countered by ensuring 2 out of the 3 medical officers in the sub county

were sampled. The study was conducted in one Sub County of the six within the County, which may not be representative of the entire County or Country.

There was implicit bias to try and compare the responses across cadres, however this was addressed with the operationalization of the term clinicians at the start of the study. The fact that all the cadres that were part of the study review, diagnose and prescribe medications in peripheral facilities in Kenya makes it an evaluation rather than a comparative study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Rheumatic Heart Disease arises as a complication of Acute Rheumatic Fever which is among the sequelae of infections of the skin or the throat by Group A*Streptococcus* bacteria (Auala et al., 2022). Sore throats in children are caused by Group A *Streptococcus* in 30% of cases and without treatment some develop Acute Rheumatic Fever (Kenya Cardiovascular Guidelines, 2018). Acute Rheumatic Fever is an abnormal immune reaction to the M proteins produced by Group A *Streptococcus* bacteria which often affects children between ages 5-15 with the post infectious complications presenting well into adulthood (Auala et al., 2022). This chapter outlines the literature that is in line with the study objectives mentioned earlier.

2.2 Literature of the Study Variables

2.2.1 Diagnosis of Group A Streptococcus, Acute Rheumatic Fever and Rheumatic Heart Disease

Rheumatic Heart Disease often results indirectly from Group A *Streptococcus* which can cause Acute Rheumatic Fever in some cases—with about 0.3-3% of people exposed to Group A *Streptococcus* developing Acute Rheumatic Fever (Auala et al., 2022). Acute Rheumatic Fever occurs as a post infectious disorder and involves multiple sites such as joints, subcutaneous tissues, the brain and the heart muscles with most of the symptoms resolving without any sequelae over weeks to months (Kenya National Guidelines on Management of Cardiovascular Diseases, 2018). The infective organism is often Group A *Streptococcus*, also known as *Streptococcus* pyogenes; a causative agent of several diseases including superficial infection; invasive infection and immune mediated post infectious sequelae. In some cases, patients with carditis

from Acute Rheumatic Fever may develop valvular damage that results in Rheumatic Heart Disease in approximately 60% of cases (Auala et al., 2022). Therefore, it is imperative that Group A *Streptococcus* and Acute Rheumatic Fever are correctly diagnosed and promptly treated as per the recommended global treatment guidelines to help in preventing progression to Rheumatic Heart Disease.

The diagnosis of Group A *Streptococcus* can be clinical or microbiological. The clinical diagnosis can be made through the use of clinical predictors like the Walsh pharyngitis criteria, the McIsaac decision rule and /or the Centor criteria (Moloi et al., 2016). These are tools that are easily accessible on the internet through educational portals such as UptoDate. The use of microbiological tests includes the use of a rapid diagnostic test kit or the use of throat and skin swab cultures to make the diagnosis of Group A *Streptococcus*. However, the presence of bacteria could indicate colonization with the organism rather than the presence of an active infection (Kenya Cardiovascular Guidelines, 2018). Identification of bacteria from skin lesions is often difficult due to the super colonization of Staphylococcus aureus which is a skin commensal. The availability of throat and skin cultures are often available but not routinely utilized due to their long turn-around times and the high loss to follow up of patients as they are not able to come back to hospital for results due to several factors. Often, immune mediated responses against enzymes produced by Group A *Streptococcus* can be diagnosed serologically weeks after the infection based on the strength of the immune response mounted. The commonest test used to confirm antecedent Group A *Streptococcus* infection is elevated or rising Anti- Streptolysin O titres but if low, anti- DNase B, anti- hyaluronidase, anti-NADase, and anti- streptokinase titres can also be used.

The diagnosis of Acute Rheumatic Fever is often clinical and, according to the Kenya Cardiovascular guidelines is based on Jones Criteria that was developed with a set of

major and minor criteria with supporting evidence of an illness in the preceding 45 days. Further, the guidelines outline the Revised Jones criteria that advocates for the use of echocardiography to check for the presence of valve damage in patients who have Acute Rheumatic Fever. The knowledge and practice of this is pertinent towards identification and treatment of Acute Rheumatic Fever because over diagnosis results in unnecessary treatment over a prolonged duration and may predispose to antimicrobial resistance whereas under diagnosis leads to repeat attacks that then cause valve damage and scarring with Rheumatic Heart Disease as sequelae.

Once someone has developed Rheumatic Heart Disease, the diagnosis is often made through echocardiography to evaluate the extent of valve involvement of the heart. Echocardiography can assess if a single or multiple valves are involved and if heart failure has set in (Rwebembera et al., 2023). It is also used to follow up patients to trend the morphological changes that have happened over the course of treatment of the disorder. Multiple studies show that most health care workers do not examine throats in order to make an assessment of whether a child requires a scoring modality or a microbiological analysis in order to get treated for pharyngeal infections. There are multiple scoring systems that are used to make diagnosis of bacterial pharyngitis; the Centor score and the Fever Pain Score. These help to determine whether antibiotics should be administered, and the timing for it. However, clinicians may be unaware of them, or may be unable to access them due to several factors and as such may not employ them in their practice. A study done in Zambia by Musuku et al, 2017 had guardians reporting that their children were treated for throat infections without skilled assessment which led to increased risk of suboptimal treatment with resultant disease progression. Other studies in Nepal, Iran and Cameroon also showed low knowledge among both parents and health care workers with regard to awareness of the risk of throat infections

and the role diagnosis plays in preventing disease progression from the throat to the heart (Isezuo et al., 2023).With multiple studies showing low level awareness, low attitude and poor practice in diagnosing throat infections, Acute Rheumatic Fever and Rheumatic Heart Disease, a similar study would help to bridge this gap by building capacity among the healthcare workers. This will be achieved by identifying if clinicians are aware of these practice guidelines; whether they can access them to help in the diagnosis of Group A *Streptococcus* infections, and if they use them regularly in their patient care to make appropriate diagnoses.

2.2.2 Management of Group A Streptococcus and Acute Rheumatic Fever

The management of Group A *Streptococcus* infections presenting as throat or skin infections entail the use of antibiotics that are either bacteriostatic or bactericidal as per a country's set antibiogram. Often, penicillins are the first line used in treating Group A *Streptococcus* and alternatives used in those allergic to them. The penicillins in use include Benzathine Penicillin injection 1.2 MU in adults (and 0.6MU in those <27kgs) given as a stat dose or Amoxycillin per oral given over 10 days at 500mg twice daily in adults and dosed at between 12-22 mg per kilo twice daily in children based on disease severity (Kenya Cardiovascular Guidelines, 2018). In those with Penicillin allergies; Azithromycin can be used at 500mg once daily for 5 days or Erythromycin at 500mg four times a day for 10 days in adults and at between 30-50mg per kilo per day in 2 divided doses among children (Kenya Cardiovascular Guidelines, 2018).

The treatment of symptomatic streptococcal infection is inadequate to prevent Acute Rheumatic Fever as it may be triggered by asymptomatic throat infections and may occur even with adequate Group A *Streptococcus* treatment in the interplay of environmental, bacterial and genetic factors (Kumar et al., 2020). The diagnosis and treatment of asymptomatic group A Streptococcus (GAS) infections, particularly in the

context of pharyngeal carriage, are nuanced and depend on several factors. Asymptomatic carriage of GAS is common, especially in children, and typically does not require treatment unless specific circumstances arise.

Diagnosis of asymptomatic GAS carriage is usually incidental, often discovered during investigations for other conditions or during outbreaks. It involves the identification of GAS in throat cultures without accompanying clinical symptoms of infection. Treatment of asymptomatic GAS carriage is generally not recommended due to the low risk of complications such as rheumatic fever and the potential for antibiotic resistance. However, treatment may be considered in certain situations, such as during an outbreak of acute rheumatic fever, post-streptococcal glomerulonephritis, or invasive GAS infections in a community, or if the individual has a personal or family history of rheumatic fever. In these cases, eradication of the carrier state might be pursued using antibiotics.

A systematic review highlighted that oral clindamycin for 10 days was found to be more effective in eradicating pharyngeal GAS carriage compared to other regimens, such as benzathine penicillin G followed by rifampicin or monotherapy with penicillin, phenoxymethylpenicillin, or erythromycin(Hung et al., 2024).However, the evidence is limited, and further research is needed to establish the most effective treatment regimens for asymptomatic carriers. Analgesics and anti-inflammatory drugs can be used as adjunct to offer symptomatic relief.

The cornerstone of prevention of Acute Rheumatic Fever is the prevention of new infections and appropriate treatment of Group A *Streptococcus*. According to the Kenya Cardiovascular Guidelines, all patients suspected of having Acute Rheumatic Fever should be managed as in-patients and should preferentially be initiated on single dose Benzathine Penicillin G or 10 day course of oral Penicillin Vif first alternative is not

feasible. The use of anti-inflammatory agents to control fever, arthritis, carditis and other acute symptoms is also pertinent in management of Acute Rheumatic Fever. The agents used are often Paracetamol and /or NSAIDs such as Naproxen, Aspirin or Ibuprofen if arthritis or arthralgia is very bad. Carbamazepine may be used for patients with debilitating chorea and anti-failure regimens may be instituted for those with symptoms of heart failure. These include diuretics, Angiotensin Converting Enzyme Inhibitors (ACEIs), or Digoxin if a patient has Atrial Fibrillation. Patients who already have valvular damage from Rheumatic Heart Disease can be managed through cardiac surgery to get valve replacements or repair then be put on long term monthly (Benzathine Penicillin G) injection as well as anticoagulation. These patients also need to be reviewed regularly by the dentists to reduce the risk of endocarditis (Kenya Cardiovascular Guidelines, 2018).

Challenges that are contributory to the disease progression include delayed identification of, and poor management of Acute Rheumatic Fever and delayed initiation of secondary prophylaxis in the form of monthly injections of Benzathine Penicillin (Watkins et al., 2016). In addition, the adherence to the monthly injections of Benzathine Penicillin for the duration for which they are prescribed can be daunting for patients. This is because the cost and availability of the drug may be a challenge and even then, some patients may be far from facilities and thus may not easily access the medicine (Coates et al., 2021). The side effect profile of Benzathine Penicillin may also make some clinicians be hesitant to administer. It has been noted that some patients have died a few minutes after getting the Benzathine Penicillin G injection. This has been attributed to rapid hemodynamic changes that result from hypotension that causes reduced coronary perfusion and subsequent ventricular arrhythmias. This may cause death especially in patients who already had coexisting cardiovascular compromise (Kumar et al., 2020).

This may be exacerbated by patients having walked long distances to get to a facility for the injection and may be dehydrated and hungry. Health care workers are thus encouraged to ensure patients have eaten and are well hydrated prior to getting the injection and to lie supine after the injection (Watkins et al., 2016).

Nkoke et al, 2018, reported that Cameroon medical students had average knowledge on the management of Rheumatic Heart Disease whereas a similar assessment of medical students in Saudi Arabia showed that more than 50% of the respondents would be prompt to treat sore throats with antibiotics (Alnemari et al., 2022). A Nigerian study among varied health care workers had 24% of the participants reporting that antibiotics had no role in the treatment of sore throat infections (Isezuo et al., 2023). These studies support the hypothesis that having good knowledge and good attitude towards diagnosis and treatment of bacterial pharyngitis, acute rheumatic fever and rheumatic heart disease leads to better practices in the same. This study will help to inform the knowledge gaps that exist in the management of pharyngitis, Acute Rheumatic Fever and Rheumatic Heart Disease among the sampled healthcare workers.

2.2.3 Integration of Acute Rheumatic Fever and Rheumatic Heart Disease control programs into Primary Care

According to the Kenya Cardiovascular guidelines of 2018; the risk of developing Acute Rheumatic Fever after Group A *Streptococcus* pharyngitis that was poorly treated or untreated falls between 0.3- 3% and it rises to 50% for patients with previous history of Acute Rheumatic Fever. With repeated infections with Group A *Streptococcus* and Acute Rheumatic Fever there is progressive heart valve damage with resultant scar formation that if persistent results in Rheumatic Heart Disease. The burden of Rheumatic Heart Disease prevalence globally is currently estimated at 40.5 million people with 306,000 people dying from the disease annually (Dougherty et al., 2023). The morbidity

associated with Group A *Streptococcus*, Acute Rheumatic Fever and Rheumatic Heart Disease is also noteworthy with children noted to be missing school or young adults missing out on being productive due to illnesses resulting in hospital admissions with overall effect on the productivity of the youth.

Rheumatic Heart Disease is now rare in most high-income countries, but its prevalence is still notable in low income, middle income and in marginalized populations in the high income countries (Kumar et al., 2020). According to Kumar et.al 2020, Sub Saharan Africa experiences 14-40% of the burden of cardiovascular disease due to Rheumatic Heart Disease with approximately 5-7 per 1000 children living with Rheumatic Heart Disease as compared to 0.5 per 1,000 children in developed countries. In Kenya, the prevalence of Rheumatic Heart Disease is between 1.7-2.7% in surgical patients aged between 5-35 years according to the Kenya cardiovascular guidelines, 2018. This high prevalence for LMICs, of which Kenya is one of, could be attributed to some factors that contribute to and exacerbate the disease process.

These include socio economic status like the level of income of a household, the level of education of the household and employment status. It also includes environmental factors such as number of social contacts, overcrowding and sharing of beds in a household, laundry and conditions of housing. Furthermore, healthcare factors including health literacy, distance to and health access, an individuals' health status, as well as the state of their oral health and nutrition (Auala et al., 2022) are other contributory factors. There has been noted some influence of the triad of environmental, genetic and bacterial factors in propagating a disease process that is clinically significant (Lumsden et al., 2016). The human leukocyte antigen (HLA) region, particularly the HLA-DQA1 and HLA-DQB1 loci, has been consistently associated with increased susceptibility to ARF and its sequela, rheumatic heart disease (RHD) (Muhamed et al., 2020). These loci are

involved in the immune response, and variations in these genes may influence the body's ability to recognize and respond to streptococcal antigens, potentially leading to autoimmune reactions against cardiac tissue.

The Addis Ababa Communique of 2015 that had experts on Rheumatic Heart Disease come together to brainstorm ways to reduce the burden of Rheumatic Heart Disease in East Africa by 2025 came up with 7 strategies that included among others decentralization of appropriate technical expertise to the primary and district levels in order to improve the diagnosis of Acute Rheumatic Fever as well as diagnosing, preventing and treating Rheumatic Heart Disease using the relevant diagnostic tools and antimicrobials (Watkins et al., 2016).

The prevention of Rheumatic Heart Disease is based on 3 strategies: Primordial, primary and secondary prevention. Primordial prevention aims at reducing exposure to Group A *Streptococcus* infections as well as preventing its spread among children once one is infected (Dougherty et al., 2023). They mainly involve things that can be done at the household level and include reducing overcrowding, washing of hands and beddings regularly to prevent for mite transmission and spread. The inclusion of proper ventilation in a house to prevent damp or moist environments can also be added to the inclusion. Primary prevention aims at identifying which children have an active infection and have them access health services, correctly identifying the infective organism using the right diagnostic tools and appropriately and promptly treating the active infection, and following up the patient periodically in order to promptly identify any arising complications from the Group A *Streptococcus* infections especially Acute Rheumatic Fever (Lumsden et al., 2016). This often involves the community and parents to rally and have the knowledge to identify throat infections however subtle, and especially the recurrent ones. It also requires primary caregivers to correctly identify, diagnose and

treat the active infection and schedule periodic appointments to follow up.

Secondary prevention entails the identification of the early symptoms of Rheumatic Heart Disease, use of echocardiography to confirm valvular heart disease and the initiation of secondary prophylaxis in the form of Benzathine Penicillin injections scheduled monthly for the specified duration (Kumar et al., 2020). This calls on primary care physicians to be knowledgeable on these practices to prevent disease progression to Rheumatic Heart Disease, and to then put the knowledge into practice as they have a role to play in all the preventive aspects of Rheumatic Heart Disease prevention. Finally, tertiary prevention aims at management of heart failure and surgical valve replacement for patients with valvular damage arising from Rheumatic Heart Disease.

According to a study done among cardiac nurses in Addis Ababa, it was noted that knowledge of identification of bacterial pharyngitis and its appropriate and prompt treatment and its association to Rheumatic Heart Disease is not common even to those who care for Rheumatic Heart Disease patients. The study found that more than half of the study participants (51.3%) had poor knowledge of Rheumatic Heart Disease (Techane et al., 2022). This calls us to evaluate what our clinical service providers know in terms of diagnosing, treating Group A streptococcus, identifying and treating acute Primary prevention aims at identifying which children have an active infection and have them access health services, correctly identifying the infective organism using the right diagnostic tools and appropriately and promptly treating the active infection, and following up the patient periodically in order to promptly identify any arising complications from the Group A *Streptococcus* infections especially Acute Rheumatic Fever (Lumsden et al., 2016).

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To reduce the burden of Rheumatic Heart Disease, prevention of new Streptococcal infections and eradication of existing streptococcal infections and the prompt identification and treatment of Acute Rheumatic Fever to prevent progression to Rheumatic Heart Disease is key. The attainment of this is in the four-pronged prevention strategies outlined as Primordial, Primary, Secondary and Tertiary prevention strategies.

These strategies work in cohesion with each other, none works as a stand-alone entity. Their implementation is often done at different cadres of care taking up different prevention model.

According to Coates, 2021, primary prevention delivery does not rely on the other methods of prevention of Rheumatic Heart Disease from the perspective of health system delivery. There are factors that are involved in the care cascade that strongly interlink the different interventions and include human resources, equipment and connections. For instance, surgical cardiac programs that exist have other programs within them that would be able to manage heart failure patients, determine surgery eligibility using echocardiography and follow up patients post operatively for anticoagulation management. In addition, primary prevention strategies are often delivered through primary health care providers at health centers or in the community.

This is because primary health care workers at the peripheral facilities will be the first point of contact for patients presenting with sore throat, skin infections and other post infectious sequelae of the same. In comparison, other secondary and tertiary prevention strategies require access to secondary or tertiary care which is often found in higher level facilities. Several studies conducted on primary prevention strategies of Rheumatic Heart Disease have yielded results that confirm that educating the masses on ways of identifying, seeking health care promptly, and getting treated adequately can reduce cases of Rheumatic Heart Disease in the long term. On the other hand, focusing on secondary prevention would help to reduce morbidity and mortality in the short term. Despite this, the lack of knowledge of symptoms, as well as lack of access to treatment may cause persistent high cases of Acute Rheumatic Fever and Rheumatic Heart Disease (Ramsey et al., 2013).

Capacity development for health care workers is vital towards improving strategies that aim at health promotion for primary prevention of Rheumatic Heart Disease. The World Heart Federation aims to reduce by 25% the premature deaths of those younger than 25 years by 2025 (Nulu et al., 2017). To this end, there are control programs that are recommended for uptake by countries in which Rheumatic Heart Disease is still endemic. These include among others the use of registers for mapping out areas of high disease burden, recurrent training of healthcare workers to be up to date with current guidelines on Rheumatic Heart Disease diagnosis and management, and extensive community engagement to increase disease awareness (Shimanda et al., 2024). According to the Evaluation of the Fiji Islands Rheumatic Heart Disease Control and Prevention Activity; early case detection programs and primary prevention guidelines were given a perceived low value towards reducing Acute Rheumatic Fever and Rheumatic Heart Disease whereas the register-based program was considered a high value output (2019). The administration of monthly antibiotic within the primary care framework is also considered a significant control program as is noted in Australia (ARF/ RHD Writing Group, 2020).

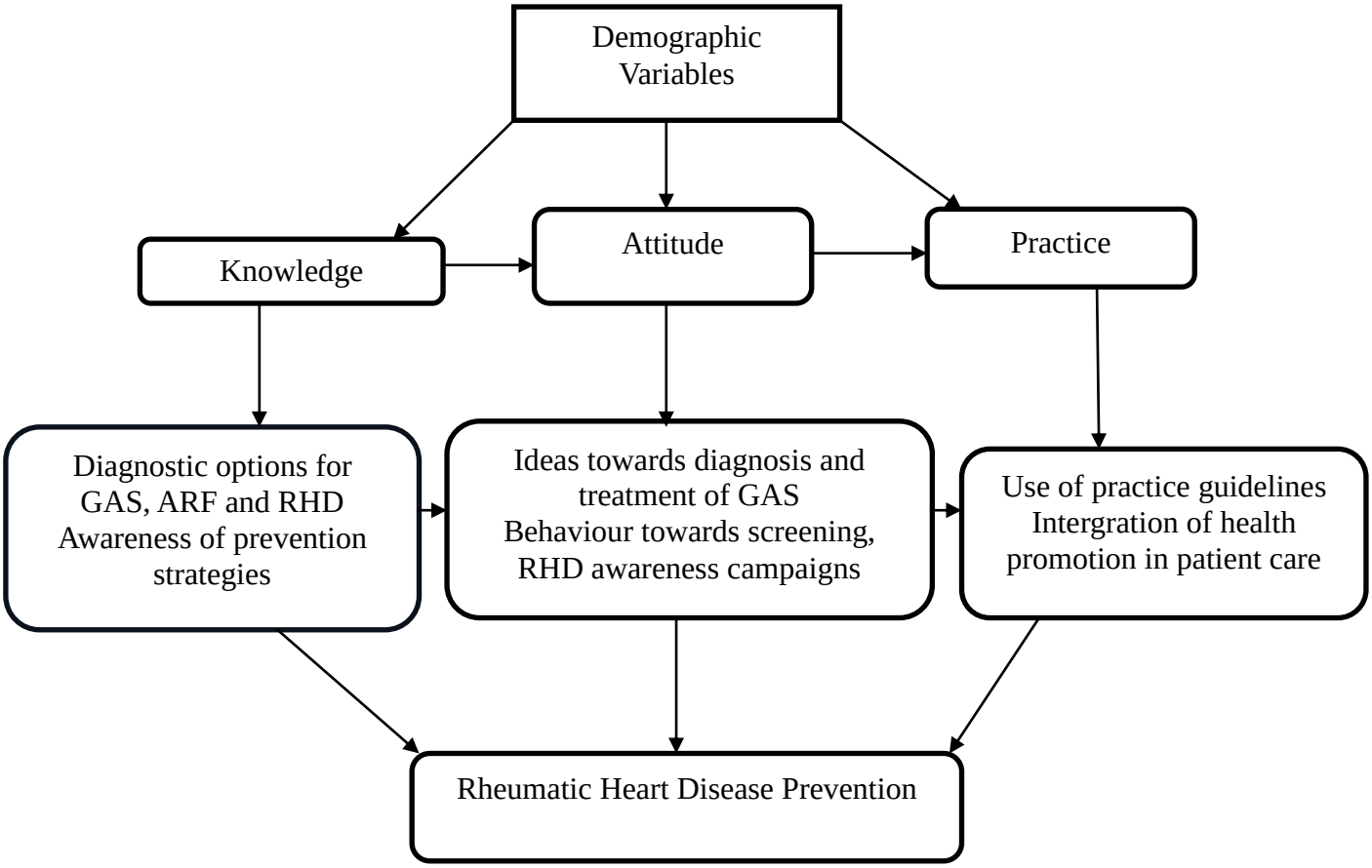
The role of primary health care in the primary prevention of Rheumatic Heart Disease cannot be overlooked hence the evaluation of knowledge, attitude and practice of clinicians On Acute Rheumatic Fever and Rheumatic Heart Disease programs and how they interlink with primary health care is important.

2.3 The Theoretical Framework

The figure below shows the theoretical framework.

Figure 2

Outline of Theoretical Framework



Adapted from Dougherty et al, (2022)

The figure above shows the relationship between dependent variables which are the demographic characteristics and the independent variables that include knowledge, attitude and practices of health service providers towards Rheumatic Heart Disease prevention.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This section outlines the design of the study, location and population of the study participants. It also outlines the calculation of the sample size, techniques employed in the data collection for the study, and the data analysis methods.

3.2 Research Design

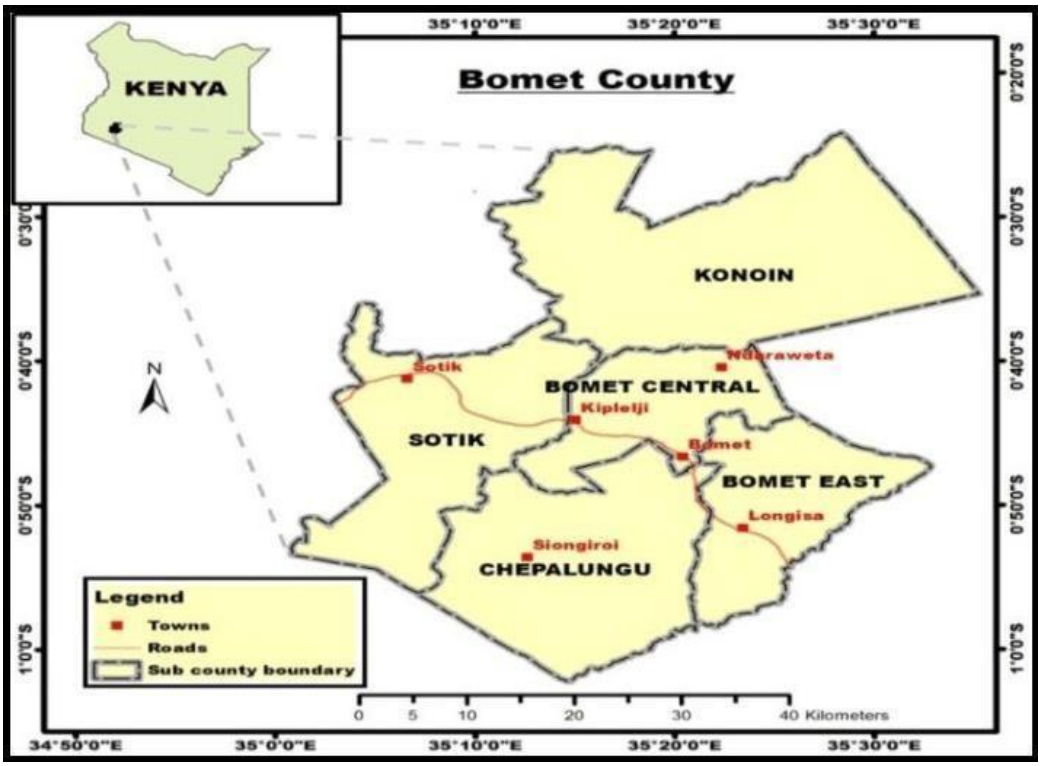
The study is a prospective cross-sectional study. This study design was selected as the research was conducted over a specified time period and involved all the primary health care workers in a specific sub county.

3.3 Location of the study

The study was conducted in Chepalungu Sub County of Bomet County (Figure 3). At levels 2, 3 and 4 facilities within the Sub County. In the Kenyan healthcare system, health facilities are categorized based on their capacity to handle simple or complex health cases, how well equipped they are and their level of staffing. Level 2 and 3 facilities are considered lower cadre facilities. This is because they are commonly the first entry point into the healthcare system for patients. The only Level 4 facility was considered in this study because it is a first point of contact for some patients and also because there is staff reshuffling every so often. This means that a clinical service provider would be in a level 4 facility at one time and in a level 3 facility at another time during their career at the County Government.

Figure 3

Bomet County Map



Source: Bomet Spatial Plan, (2023)

Chepalungu Sub County is among the five sub counties of Bomet County. According to a World Vision Economic Empowerment Project report of 2021, Chepalungu Sub County had a poverty level of 38% down from 53% by the end of the project. In addition, the state of transport within the sub county is poor and this further drives the inaccessibility to health service delivery points, as well as increasing poverty through various other means, an example of which is outlined in the Bomet County's Spatial Plan, 2023.

In the pathogenesis of Rheumatic Heart Disease, low socioeconomic status, environmental factors and poverty all play a role in driving the disease progression. All of these are noted in Chepalungu Sub County and is the reason why it is an ideal site for the study. In addition, preliminary studies assessing distribution patterns of patients attending cardiac clinic at Tenwek Hospital show that the majority of the patients are

from Chepalungu Sub County in Bomet County.

3.4 Population of the Study

The study population was derived from health care workers based in level 2, 3 and 4 facilities in Chepalungu Sub County in Bomet County. The Kenyan Primary Health Care System has categorized health facilities into six levels. These levels vary based on staffing of health care workers, financing and governance as well as their diagnostic and pharmaceutical capacities. Levels 2, 3 and 4 facilities were selected for this study because often when patients are unwell their first point of contact to seek health services before they are referred up the chain of care to larger and more specialized hospitals. They also have the cadre of clinical service providers who are to be included in the study.

The health care workers targeted for the study included primary health care workers who are usually the first point of contact for patients presenting to the lower cadre facilities. These include nurses, clinical officers and medical officers who run outpatient clinics in the level 2, 3 and 4 facilities within Chepalungu Sub County. For the purpose of this study, they are collectively referred to as clinicians since they all form the first point of contact for patients in facilities. They are key in reviewing patients, making diagnoses and in writing prescriptions for diagnoses made. There are a total of 132 clinical service providers in the Sub County. This is distributed as 3 Medical Officers, 33 Clinical Officers and 96 Nursing Officers.

3.4.1 Study Subjects

Inclusion criteria

Be a medical officer, clinical officer or nursing officer

Be employed in level 2, 3 or 4 facilities

Exclusion criteria

Primary Health Care Workers in the peripheral facilities who are first point of contact for patients but are not Nurses, Clinical Officers or Medical Officers. Those on statutory leave or unwell during the study period.

3.5 Sampling Procedure and Sample Size

A sample size was calculated from this population as described below.

The sample size (n) calculation was based on the formula for calculating sample size for cross- sectional studies as described by Daniel (1978).

Thus, $n=Z2P\ (1-P)\ d2$

Where:

Z = value from standard normal distribution corresponding to desired confidence level (Z=1.96 for 95% CI)

P is the expected proportion set at 0.5 in this study

d is the desired precision set at 0.05.

An adjustment was made for small population described by Thrusfield (2005) to estimate a proportion or apparent prevalence with specified precision.

The adjustment for finite population size is given by n =N×n\N+n.

Hence, from a study population of (N=132), and n= 384(calculated from above) the calculated sample size (n) is 98.

3.5.1 Recruitment Procedures

Nurses, clinical officers and medical officers working as primary health care providers in level 2, 3 and 4 facilities within Chepalungu Sub County were recruited through the office of the County Director of Health in Bomet County as it was the office granting permission to have their staff involved in the study as well as have the study conducted

within the County.

3.5.2 Sampling Process

The study population was sampled through a stratified sampling method. There are different cadres of health professionals to be involved in the study and within Chepalungu Sub County they number as 3 Medical Officers, 6 Clinical Officers and 123 Nursing Officers. They all were then conveniently sampled as per their cadre with the aim to have them all represented and still achieve the requisite sample size as calculated.

3.6 Data Collection Procedures

The study participants consented prior to being asked to fill the data collection tool which was a questionnaire that had 4 sections: Demographic data, Knowledge, attitude and practice assessment areas.

The clinicians were given serial numbers to retain anonymity and to prevent bias during data analysis. The questionnaires were administered face to face. There challenges with poor internet connectivity made online surveys impractical.

The consent form was on the first page of the questionnaire with details of ethical approvals as well to allow the sampled participants to decide whether to be part of the study or not. The face-to-face questionnaires were checked for completion prior to being collected. The physical forms were collected, sorted and stored in a safe cabinet under lock and key. The data was then entered onto an excel sheet for ease of analysis. The questionnaires have been stored in a safe accessible only by the researcher in case of need for future reference.

3.7 Instrumentation

The data collection tool used in this study was adopted and modified from a questionnaire that had been used to conduct a similar Knowledge, Attitude and Practice study on Rheumatic Heart Disease among Medical Students in Cameroon. The data collection tool was piloted at Tenwek Hospital among 12 participants; 3 medical officers, 4 clinical officers and 5 nursing officers. They gave feedback on the length of the questionnaire, ambiguity of questions on the knowledge section and assessment of attitude section. The tool had to be modified post piloting to assess fulfillment of study objectives and be congruent with the cardiovascular management guidelines of the country.

The participant consent form and the study questionnaire are listed in this document as *Appendix 1* and *Appendix 2* respectively.

3.7.1 Data Analysis and Presentation

Categorical variables such as age group categories, gender, type of health worker, institutional level and responses on knowledge, attitude, and practice are presented as frequencies and proportions using tables and charts for univariate analysis. Whereas for bivariate analysis, test of association Chi- square analysis at 95% confidence interval with p value set at 0.05, was done to assess the relationship between different variables. Knowledge, attitude, and practice grade of respondents were set as the dependent variables while the independent variables were institution level, cadre, gender and age.

The data was analyzed using STATA v14. Demographic data is analyzed through the use of frequencies and tables and presented with pie charts. On the other hand, outcomes that generate categorical data were analyzed by Odds Ratio and Chi-Square tests. Odds Ratio was calculated by comparing the odds of events in each of the categorical data sets and

then adjusted with a data set that yielded a statistically significant ratio. To test the hypothesis, data collected was populated in contingency tables representing the observed frequencies for each combination of categories. The Chi-Square statistic was calculated using the observed frequencies and expected frequencies under the null hypothesis.

3.7.2 Knowledge, Attitude, and Practice Scores

The knowledge was assessed by questions each being scored 1. The level of knowledge was calculated as the number of correct responses divided by the total score of the segment multiplied by 100 to get the percentages of correct responses and was analyzed dichotomously into 0%–49% as poor knowledge while 50% to 100% as good knowledge. The knowledge section had 18 questions but only 13 were used to evaluate knowledge. The others in the knowledge section were experiential questions that did not contribute to the knowledge scores. The cut off scores for knowledge were based on the benchmark scores done by previous studies. The attitude and practice sections were in a 4-point Likert scale ranging from strongly agree to strongly disagree and very unlikely to very likely. They were both analyzed by medians and interquartile ranges as well through modes and frequencies by generating data for the overall clinical service providers and comparing data sets across cadres. These scores for each variable would be compared with each other to evaluate the hypothesis that clinicians with adequate knowledge and a positive attitude towards Rheumatic Heart Disease prevention demonstrate better preventive practices.

3.8 Ethical Considerations

Ethical clearance was obtained from Tenwek Hospital Institutional Ethics Review Committee; Protocol 2024-0012; as well as the National Commission for Science, Technology and Innovation (NACOSTI); License No; NACOSTI/P/24/36464. Study

participants were consented and identities were coded to maintain anonymity and to prevent bias during data analysis. There was no expected minimal environmental impact from the study. The papers used for the physical questionnaires have been stored in a safe only accessible by the researcher once the data from them had been tabulated onto excel sheets.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND DISCUSSION

4.1 Introduction

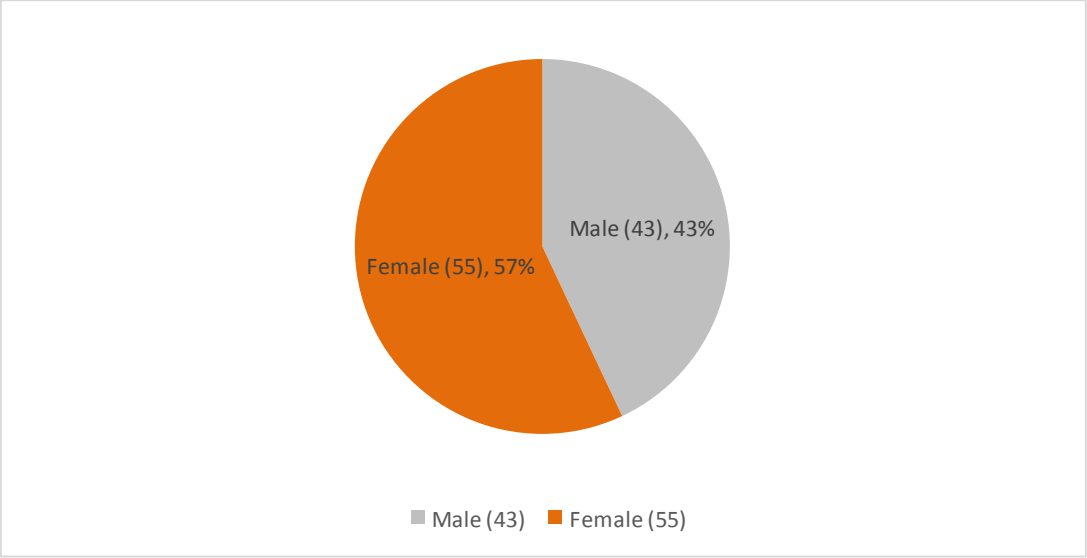
The following section outlines the results obtained from the study. A total of 98 health professionals participated in the survey. To gain insights into their characteristics, a demographic analysis was first conducted, followed by a detailed analysis aligned with the study's objectives.

4.2 Response Rate

The sample comprised 43% male and 57% female respondents.

Figure 4

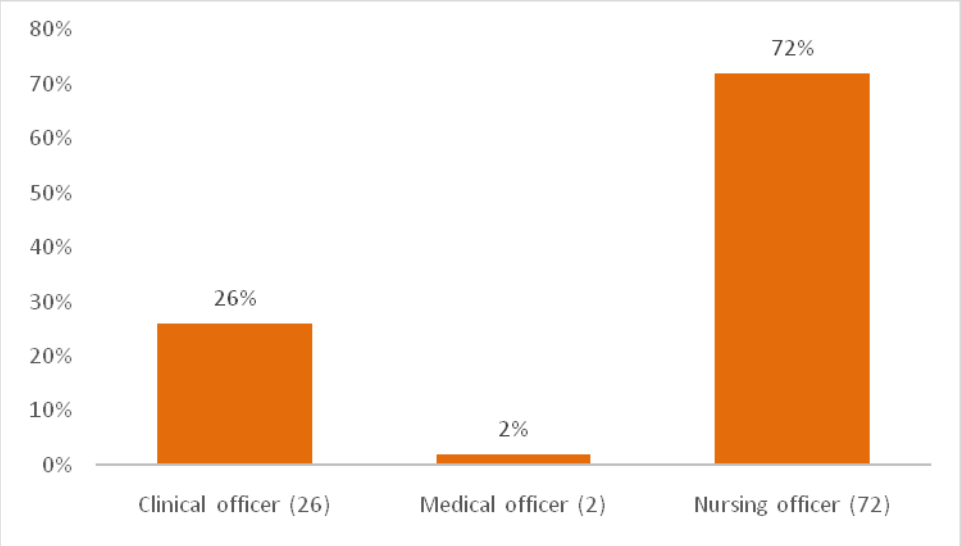
Chart Showing Distribution of Gender



The majority of respondents were Nursing Officers (71%), followed by Clinical Officers (27%) and a small proportion of Medical Officers (2%).

Figure 5

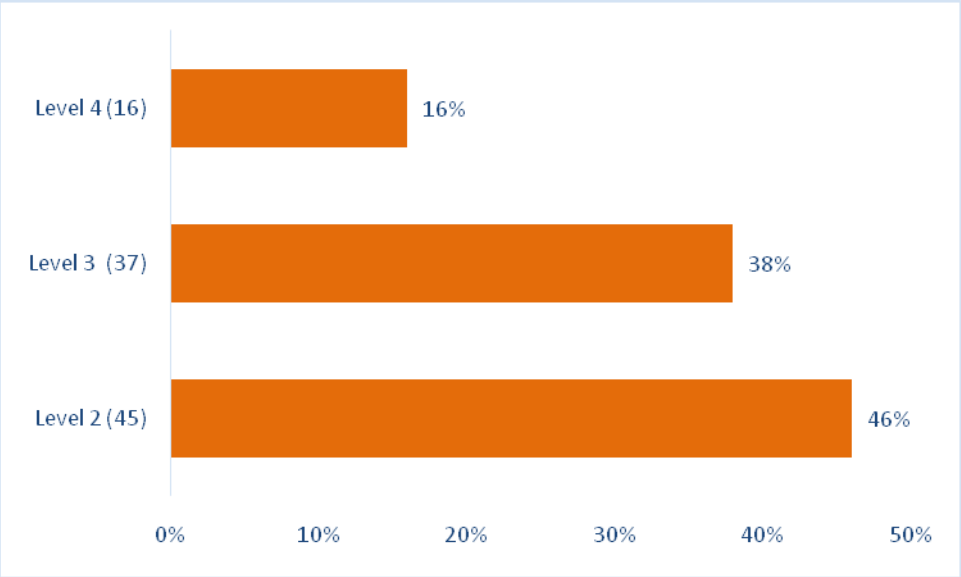
Clinicians Distribution by Cadre



Most participants worked in Level 2 (46%) and Level 3 (38%) healthcare institutions, with a smaller group from Level 4 institutions (16%). There was a total of 28 health institutions captured in the study. 1 was a level 4 facility, 6 were level 3facilities and 21 were level 2 facilities.

Figure 6

Institution Types in Study



The mean age of the study population was 34.6 ± 8.7 years with an age range of 21 years to 58 years. The median age was 33 years, and the inter-quartile range (IQR) was 10.5 years. The distribution of the age was as follows; the largest age group was 31–40 years (48%), followed by 20–30 years (33%). Smaller percentages were in the 41–50 years (11%) and 51 years and above (8%) age groups.

Figure 7

Distribution by Age

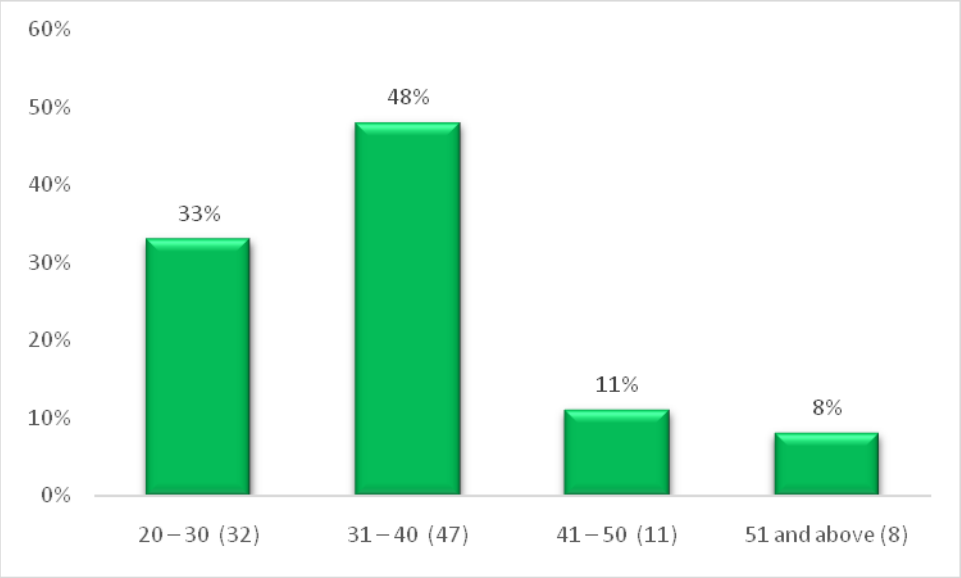
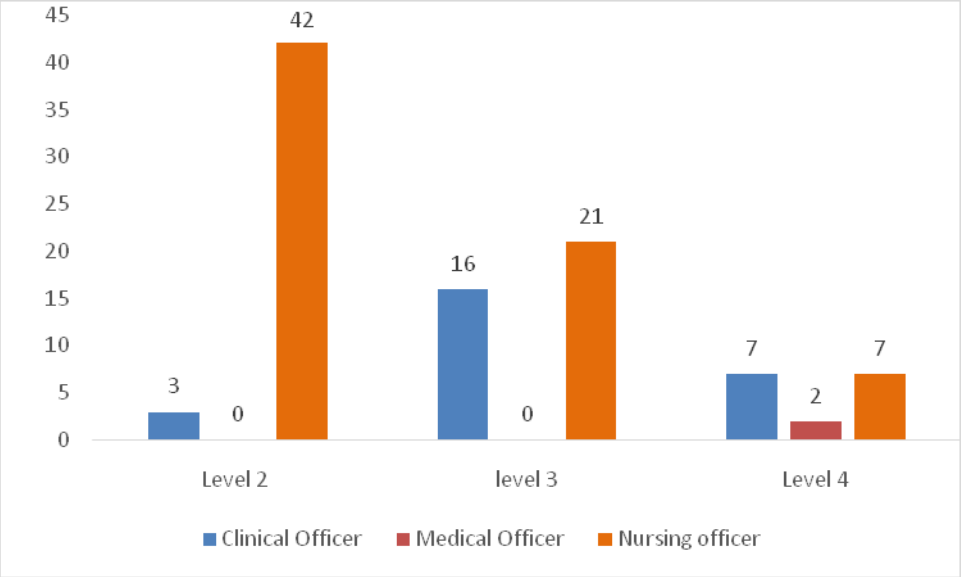


Figure 7 shows the distribution of clinicians by institution type in Bomet County which reveals distinct patterns across different levels of healthcare facilities. At Level 2 facilities, the majority of clinicians are Nursing Officers, accounting for 44 individuals, with only 3 Clinical Officers and no Medical Officers present. Level 3 facilities have a more diverse representation, with 21 Nursing Officers, 16 Clinical Officers, and still no Medical Officers. In Level 4 facilities, the distribution shifts slightly, with 7 Nursing Officers, 7 Clinical Officers, and 2 Medical Officers. These findings indicate that Nursing Officers are the most prevalent across all levels, especially at Level 2 facilities, while Medical Officers are only found at Level 4 facilities, suggesting a concentration of more specialized medical personnel at higher-level institutions.

Figure 8

Distribution of Clinicians by Institution Type



The table below provides a summary of the demographic variables presented in charts above.

4.3 Findings of the study

4.3.1 Experiential Questions Analysis

The majority of clinicians (84%) reported having encountered a patient with acute bacterial pharyngitis, while 16% had not. This indicates a high level of exposure to acute pharyngitis among the health professionals, which is relevant given its identification is often based on clinical examination as well as the use of clinical predictive tools such as the Centor score.

The majority of the clinicians (74%) have encountered a patient with Acute Rheumatic Fever, while 26% have not. This suggests that most health professionals have direct experience with this condition, which is critical for effective diagnosis and management of Rheumatic Fever.

The findings show that 38% of clinicians have access to the Kenya National Guidelines for Cardiovascular Diseases Management, 4% rely on the Up-to-date resources, and 16% have access to both. However, a concerning 42% of clinicians reported having no access to any of these treatment guidelines, highlighting a significant gap in the availability of critical resources for managing cardiovascular conditions.

The majority of clinicians (97%) reported that their facilities do not have a Rheumatic Heart Disease register, while only 3% confirmed its availability. This highlights a critical gap in the resources needed for effective monitoring and management of Rheumatic Heart Disease in these facilities.

4.3 .2 Knowledge of Clinicians on ARF and RHD

The evaluation of clinicians' knowledge in Bomet County regarding the diagnosis and management of Group A Streptococcus and Acute Rheumatic Fever reveals both strengths and areas for improvement. The majority of clinicians correctly identified Benzathine penicillin G as the appropriate treatment for preventing Acute Rheumatic Fever (87%). A significant proportion (87%) recognized that surgery can be a management option for Rheumatic Heart Disease. Knowledge about the causes of Rheumatic Heart Disease was relatively strong (75%), and 60% acknowledged that Rheumatic Heart Disease can occur without prior evident Acute Rheumatic Fever. However, there were notable gaps: only 65% correctly identified Group A Streptococcus as the germ causing sore throat leading to heart disease, and just 4% were aware of all diagnostic tests for bacterial pharyngitis. Only 44% knew the Jones criteria for diagnosing Acute Rheumatic Fever, and 4% understood the recommended duration of antibiotic prophylaxis. Additionally, 42% correctly identified that carditis in Acute Rheumatic Fever is treated with bed rest and corticosteroids, if severe. Despite 100%

recognizing the role of primary health care workers in prevention, these gaps indicate a need for targeted educational interventions to enhance overall knowledge and clinical practices. The findings are presented below.

Table 2

Knowledge of Clinicians on ARF and RHD: Summary of Correct Responses

Statement	Correct responses	
	N	%
What causes Rheumatic Heart Disease?	75	75%
Which germ causes sore throat that can lead to heart disease?	65	65%
What tests can we use to diagnose the presence of bacterial pharyngitis?	4	4%
Which modalities can show evidence of preceding *Streptococcus* infection in Acute Rheumatic Fever diagnosis	54	54%
Which treatment is appropriate for a sore throat to prevent Acute Rheumatic Fever and Rheumatic Heart Disease?	87	87%
Rheumatic Heart Disease can occur without prior evident Acute Rheumatic Fever	60	60%
Carditis in Acute Rheumatic Fever is treated with?	42	42%
How many elements of the Jones criteria are used for the diagnosis of Acute Rheumatic Fever?	44	44%
What is the frequency of prophylactic antibiotics for patients with Rheumatic Heart Disease	80	80%
What is the recommended duration of antibiotic prophylaxis in a patient with Rheumatic Heart Disease?	4	4%
What are the complications of Rheumatic Heart Disease?	61	61%
Which valve is most commonly involved in Rheumatic Heart Disease?	54	54%
One of the management modalities of Rheumatic Heart Disease involves surgery.	87	87%
Do primary health care workers have a role in the prevention of Acute Rheumatic Fever and Rheumatic Heart Disease?	100	100%

4.3.3 Attitudes towards Rheumatic Heart Disease and its Prevention

The findings from the assessment of clinicians' attitudes towards diagnosing and managing Group A Streptococcus and Acute Rheumatic Fever in Bomet County, Kenya, reveal several key perspectives. A significant majority (87.8%) agree that bacterial pharyngitis requires antibiotic treatment, and 95.9% would recommend consulting a doctor for sore throats. However, opinions are divided regarding the association between Rheumatic Heart Disease and low socioeconomic status, with only 45.9% agreeing. Most clinicians (78.6%) recognize that reducing overcrowding can lower the risk of sore throats, while 68.4% believe that Acute Rheumatic Fever and Rheumatic Heart Disease are underreported in Bomet County. Additionally, 75.5% support the need for sensitization on Rheumatic Heart Disease, and 91.9% recommend screening for the disease in children under 15 in high-risk areas. Cardiologist consultations for all Rheumatic Heart Disease patients are favored by 91.9% of respondents. Finally, 91.8% agree that home measures are inappropriate for managing sore throats. Overall, the average agreement with these statements is high, with 81% agreeing or strongly agreeing across all questions. The findings are presented below.

Table 1

Distribution of Clinicians' Responses - (Percentage of Agreement across Four Levels).

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
It is necessary to treat a bacterial pharyngitis with antibiotics	6 (6.1%)	6 (6.1%)	33 (33.7%)	53(54.1%)
You would recommend everyone with a sore throat to consult a doctor	2 (3.1%)	1(1.0%)	26(26.5%)	68(69.4%)
Rheumatic Heart Disease is associated with low-socioeconomic status	29(29.6%)	24(24.5%)	28(28.6%)	17(17.3%)
Reducing overcrowding reduces the risk of sore throat	10(10.2%)	11(11.2%)	45(45.9%)	32(32.7%)
Acute Rheumatic Fever and Rheumatic Heart Disease are underreported in Bomet County.	6(6.1%)	25(25.5%)	48(49.0%)	19(19.4%)
Sensitization on Rheumatic Heart Disease is appropriate in Bomet County	13(13.3%)	11(11.2%)	21(21.4%)	53(54.1%)
Echocardiography is recommended in a patient with Acute Rheumatic Fever	4(4.1%)	12(12.2%)	48(49.0%)	34(34.7%)
Screening for Rheumatic Heart Disease is recommended in all children <15years in high-risk areas	4(4.1%)	4(4.1%)	38(38.8%)	52(53.1%)
Cardiologist consultation is recommended in all patients with Rheumatic Heart Disease?	6(6.1%)	2(2.0%)	32(32.7%)	58(59.2%)
Home measures are inappropriate for the management of sore throat.	4(4.1%)	4(4.1%)	41(41.8%)	49(50.0%)
Average	9%	10%	37%	44%

All cadres are similarly inclined to recommend healthcare for someone with a sore throat. There is a lower likelihood across all cadres to ask a patient with a sore throat to

take a home prescription. The study revealed that clinicians in Bomet County strongly agreed on the importance of treating bacterial pharyngitis with antibiotics (median = 4.00, IQR = 1.00) and recommending medical consultation for sore throats (median = 4.00, IQR = 1.00), highlighting their awareness of early intervention in preventing complications like Acute Rheumatic Fever (ARF) and Rheumatic Heart Disease (RHD). Clinical officers and nursing officers are similarly likely to consider the diagnosis of ARF in a patient with monoarthritis. Nursing officers are slightly more likely to admit a patient with suspected ARF compared to clinical officers. Medical officers show a lower likelihood. Medical officers are more likely to request an echocardiogram for a patient with ARF, followed by clinical officers and nursing officers. Medical officers are the most likely to suspect RHD in a patient with a heart murmur.

Clinical officers also show a high likelihood, while nursing officers are somewhat lower. All cadres show similar tendencies to recommend secondary prophylaxis in patients with ARF or RHD, with clinical officers and nursing officers, and medical officers slightly higher. There was strong support for sensitization on RHD (median = 4.00, IQR = 1.00), screening for RHD in high-risk children under 15 years (median = 4.00, IQR = 1.00), and cardiologist consultations for RHD patients (median = 4.00, IQR = 1.00). Moderate agreement was observed on the role of reducing overcrowding in lowering sore throat risk (median = 3.00, IQR = 1.00), the underreporting of ARF and RHD in the county (median = 3.00, IQR = 1.00), and the recommendation of echocardiography for ARF patients (median = 3.00, IQR = 1.00).Clinical officers are slightly more likely to advocate for the establishment of an RHD registry in Bomet County, with nursing officers and medical officers reporting similar likelihoods. Nursing officers are the most likely to include RHD awareness in health campaigns, closely followed by medical officers and clinical officers.

Clinicians were divided on the association of RHD with low socioeconomic status (median = 2.00, IQR = 2.00) and moderately agreed that home measures are inappropriate for managing sore throats (median = 3.50, IQR = 1.00). Overall, the findings underscore strong support for medical and preventative measures for RHD, while highlighting variability in perspectives on certain socio-environmental and diagnostic factors.

Table 2

Summary of Clinicians' Attitudes – Medians with Interquartile range (IQR) and Modes with frequency

Statement	Median (IQR)	Mode (Frequency)
It is necessary to treat a bacterial pharyngitis with antibiotics	4.00(1.00)	4.00 (54.1%)
You would recommend everyone with a sore throat to consult a doctor	4.00(1.00)	4.00(69.4%)
Rheumatic Heart Disease is associated with low-socioeconomic status	2.00(2.00)	1.00(29.6%)
Reducing overcrowding reduces the risk of sore throat	3.00(1.00)	3.00(45.9%)
Acute Rheumatic Fever and Rheumatic Heart Disease are underreported in Bomet County.	3.00(1.00)	3.00(49.0%)
Sensitization on Rheumatic Heart Disease is appropriate in Bomet County	4.00(1.00)	4.00(54.1%)
Echocardiography is recommended in a patient with Acute Rheumatic Fever	3.00(1.00)	3.00(49.0%)
Screening for Rheumatic Heart Disease is recommended in all children <15years in high-risk areas	4.00(1.00)	4.00(53.1%)
Cardiologist consultation is recommended in all patients with Rheumatic Heart Disease?	4.00(1.00)	4.00(59.2%)
Home measures are inappropriate for the management of sore throat.	3.50(1.00)	4.00(50.0%)

4.4 Regression Analysis

The findings indicate that clinicians in peripheral facilities within Bomet County generally demonstrate proactive practices in managing Acute Rheumatic Fever (ARF) and Rheumatic Heart Disease (RHD). A significant proportion of clinicians (71%) are likely or very likely to consult a doctor when they have a sore throat, and 93% would encourage others with a sore throat to seek healthcare. However, only 38% would ask patients to take a home prescription, indicating caution in self-treatment recommendations. Regarding ARF management, 68% of clinicians are likely or very likely to consider ARF in a patient with monoarthritis, while 58% would admit a suspected ARF case. The use of echocardiograms in ARF management is widely supported, with 76% of clinicians likely or very likely to request one.

Moreover, clinicians are vigilant about RHD, with 92% likely or very likely to suspect RHD in patients with heart murmurs, and 88% would recommend secondary prophylaxis for ARF or RHD patients. There is also a strong inclination toward public health initiatives, with 87% of clinicians likely or very likely to include RHD awareness in health campaigns and 92% advocating for a RHD registry in Bomet County. Overall, the average likelihood of positive practices across all items was 76%, with 39% of responses in the "likely" category and 37% in the "very likely" category, indicating strong clinician engagement in ARF and RHD control efforts in the region.

Table 3

Likelihood of Various Clinical Actions Based on Survey Responses

Statement	Very Unlikely	Unlikely	Likely	Very Likely
How likely are you to consult a doctor when you have a sore throat?	7(7%)	20(20.4%)	43(43.9%)	27(27.6%)
How likely are you to ask someone with a sore throat to seek healthcare	2(2%)	4(4.1%)	49(50%)	43(43.9%)
How likely are you to ask a patient with a sore throat to take a home prescription?	26(26.5%)	35(35.7%)	21(21.4%)	16(16.3%)
How likely are you to consider the diagnosis of Acute Rheumatic Fever in a patient with monoarthritis?	6(6.1%)	25(25.5%)	43(43.9%)	24(24.5%)
How likely are you to admit a patient with suspected Acute Rheumatic Fever?	8(8.2%)	34(34.7%)	38(38.8%)	18(18.4%)
How likely are you to request an echocardiogram in a patient with Acute Rheumatic Fever?	9(9.2%)	14(14.3%)	46(46.9%)	29(29.6%)
How likely are you to suspect Rheumatic Heart Disease in a patient with a heart murmur?	4(4.1%)	4(4.1%)	51(52.0%)	3 9(39.8%)
How likely are you to recommend for secondary prophylaxis in a patient with Acute Rheumatic Fever or Rheumatic Heart Disease?	5(5.1%)	7(7.1%)	35(35.7%)	51(52.0%)
How likely are you to include the awareness of Rheumatic Heart Disease in your health campaign programs?	4(4.1%)	9(9.2%)	31(31.6%)	5 4(55.1%)
How likely are you to advocate for the establishment of a Rheumatic Heart Disease registry in Bomet County?	4(4.1%)	4(4.1%)	29(29.6%)	61(62.2%)
Average	8%	16%	39%	37%

Table 4

Summary of Clinicians' Likelihood to Engage in Specific Practices for the Management and Control of Acute Rheumatic Fever and Rheumatic Heart: Median with Interquartile range and modes with frequency

Statement	Median (IQR)	Mode (Frequency)
How likely are you to consult a doctor when you have a sore throat?	3.00(2.00)	3.00(43.9%)
How likely are you to ask someone with a sore throat to seek healthcare?	3.00(1.00)	3.00(50%)
How likely are you to ask a patient with a sore throat to take a home prescription?	2.00(2.00)	2.00(35.7%)
How likely are you to consider the diagnosis of Acute Rheumatic Fever in a patient with monoarthritis?	3.00(1.00)	3.00(43.9%)
How likely are you to admit a patient with suspected Acute Rheumatic Fever?	3.00(1.00)	3.00(38.8%)
How likely are you to request an echocardiogram in a patient with Acute Rheumatic Fever?	3.00(1.00)	3.00(46.9%)
How likely are you to suspect Rheumatic Heart Disease in a patient with a heart murmur?	3.00(1.00)	3.00(52.0%)
How likely are you to recommend for secondary prophylaxis in a patient with Acute Rheumatic Fever or Rheumatic Heart Disease?	4.00(1.00)	4.00(52.0%)
How likely are you to include the awareness of Rheumatic Heart Disease in your health campaign programs?	4.00(1.00)	4.00(55.1%)
How likely are you to advocate for the establishment of a Rheumatic Heart Disease registry in Bomet County?	4.00(1.00)	4.00(62.2%)

The table summarizes responses to various questions related to healthcare practices towards conditions like Acute Rheumatic Fever (ARF) and Rheumatic Heart Disease (RHD). In terms of experiential traits, generally all clinical service providers were noted to have a high likelihood of consulting a doctor for a sore throat: Median = 3 (IQR = 2), Mode = 3 (43.9%) as well as a high likelihood of asking someone with a sore throat to seek healthcare: Median = 3 (IQR = 1), Mode = 3 (50%).

Onto specific patient management practice, clinical service providers were noted to have a low likelihood of asking a patient with a sore throat to take a home prescription: Median = 2 (IQR = 2), Mode = 2 (35.7%). These include the use of ginger, warm salty water gurgles and herbal supplements.

In contrast, they were noted to have a moderate likelihood of considering ARF diagnosis in monoarthritis: Median = 3 (IQR = 1), Mode = 3 (43.9%) and to admit a patient with suspected ARF: Median = 3 (IQR = 1), Mode = 3 (38.8%). Moreover, they were also moderately likely to request an echocardiogram for patients with Acute Rheumatic Fever: Median = 3 (IQR = 1), Mode = 3 (46.9%).

In relation to awareness and advocacy, clinical service providers were not as likely to suspect Rheumatic Heart Disease in a patient with a heart murmur: Median = 3 (IQR = 1), Mode = 3 (52%) as they were to recommend secondary prophylaxis for ARF/RHD: Median = 4 (IQR = 1), Mode = 4 (52%). They were also highly likely to include Rheumatic Heart Disease awareness in health campaigns: Median = 4 (IQR = 1), Mode = 4 (55.1%) and advocate for a Rheumatic Heart Disease registry in Bomet County: Median = 4 (IQR = 1), Mode = 4 (62.2%).

Higher median and mode scores (3-4) indicate relatively strong agreement on healthcare awareness and advocacy actions. Variability (as seen in IQR) is low in most cases, suggesting consistency among respondents.

The findings indicate that knowledge of Acute Rheumatic Fever (ARF) varies significantly across demographic characteristics. Younger participants (20-30 years) and those aged 31-40 years show a higher proportion of good knowledge compared to older age groups. Female participants tend to have better knowledge than males, with 71.4% reporting good knowledge. Among healthcare cadres, clinical officers and nursing

officers demonstrate substantial good knowledge, while medical officers, though fewer, all reported good knowledge. Additionally, participants from Level 3 institutions exhibit the highest levels of good knowledge, followed by those from Level 2 and Level 4 institutions.

Table 7

Knowledge towards ARF by Demographic Characteristics

Participant characteristics		Knowledge towards ARF	
		Poor n (%)	Good n (%)
Age	20 – 30	14(14.3%)	18(18.4%)
	31 - 40	8(8.2%)	39(39.8%)
	41 – 50	4(4.1%)	7(7.1%)
	>51 years	2(2.0%)	6(6.1%)
Gender	Male	13(13.3%)	42(42.9%)
	Female	15(15.3%)	70(71.4%)
Cadre/Designation	Medical Officer	0(0.0%)	2(2.0%)
	Clinical Officer	0(0.0%)	26(26.5%)
	Nursing Officer	28(28.6%)	42(42.9%)
Institution	Level 2	19(19.4%)	26(26.5%)
	Level 3	6(6.1%)	31(31.6%)
	Level 4	3(3.1%)	13(13.3%)

The analysis reveals significant associations between knowledge of Acute Rheumatic Fever (ARF) and certain demographic characteristics. Participants aged 31-40 years are significantly more likely to have good knowledge compared to those aged 20-30 years, with both unadjusted (Un-OR 3.79, 95% CI 1.35-10.65, p=0.01) and adjusted odds ratios (AOR 3.80, 95% CI 1.07-13.44, p=0.04) showing strong associations. Gender analysis reveals that males are less likely to have good knowledge compared to females after adjustment (AOR 0.26, 95% CI 0.08-0.85, p=0.03). The results for cadre/designation

show that the likelihood of having good knowledge of ARF does not significantly differ between Clinical Officers, Nursing Officers, and Medical Officers after adjusting for other demographic characteristics. The wide confidence intervals and non-significant p-values suggest high variability and uncertainty, making it difficult to draw definitive conclusions about the impact of cadre/designation on ARF knowledge. This can be attributed to few observations in the medical officer cadre. Further research with a larger sample size might be needed to better understand the relationship between cadre/designation and knowledge of ARF. Regarding institution type, participants from Level 3 institutions initially appear more likely to have good knowledge (Un-OR 3.78, 95% CI 1.31-10.84, p=0.014), though this association is not significant after adjustment.

Table 8

Association between Knowledge towards ARF and Demographic characteristics

Participant characteristics		Un-OR 95% CI	Pvalue		AOR 95% CI	Pvalue	P value
Age	20 – 30	RC	RC	0.07	RC		0.09
	31 - 40	3.79 (1.35 to 10.65)	0.01*		3.80 (1.07 to 13.44)	0.04*	
	41 – 50	1.36 (0.33 to 5.59)	0.67		1.98 (0.39 to 10.10)	0.41	
	>51 years	2.33 (0.41 to 13.37)	0.34		4.95 (0.71 to 34.58)	0.11	
Gender	Female	RC	RC	0.22	RC		
	Male	0.58 (0.23 to 1.40)	0.224		0.26 (0.08 to 0.85)	0.03*	
Cadre	Medical Officer	RC		0.04*	RC		
	Clinical Officer	10.6 (0.17 to 58.32)	0.26		1.78(0.22 to 38.78)	0.21	
	Nursing Officer	0.30(0.01 to 6.44)	0.44		0.05(0.001 to 2.16)	0.46	
Institution	Level 2	RC	RC	0.02*	RC		
	Level 3	3.78 (1.31 to 10.84)	0.014*		2.40 (0.69 to 8.35)	0.17	
	Level 4	3.12 (0.79 to 12.69)	0.104		0.48 (0.07 to 3.10)	0.44	

The findings on attitudes toward Acute Rheumatic Fever (ARF) among clinicians in Chepalungu Sub County indicate a predominantly positive attitude across demographic characteristics. In terms of age, clinicians aged 31-40 years had the highest proportion of positive attitudes (47.9%), followed by those aged 20-30 years (31.6%), while participants over 51 years showed an 8.2% positive attitude, with no negative responses in older age groups. Gender analysis revealed that 55.1% of females and 43.9% of males expressed a positive attitude, with only 1% of females showing a negative attitude. Among the different cadres, nursing officers demonstrated the highest positive attitude (70.5%), followed by clinical officers (26.5%) and medical officers (2.0%). With respect to institutions, most positive attitudes were recorded at level 2 facilities (45.9%), followed by level 3 (36.8%), and level 4 (16.3%), with only one negative response noted at a level 3 facility. Overall, the majority of clinicians across all categories exhibited a positive attitude towards ARF management.

Table 9

Attitude towards ARF by Demographic characteristics

Participant characteristics		Attitude towards ARF	
		Positive n (%)	Negative n (%)
Age	20 – 30	31(31.6%)	1(1.0%)
	31 – 40	47(47.9%)	0(0.0%)
	41 – 50	11(11.2%)	0(0.0%)
	>51 years	8(8.2%)	0(0.0%)
Gender	Male	43(43.9%)	0(0.0%)
	Female	54(55.1%)	1(1.0%)
Cadre/Designation	Medical Officer	2(2.0%)	0(0.0%)
	Clinical Officer	26(26.5%)	0(0.0%)
	Nursing Officer	69(70.5%)	1(1.0%)
Institution	Level 2	45(45.9%)	0(0.0%)
	Level 3	36(36.8%)	1(1.0%)
	Level 4	16(16.3%)	0(0.0%)

The analysis of the association between attitudes toward Acute Rheumatic Fever (ARF) and demographic characteristics showed no statistically significant associations across all variables. Age did not significantly influence attitude, with those aged 31-40 years (AOR 3.0, 95% CI: 0.11 to 85.1, p = 0.52) and 41-50 years (AOR 1.29, 95% CI: 0.03 to 64.0, p = 0.90) showing no notable difference compared to the reference group (20-30 years). Gender analysis indicates that males were slightly more likely to have a positive attitude than females, but this was not statistically significant after adjustment (AOR 1.96, 95% CI 0.06–70.1, p=0.71).

Regarding cadre, clinical officers and nursing officers had higher odds of positive attitudes compared to medical officers, but the associations were not statistically significant (AOR 7.17 and 3.92, respectively). Regarding cadre, clinical officers and nursing officers had higher odds of positive attitudes compared to medical officers, but the associations were not statistically significant (AOR 7.17 and 3.92, respectively). Lastly, the type of institution (level 3 and level 4 facilities) did not show a significant association with attitude compared to level 2 facilities (AOR 0.19 and 0.24, respectively). Overall, none of the demographic characteristics were found to have a statistically significant impact on clinicians' attitudes towards ARF.

Table 10

Association between Attitude towards ARF and Demographic characteristics

Participant characteristics		Un-OR 95% CI	Pvalue		AOR 95% CI	Pvalue	P value
Age	20 – 30	RC	RC	0.80	RC		0.97
	31 - 40	4.5 (0.18 to 114.6)	0.36		3.0 (0.11 to 85.1)	0.52	
	41 – 50	1.1 (0.04 to 28.8)	0.96		1.29 (0.03 to 64.0)	0.90	
	>51 years	0.81 (0.03 to 21.7)	0.90		1.25 (0.04 to 43.3)	0.90	
Gender	Female	RC	RC	0.60	RC		
	Male	2.39 (0.09 to 60.2)	0.60		1.96 (0.06 to 70.1)	0.71	
Cadre/Designation	Medical Officer	RC		0.41	RC		
	Clinical Officer	10.6 (0.17 to 658.3)	0.26		7.17(0.00 to 19.4)	0.63	
	Nursing Officer	9.27(0.30 to 289.1)	0.21		3.92(0.01 to 10.7)	0.63	
Institution	Level 2	RC	RC	0.73	RC		
	Level 3	0.27 (0.01 to 6.76)	0.42*		0.19 (0.01 to 5.56)	0.33	
	Level 4	0.36 (0.01 to 19.0)	0.62		0.24 (0.00 to 17.4)	0.51	

The findings on practices towards Acute Rheumatic Fever (ARF) among clinicians in Chepalungu Sub County revealed that most participants demonstrated good practices across all demographic groups. In terms of age, those aged 31-40 years had the highest proportion of good practices (47.9%), followed by those aged 20-30 years (31.6%). Minimal poor practices were observed, with only one individual each in the 20-30 and 41-50 age groups reporting poor practices. Gender-wise, 55.1% of females and 42.9% of males demonstrated good practices, with only one poor practice recorded for each

gender. Nursing officers showed the highest proportion of good practices (69.4%), followed by clinical officers (26.6%) and medical officers (2.0%), with only two nursing officers reporting poor practices. Across institutions, clinicians from level 2 facilities had the highest proportion of good practices (44.9%), followed by those in level 3 (36.7%) and level 4 (16.3%), with only one poor practice each reported from level 2 and level 3 facilities. Overall, good practices towards ARF were prevalent among clinicians across all demographic groups.

Table 1

Practices towards ARF by Demographic characteristics

Participant characteristics		Practices towards ARF	
		Good n (%)	Poor n (%)
Age	20 – 30	31(31.6%)	1(1.0%)
	31 – 40	47(47.9%)	0(0.0%)
	41 – 50	10(10.2%)	1(1.0%)
	>51 years	8(8.2%)	0(0.0%)
Gender	Male	42(42.9%)	1(1.0%)
	Female	54(55.1%)	1(1.0%)
Cadre/Designation	Medical Officer	2(2.0%)	0(0.0%)
	Clinical Officer	26(26.6%)	0(0.0%)
	Nursing Officer	68(69.4%)	2(2.0%)
Institution	Level 2	44(44.9%)	1(1.0%)
	Level 3	36(36.7%)	1(1.0%)
	Level 4	16(16.3%)	0(0.0%)

The analysis of the association between practices towards Acute Rheumatic Fever (ARF) and demographic characteristics showed no statistically significant relationships. Age was not significantly associated with practices, with those aged 31-40 years showing

higher odds of good practices compared to the reference group (20-30 years), but the association was not significant (AOR 2.97, 95% CI: 0.14 to 64.0, p = 0.49). Similarly, clinicians aged 41-50 and over 51 years did not show a significant difference in practices compared to younger clinicians (AOR 0.39 and 1.24, respectively). Gender also did not influence ARF practices, with males showing no significant difference from females (AOR 0.68, 95% CI: 0.08 to 5.66, p = 0.72).

Among cadres, clinical officers and nursing officers demonstrated higher odds of good practices compared to medical officers, but these were not statistically significant (AOR 3.47 and 2.12, respectively). Regarding institution type, clinicians in level 3 and level 4 facilities did not differ significantly in their practices compared to those in level 2 facilities (AOR 0.49 and 0.44, respectively). Overall, no significant associations were observed between demographic characteristics and practices towards ARF.

Table 12

Association between Attitude towards ARF and Demographic characteristics

Participant characteristics		Un-OR 95% CI	Pvalue		AOR 95% CI	Pvalue	P value
Age	20 – 30	RC	RC	0.46	RC		0.94
	31 – 40	1.51 (-1.72 to 4.74)	0.36		2.97 (0.14 to 64.0)	0.49	
	41 – 50	-1.10 (-3.45 to 1.27)	0.36		0.39 (0.04 to 3.70)	0.41	
	>51 years	-0.21 (-3.50 to 3.08)	0.90		1.24 (0.05 to 34.08)	0.90	
Gender	Female	RC	RC	0.83	RC		
	Male	-0.25 (-2.54 to 2.05)	0.83		0.68 (0.08 to 5.66)	0.72	
Cadre/Designation	Medical Officer	RC		0.50	RC		
	Clinical Officer	2.36 (-1.77 to 6.49)	0.26		3.47(0.04 to 40.17)	0.60	
	Nursing Officer	1.70(-1.59 to 4.99)	0.31		2.12 (0.02 to 23.86)	0.75	
Institution	Level 2	RC	RC	0.98	RC		
	Level 3	-0.20 (-2.50 to 2.11)	0.87		0.49 (0.05 to 4.85)	0.54	
	Level 4	0.11 (-3.14 to 3.36)	0.95		0.44 (0.01 to 15.13)	0.65	

The analysis of the association between knowledge and attitude towards Acute Rheumatic Fever (ARF) showed no statistically significant relationship. Among participants with poor knowledge, 27 (96.4%) had a positive attitude towards ARF, while 1 (3.6%) had a negative attitude. Similarly, all 70 participants with good knowledge demonstrated a positive attitude. The chi-square test indicated no significant association between knowledge and attitude ($\chi^2 = 2.526$, $p = 0.112$). This suggests that knowledge level does not have a significant impact on clinicians' attitudes towards ARF in this study population.

Table 13

Association between Knowledge and attitude Towards RHD Prevention

Variable	Attitude - Negative n (%)	Attitude - Positive (%)	N	Chi square statistic (df)	P-value
Knowledge - poor	1	27	28	2.526	0.112
Knowledge – Good	0	70	70		

The analysis of the association between knowledge and practices towards Acute Rheumatic Fever (ARF) revealed a statistically significant relationship. Among participants with poor knowledge, 26 (92.9%) demonstrated good practices, while 2 (7.1%) showed poor practices. In contrast, all 70 participants with good knowledge exhibited good practices, with no reports of poor practices. The chi-square test indicated a significant association between knowledge and practices ($\chi^2 = 5.104$, $p = 0.024$), suggesting that better knowledge is linked to better practices towards ARF among clinicians in this study population.

Table 14

Association between Knowledge and Practices towards RHD prevention

Variable	Practices - Poor n (%)	Practices - Good (%)	n	Chi square statistic (df)	P-value
Knowledge – Poor	2	26	28	5.104	0.024*
Knowledge – Good	0	70	70		

The analysis of the association between attitude and practices towards Acute Rheumatic Fever (ARF) revealed a highly significant relationship. Among participants with a negative attitude, 1 (100%) exhibited poor practices, while no good practices were observed. In contrast, among those with a positive attitude, 96 (99%) demonstrated good practices, with only 1 (1%) showing poor practices. The chi-square test showed a strong and statistically significant association between attitude and practices ($\chi^2 = 48.49$, $p < 0.001$), indicating that a positive attitude is closely linked to better practices towards ARF among clinicians.

Table 15

Association between Attitude and Practices towards RHD prevention

Variable	Practices - Poor n (%)	Practices - Good (%)	N	Chi square statistic (df)	P-value
Attitude – Negative	1	0	1	48.49	0.000*
Attitude – Positive	1	96	97		

The study hypothesis stated that clinicians with adequate knowledge and a positive attitude towards Rheumatic Heart Disease prevention demonstrate better preventive practices. The results analyzed above show a statistically significant association between knowledge and practice (p = 0.024, CI 95%), and between attitude and practice (p = <0.001, CI 95%). This therefore supports the study hypothesis that good knowledge and good attitude leads to good practices in Rheumatic Heart Disease prevention.

CHAPTER FIVE

SUMAMRY, CONCLUSIONS AND RECCOMENDATIONS

5.1 Introduction

The study examines the knowledge, attitudes, and practices (KAP) of healthcare professionals in Bomet County, Kenya, regarding Acute Rheumatic Fever (ARF) and Rheumatic Heart Disease (RHD).

5.2 Summary of the Findings

5.2.1 Demographics and Experience

The study included a diverse group of healthcare professionals, predominantly nursing officers (71%), with clinical officers (27%) and medical officers (2%) also represented. This distribution reflects the typical staffing pattern in many low and middle-income countries, where nurses form the backbone of the healthcare system. The majority of participants worked in Level 2 and Level 3 healthcare institutions, which are typically primary and secondary care facilities.

The high percentage of clinicians who have encountered cases of acute pharyngitis (84%) and ARF (74%) indicates that these conditions are common in the region. A study evaluating the prevalence of GAS pharyngeal carriers among school going children in Bomet County was at 9.5% (Murugami, 2021). This prevalence underscores the importance of proper knowledge and management practices among healthcare workers.

5.2.2 Knowledge of ARF and RHD

The study revealed varying levels of knowledge across different aspects of ARF and RHD. There was generally good knowledge about the causative agent of ARF (Group A Streptococcus) and the appropriate treatment (Benzathine penicillin G). However, significant knowledge gaps were identified, particularly in diagnostic criteria (only 44%

knew the Jones criteria) and the recommended duration of antibiotic prophylaxis (only 4% knew the correct duration). There was also notable poor knowledge of the diagnostic tests for bacterial pharyngitis (1.4%). Medical officers consistently demonstrated the highest level of knowledge, followed by clinical officers and then nursing officers. Participants aged 31-40 years were significantly more likely to have good knowledge compared to those aged 20-30 years. Males were less likely to have good knowledge compared to females after adjustment. The impact of cadre/designation on ARF knowledge was inconclusive due to small sample sizes in some categories.

This pattern is expected given the differences in training and specialization among these groups and they highlight the need for targeted educational interventions, especially for nursing officers who form the majority of the healthcare workforce but showed lower levels of knowledge in some areas. In comparison to other studies assessing Knowledge of Rheumatic Heart Disease, this study showed a good level of knowledge across all cadres of the spectrum of Rheumatic Heart Disease. A study assessing knowledge among cardiac nurses showed 48% of them had good knowledge (Techane et al., 2022). A study among doctors in Sudan showed average knowledge prior to an educational intervention which improved to good knowledge after the education intervention.

5.2.3 Attitudes towards ARF and RHD

Overall, the healthcare professionals demonstrated positive attitudes towards the management and prevention of ARF and RHD. There were no statistically significant associations found between demographic characteristics and attitudes towards ARF. There was strong agreement on the necessity of treating bacterial pharyngitis with antibiotics and recommending doctor consultations for sore throats. Most clinicians recognized the importance of echocardiography in ARF patients and the need for

cardiologist consultations in RHD cases. There was less consensus on the association between RHD and low socioeconomic status, with medical officers showing stronger agreement compared to other cadres. The higher standard deviation suggests considerable variability in responses, reflecting differing perceptions or experiences among clinicians regarding the socioeconomic factors influencing RHD. This shows the need to sensitize health care workers on these pertinent issues to form part of patient education. These attitudes suggest a good foundation for implementing ARF and RHD control programs, but also indicate areas where further education might be beneficial. There were notable varied responses across cadres on the need for reporting of RHD cases within the County. This indicates that while there is some recognition of under-reporting, a significant proportion of clinicians either do not strongly perceive this as a problem or are uncertain about the extent of underreporting.

The Nkoke et al, 2020 study showed 89.6% of the participants had more awareness towards Rheumatic Heart Disease prevention. On the other hand, Tellawy et al, 2021 showed poor attitude towards Rheumatic Heart Disease prevention among the parents who were the study participants. The good attitude noted in this study could be due to more awareness being made regionally and in the country on Rheumatic Heart Disease and majority of the clinicians who took part in the study were receptive to information on the same. There was a notable percentage of clinicians who could not correlate low socioeconomic status and overcrowding to Rheumatic Heart Disease incidences. There is a need to integrate social determinants of health into everyday health conversations and practice to improve health access and patient care.

5.2.4 Practices Related to ARF and RHD

The study revealed generally positive practices among healthcare professionals. There were no statistically significant associations found between demographic characteristics and attitudes towards ARF. Most clinicians reported being likely or very likely to suspect RHD in patients with heart murmurs and to recommend secondary prophylaxis for ARF or RHD patients. There was strong support for public health initiatives, with high percentages of clinicians likely to include RHD awareness in health campaigns and advocate for an RHD registry. These findings indicate a shared commitment among clinicians in Bomet County to ARF and RHD control, though the degree of engagement varies by cadre. Medical officers, despite their smaller numbers, tend to exhibit a higher likelihood in more specialized areas like requesting echocardiograms and suspecting RHD in patients with heart murmurs, while nursing and clinical officers show more uniform engagement in general practices. However, there were some concerning practices, such as a significant proportion of clinicians (38%) who would ask patients to take home remedies for sore throats, which could lead to inappropriate and delayed treatment of bacterial pharyngitis if present.

The overall good practices are supported by the Nkoke et al, 2020 study among medical students in Cameroon that showed the students had good practices whereas a study among primary health care workers by Isezuo et al, 2023 showed inadequate practice as those sampled did not have the requisite diagnostic expertise. This disparity is noted in this study as well with medical and clinical officers notably having good practices possibly because they have been taught about bacterial pharyngitis and its complications and are thus keen to offer the right treatment. In support of the poor use of antibiotics was the study by Tellawy et al, 2021 that showed that 15.5% of parents would give their children salty water and herbal medications to treat sore throat. Isezuo et al, 2023

showed the study participants had a higher propensity to prescribe antibiotics without differentiating viral from bacterial pharyngitis. The high percentage of clinicians recommending home remedies in this study could possibly stem from prescriber hesitancy arising from increasing antimicrobial resistance as well as patient non-compliance to medications. There is need to educate the clinical service providers to know that most sore throats arise from viruses. There is need to differentiate between bacterial and viral sore throat infections in order to guide antibiotic management. In this setting where diagnostic kits are not readily available, clinical service providers should be encouraged to use clinical predictive tools to inform antibiotic use.

5.2.5 Associations between Knowledge, Attitude, and Practices

There was no significant association was found between knowledge and attitude towards ARF. However, a significant association was found between knowledge and practices, suggesting that better knowledge is linked to better practices. There was also a strong and statistically significant association was found between attitude and practices, indicating that a positive attitude is closely linked to better practices.

5.3 Conclusions

In conclusion, while the study reveals generally positive attitudes and practices towards ARF and RHD management among healthcare professionals in Bomet County, it also highlights significant knowledge gaps, particularly among nursing officers. These findings underscore the need for continued medical education and the potential benefit of establishing standardized protocols for ARF and RHD management across all levels of healthcare facilities. The strong support for public health initiatives suggests that healthcare professionals would be receptive to such interventions.

The study findings showed statistically significant associations between knowledge and practice and attitude and practice. This therefore supported the study hypothesis that clinicians with adequate knowledge and a positive attitude towards Rheumatic Heart Disease prevention demonstrate better preventive practices.

5.4 Recommendations

5.4.1 Recommendations for Policy

There is need for targeted education programs for clinicians, these should be developed and implemented to improve the knowledge of GAS, ARF and RHD. These can be supplemented with comprehensive periodic training across all cadres to ensure consistent knowledge and practices regarding GAS, ARF and RHD diagnosis and management.

In addition, implementation of ongoing professional development programs to keep clinicians updated on the latest GAS, ARF and RHD management guidelines and best practices would improve knowledge levels across cadres on Rheumatic Heart Disease. These management guidelines ought to be availed in either soft or hard copies in all health facilities in the County for ease of access. The use of predictive diagnostic tools like Centor Score and Fever Pain Score should also be encouraged to help in making the right diagnosis and guiding treatment for bacterial pharyngitis. There ought to be consideration to extend the education efforts to the community to improve overall awareness and early detection of GAS and ARF cases.

Furthermore, a national and local programmatic strategy aimed at advocating for Rheumatic Heart Disease is necessary. This would entail resource allocation with periodic monitoring and evaluation of key performance indicators to track progress within the sub county, county and nationally. Just like malaria programs target malaria endemic zones, this can also be set to target regions with high Rheumatic Heart Disease burden in the country. This would also encourage to further studies within the country to

assess regional prevalence and seasonal influences with this. Down the line this could create an opportunity for advocacy especially for the minority groups affected by Rheumatic Heart Disease. These include women who are pregnant or in the reproductive age and are at risk of, or already suffer from Rheumatic Heart Disease.

5.4.2 Recommendations for Further Research

To add on to that, there ought to be strategies developed to better integrate knowledge into practice, given the significant association between knowledge and practices. This can be done through routine support supervisions targeting Rheumatic Heart Disease to ensure uniformity in practice.

There is also need for interdisciplinary and multi stakeholder collaboration to enhance surveillance strategies that would improve diagnosis, management and treatment of GAS, ARF and RHD. This can include availability of diagnostic test kits especially in peripheral facilities to help guide use of antibiotics. This will ultimately reduce misuse of antibiotics while ensuring adequate treatment for bacterial pharyngitis.

Finally, extensive studies with larger sample sizes, involving more healthcare workers of different cadres as well as multiple counties are required to make the study more generalizable.

These recommendations aim to address the gaps identified in the study and strengthen the overall management of Group A Streptococcus, Acute Rheumatic Fever and Rheumatic Heart Disease among clinicians in Chepalungu Sub County.

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APPENDICES

Appendix 1: Consent/Assent Form for Participation in the Study

Identification Number: …….

Principal Investigator: Dr. Annette Marcella Onyango
Address: Tenwek Mission Hospital. Family Medicine Department.

Introduction (This will be done by the researcher/research assistant)

I am a health worker currently stationed at Tenwek Mission Hospital. I am conducting a study to evaluate the knowledge, attitude and practices of clinicians towards ***Rheumatic Heart Disease*** prevention in Chepalungu Sub County health facilities.

If you agree to participate in the research study, you will be asked to fill in a questionnaire. Your name will not be recorded in the questionnaire. Participation in the study is voluntary. The information you give will be treated as confidential. Filling of the questionnaire will not take more than 15 minutes.

Possible risks of the study

We do not anticipate any risks to you during your participation in this study. You are free to decide if you want to participate in the study or not.

Confidentiality

The information we collect will be kept confidential. The research reports and publications will not reveal your identity.

Compensation

We will not be able to provide you with any payment or gift for being in this research, but we will appreciate your participation.

Participant's Agreement

I agree to be a participant in this study to evaluate knowledge, attitude and practices of clinicians toward Rheumatic Heart Disease prevention.

Signature of participant/guardian or thumb print

Date _____/_____/

I certify that I have explained the nature and purpose of the study to the participant whose study Identification number is

Signature and name of person obtaining consent

Appendix II : Questionnaire

Section 1: Demographic Information

1) Last three digits of phone number

2) Age (years)

- 20-30
- 31-40
- 41-50
- >51

8) Gender

a) Male

b) Female

3) Cadre:

a) Nursing Officer

b) Clinical Officer

c) Medical Officer

6) Institution:

a. Level 4 Hospital

b. Level 3 Hospital

c. Level 2 Hospital

Section 2: Knowledge on Rheumatic Heart Disease

1. Have you ever seen a patient with acute bacterial pharyngitis?

a) Yes

b) No

c) Don't know

20. Have you ever seen a patient with Acute Rheumatic Fever?

a) Yes

b) No

c) Don't know

21. What causes Rheumatic Heart Disease?

a. Age

b. Scarlet fever

c. Acute Rheumatic Fever

d. Not applicable

22. Which germ causes sore throat that can lead to heart disease?

a. Viruses

b. Staphylococcus aureus

c. Group A Streptococcus

d. Group B Streptococcus

23. What tests can we use to diagnose the presence of bacterial pharyngitis?

a. Rapid Antigen test kits

b. Throat swab cultures

c. PCR tests

d. All of the above

24. Which modalities can show evidence of preceding *Streptococcus* infection in Acute Rheumatic Fever diagnosis

a. Increasing anti-streptolysintitres

b. A positive throat culture for GABH streptococci

c. A positive rapid group A streptococcal carbohydrate antigen test

d. All the above

25. Which treatment is appropriate for a sore throat to prevent Acute Rheumatic Fever and Rheumatic Heart Disease?

a. Benzathine penicillin G

b. Vancomycin

c. Azithromycin

d. Acyclovir

26. Rheumatic Heart Disease can occur without prior evident Acute Rheumatic Fever.

a. Yes

b. No

c. Not applicable

27. Carditis in Acute Rheumatic Fever is treated with?

a. NSAID

b. Bedrest

c. Corticosteroid

d. Benzathine Penicillin

2. How many elements of the Jones criteria are used for the diagnosis of Acute Rheumatic Fever?

a. 5 major, 5 minor

b. 5 major, 3minor

c. 2 major or 1 major, 2minor

d. 4 major, 1 minor

21. What is the frequency of prophylactic antibiotics for patients with Rheumatic Heart Disease

a. 4 weekly

b. 3 monthly

c. 6 monthly

d. Not applicable

22. What is the recommended duration of antibiotic prophylaxis in a patient with Rheumatic Heart Disease?

……

…….....

……

23. What are the complications of Rheumatic Heart Disease?

a. Stroke, atrial fibrillation, heart failure

b. Deep venous thrombosis, infective endocarditis, renal failure

c. All the above

24. Which valve is most commonly involved in Rheumatic Heart Disease?

a. Tricuspid

b. Aortic

c. Mitral

d. Pulmonic

25. One of the management modalities of Rheumatic Heart Disease involves surgery.

a. Yes

b. No

26. Do primary health care workers have a role in the prevention of Acute Rheumatic Fever and Rheumatic Heart Disease?
    a. Yes
    b. No
27. What treatment guidelines do you have access to?
    a. Kenya National Guidelines for Cardiovascular Diseases Management
    b. UptoDate
    c. All of the above
    d. None of the above
28. Do you have a Rheumatic Heart Disease Register in your facility?
    a. Yes
    b. No

Section 3: Attitudes Towards Rheumatic Heart Disease and its Prevention

1. It is necessary to treat a bacterial pharyngitis with antibiotics
   A-Strongly disagree B-Disagree C-Agree D-Strongly agree
2. You would recommend everyone with a sore throat to consult a doctor
   A-Strongly disagree B-Disagree C-Agree D-Strongly agree
3. Rheumatic Heart Disease is associated with low-socioeconomic status
   Strongly disagree B-Disagree C-Agree D-Strongly agree
4. Reducing overcrowding reduces the risk of sore throat
   A-Strongly disagree B-Disagree C-Agree D-Strongly agree
5. Acute Rheumatic Fever and Rheumatic Heart Disease are underreported in Bomet County.
   A-Strongly disagree B-Disagree C-Agree D-Strongly agree
6. Sensitization on Rheumatic Heart Disease is appropriate in Bomet County
   A-Strongly disagree B-Disagree C-Agree D-Strongly agree
7. Echocardiography is recommended in a patient with Acute Rheumatic Feve
   A-Strongly disagree B-Disagree C-Agree D-Strongly agree
8. Screening for Rheumatic Heart Disease is recommended in all children <15years in high-risk areas

A-Strongly disagree B-Disagree C-Agree D-Strongly agree

9. Cardiologist consultation is recommended in all patients with Rheumatic Heart Disease?

   A-Strongly disagree B-Disagree C-Agree D-Strongly agree

10. Home remedies are inappropriate for the management of bacterial pharyngitis

    A-Strongly disagree B-Disagree C- Agree D-Strongly agree

Section 4: Practices Towards Rheumatic Heart Disease and its prevention

1. How likely are you to consult a doctor when you have a sore throat?

   A-Very Unlikely B-Unlikely C-Likely D-Very Likely

2. How likely are you to ask someone with a sore throat to seek healthcare?

   A-Very Unlikely B-Unlikely C-Likely D-Very Likely

3. How likely are you to ask a patient with bacterial pharyngitis to take home remedies?

   A-Very Unlikely B-Unlikely C-Likely D-Very Likely

Give reasons for your answers

……..

……

……

……

1. How likely are you to consider the diagnosis of Acute Rheumatic Fever in a patient with monoarthritis?
   A-Very Unlikely B-Unlikely C-Likely D-Very Likely
2. How likely are you to admit a patient with suspected Acute Rheumatic Fever?
   A-Very Unlikely B-Unlikely C-Likely D-Very Likely
3. How likely are you to request an echocardiogram in a patient with Acute Rheumatic Fever?
   A-Very Unlikely B-Unlikely C-Likely D-Very Likely
4. How likely are you to suspect Rheumatic Heart Disease in a patient with a heart murmur?

A-Very Unlikely B-Unlikely C-Likely D-Very Likely

5. How likely are you to recommend for secondary prophylaxis in a patient with Acute Rheumatic Fever or Rheumatic Heart Disease?

   A-Very Unlikely B-Unlikely C-Likely D-Very Likely

6. How likely are you to include the awareness of Rheumatic Heart Disease in your health campaign programs?

   A-Very Unlikely B-Unlikely C-Likely D-Very Likely

7. How likely are you to advocate for the establishment of a Rheumatic Heart Disease registry in Bomet County?

   A-Very Unlikely B-Unlikely C-Likely D-Very Likely

Appendix III : ISERC Approval Permit

AGC TENWEK HOSPITAL
A Ministry of Africa Gospel Church

Postal Address:
P.O Box 39-20400
Bomet-Kenya

Telephone: (254) 728-091900, 20-2045542
E-mail: info@tenwekhosp.org
Website: www.tenwekhospital.org

23rd May, 2024

Dear Dr. Annette Onyango,

Re: "Protocol 2024-0012; Clinician's Knowledge, Attitude and Practice in Prevention of Rheumatic Heart Disease in Bomet County, Kenya."

This is to inform you that the Tenwek Hospital ISERC Committee has reviewed application documents and approved your study with a recommendation that you delete the word prospective on page 7 section 1.3. The approval period is from **23rd May 2024 – 22nd May 2025.**

This approval is subject to compliance with the following requirements.

i. Only approved documents including informed consent, proposal, and study instruments to be used.
ii. All changes including amendments, deviations, and violations are submitted for review and approval by the Tenwek Hospital ISERC.
iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to the Tenwek Hospital ISERC within 72 hours of notification.
iv. Any changes anticipated or otherwise that may increase the risks or affect the safety or welfare of study participants and others or affect the integrity of the research must be reported to the Tenwek Hospital ISERC within 72 hours.
v. Clearance for export of biological specimens must be obtained from relevant institutions if applicable.
vi. Submission of a request for renewal of approval at least 60 days prior to the expiry of the approval period. Fill out an annual renewal form from the website and attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days upon completion of the study to the Tenwek Hospital ISERC.

Prior to commencing your study, you will be expected to obtain a research license from the National Commission for Science, Technology, and Innovation (NACOSTI) https://research-portal.nacosti.go.ke and any other relevant clearances needed.

This ethical approval requires that the study includes an investigator affiliated with Tenwek Hospital, with their affiliation listed as Tenwek Hospital on any subsequent presentations or publications related to the project.

If any of these conditions are not met, the investigator does not have ethical approval from this Committee.

Sincerely,

TENWEK HOSPITAL
ISERC CHAIR
23 MAY 2024
P. O. Box 39-20400
BOMET

Dr. Miriam Wanjala
ISERC Chairperson on behalf of the ISERC Committee.

Appendix IV: NACOSTI Research Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **671782**

Date of Issue: **01/June/2024**

RESEARCH LICENSE

This is to Certify that Dr.. ANNETTE MARCELLA ONYANGO of Kabarak University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Bomet on the topic: Clinician's Knowledge, Attitude and Practices Towards Prevention of Rheumatic Heart Disease for the period ending : 01/June/2025.

License No: **NACOSTI/P/24/36464**

671782

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

See overleaf for conditions

Appendix V: Evidence of Conference Participation

AGC TENWEK HOSPITAL

Jesus Heals

THIS CERTIFIES THAT

ANNETTE AKINYI

had a poster accepted and successfully participated in the poster competition at AGC Tenwek Hospital

November 14, 2024

Dino Crognale
Director of Medical Services

Andrea S Parker
Head of Medical Education and Research

Appendix VI: Acceptance Letter

JOURNAL OF CLINICAL CARE AND MEDICAL ADVANCEMENT

17th December 2024

To:
Annette Marcella Akinyi, Jonathan Nthula Nthusi, and Jonathan Steen

Corresponding Author: marcellaannette@gmail.com

Dear Authors,

SUBJECT: MANUSCRIPT ACCEPTANCE

We are pleased to inform you that your manuscript titled **"Clinicians' Knowledge, Attitude and Practice Towards Rheumatic Heart Disease Prevention in Bomet County, Kenya"** has been accepted for publication in the Journal of Clinical Care and Medical Advancement.

The manuscript has undergone a thorough peer-review process, and we commend the quality of your work and its relevance to the field of clinical care. The final version will be processed for publication, and further correspondence regarding copyediting, proofing, and publication timelines will follow shortly.

Congratulations on your achievement, and we look forward to sharing your valuable contribution with our readers.

Should you have any questions, feel free to contact us at info@mjmbiolabs.com

Sincerely,

j.wambani
Japheth W. Rapando, PhD
Editor-in-Chief

Website: www.mjmbiolabs.com; Email Address: info@mjmbiolabs.com; Tel: +254-705-435438