The household economic impact of Rheumatic Heart Disease (RHD) in South Africa

By

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PREAMBLE

I. DECLARATION

I, Oyebamiji Oyeleke, hereby declare that the work on which this dissertation/thesis is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university.

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II. THESIS ABSTRACT

***Background*:** Rheumatic heart disease (RHD) remains a major public health concern in African countries due to the high rates of complications such as atrial fibrillation, stroke, infective endocarditis, and heart failure, all of which can result in premature death. In 2015, RHD was estimated to affect 33 million people globally and resulted in at least 320,000 deaths, nearly all of which were in low and middle-income countries. Comparing to other non-communicable diseases (NCDs), RHD imposes economic burden on households that if measures are not in place to mitigate this, it can impoverish such household. However, there are several literatures on the intergenerational economic consequences of other chronic diseases. But, there is no study regarding the household economic of RHD. This mini-dissertation sets out to estimate the household economic impact of RHD.

***Methods*:** This study was a follow-on study from the Global Rheumatic Heart Disease Registry (REMEDY), which was a multi-center, international, hospital-based prospective registry of patients with RHD. It was designed as a cohort study to document the disease characteristics and outcomes of individuals with RHD across many countries. We recruited participants in the REMEDY study who were resident in Cape Town and received care at Groote Schuur Hospital (GSH). This study made use of patient and household member surveys to estimate the economic consequences of RHD among households in which REMEDY participants reside. REMEDY registry participants (index cases), their caregivers, and other household members were considered as respondents. 100 REMEDY participants receiving care at GSH was sampled. This sample size was chosen to balance feasibility and precision and to align with a parallel study of the cost of RHD to the health system that aimed to sample medical records from the same 100 REMEDY participants. Patient and household data collection was carried out between September 2017 to December 2017. Direct costs, indirect costs, and the downstream economic behaviors (coping strategies) that lead to medical impoverishment and other consequences were estimated. Cost of illness (COI) was used to assess the effect of ill-health and health-related expenditure on the consumption possibilities of households. Direct costs comprise both medical and non-medical costs, which may include both the financial cost of resources as well as opportunity costs (e.g., of capital items). Human capital approach was used to calculate indirect cost. Implicit in the human capital approach is the assumption that changes in health status of household members can be reflected by losses in productivity, and losses in income generation.

Productivity losses was estimated using the new South Africa minimum wage rate per month as proxy. Coping was estimated with the direct costs (e.g., borrowing from friends or relatives, or taking out formal loans) or indirect costs (e.g., intra-household labor substitution) and can be cost prevention strategies (e.g., ignoring illness, non-treatment) to cost management strategies (e.g., borrowing, selling assets, or labor substitution). Economic costs were valued in United State dollar (USD) converted from South African rand (ZAR) in 2017.

Results: Direct medical cost was estimated to ZAR 0, because all patients were exempt from medical fees. Total direct non-medical cost for outpatient and inpatient visits was estimated to be ZAR 27,000 (USD 2000) and 29,000 (USD 2200) (respectively) over 302 and 74 encounters (respectively), an average of ZAR 270 (USD 20) and ZAR 290 (USD 22) per patient (respectively). Indirect costs incurred over the 302 outpatient encounters and 74 hospital admissions were estimated to be ZAR 41,000 (USD 3100) and ZAR 26,000 (USD 1900) (respectively), an average of ZAR 410 (USD 31) and ZAR 260 (USD 19) per patient. Direct cost had a very high impact on the household and they were compelled to adopt coping. Households observed in the study recorded that seventeen percent of households took out loans at an average of ZAR 1200 (USD 91) per loan (range ZAR 100 to ZAR 7000) (range USD 7 to 500). Fifteen percent received financial gifts at an average of ZAR 800 (USD 61) per gift. Two percent sold assets valued at ZAR 5600 (USD 120) on average. Five percent engaged in multiple coping strategies. Also, HH had to cope with indirect cost of illness as 15% of household caregivers changed jobs and 10% worked extra hours. About 4% of household members dropped out of school. Four percent adopted more than one coping strategy. A considerable share of participants reported that they had reduced education to take care of the affected patient. Most of the caregivers of patients with RHD were spouses and children, and 6 % were heads of household. The total cost of RHD to the average affected household is valued at about ZAR 1600 annually. In total, the overall annual economic impact of RHD in this sample of 100 households affected by RHD was estimated at ZAR 160,000 (USD 12200) (ZAR 1600 per household) (USD 120), representing 4.4% of annual household income or 4.9% of annual household expenditure patient spending that exceeded 10% threshold was estimated to be 8% and increasing the threshold to 40 % of non- food expenditure reduced the prevalence of catastrophic spending to 4%.

***Conclusions*:** The economic impact of RHD in South Africa is substantial despite government efforts to provide free care. The total cost of RHD to the average affected household is valued at about ZAR 1600 annually. A broader and more robust range of social policies will be required to mitigate non-medical and indirect costs and reduce distortions in household economic activity.

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1. RESEARCH PROTOCOL

1.1. Introduction

Background

Globally, noncommunicable diseases (NCDs) have been described to be one of the leading causes of mortality with about 80% of deaths in low- and middle-income countries (LMICs) (WHO, 2014, Health, 2013, Nundy and Han, 2012, Desouky et al., 2014). Rheumatic heart disease (RHD) as a noncommunicable disease amongst other NCDs also is fast growing in developing countries with very high impact (Celermajer et al., 2012). In 2008, about 36 million people died from NCDs including cancers (21%), cardiovascular diseases (48%), chronic respiratory diseases (12%), and diabetes (3%) (WHO, 2014, Health, 2013, Nundy and Han, 2012). Contrary to popular beliefs, many NCD deaths occur among children and working-age adults, which has brought about discussions on how to curb the NCD epidemic, especially through preventive interventions (Petersen, 2003, Desouky et al., 2014). NCDs are projected to increase 17% globally over the next 10 years and by 24% in Africa; by the year 2030, it is projected that 75% of global deaths will be due to NCDs (Health, 2013, Alwan et al., 2010).

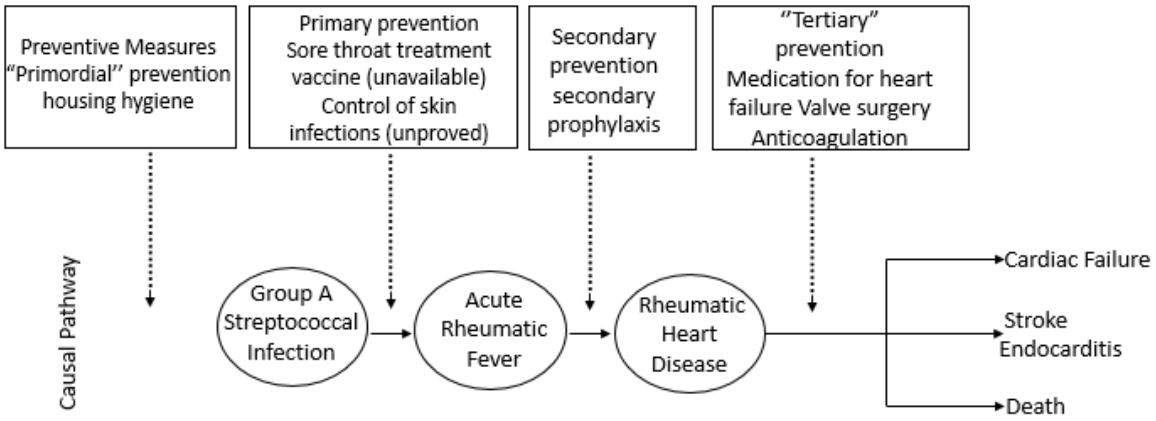
While infectious diseases are more commonly associated with poverty, the impact of NCDs in low socioeconomic status groups is very high. NCDs can create a vicious cycle where vulnerable individuals exposed to behavioral risk factors experience worse health, which pushes them further into poverty (WHO, 2014). At the same time, there are some NCDs which are endemic among the poor and that are largely amenable to socioeconomic development and better access to healthcare (Bukhman et al., 2015). One of the best examples of such an NCD is rheumatic heart disease.

Problem Statement

Rheumatic Heart Disease

Rheumatic heart disease (RHD) is a frequent cause of cardiovascular disease among children and working-age adults in LMICs. RHD results from repeated episodes of acute rheumatic fever (ARF), a delayed complication of sore throat due to group A streptococcal infection, which mostly afflicts children aged 5-14 years (Sliwa et al., 2010, Otto, 2004, Cilliers, 2014).

RHD remains a major public health concern in African countries because of its high rates of complications such as atrial fibrillation, stroke, infective endocarditis, and heart failure, all of which can result in premature death, including death during pregnancy (Zühlke et al., 2016). In 2015, RHD was estimated to affect 33 million people globally and to result in at least 320,000 deaths, nearly all of which were in LMICs (Hay et al., 2017, Naghavi et al., 2015). The high degree of disability and premature death from RHD is likely to reduce productivity and economic growth in endemic countries (Zühlke et al., 2015a, Koegelenberg et al., 2003, Watkins et al., 2016a, Marijon et al., 2012). RHD is most common in sub-Saharan Africa, south Asia, the Pacific Islands, and among indigenous populations in New Zealand and Australia (Cilliers, 2015)



Adapted from (Carapetis, 2007)

Figure 1: RHD causality partway

Rheumatic heart disease causality pathway shows the prevention housings hygiene from the primary initial infection stage of group A streptococcal infection and progresses to the secondary prevention method with the use of secondary prophylaxis that is commonly used for an acute rheumatic fever and the use of the tertiary prevention mechanism where there will be a need for heart failure valve surgery Anticoagulation due to RHD. RHD could deteriorate to stoke, cardiac failure and finally could lead to death of the patient.

Determinants of RHD

The risk factors that have been identified for RHD are low income, overcrowding, malnutrition, poor sanitation, and low educational attainment, as well as poor access to primary care for treatment of sore throat (Carapetis et al., 2005, Marijon et al., 2012, Meira et al., 2005, Bach et al., 1996, Longo-Mbenza et al., 1998, Sadiq et al., 2009, Dobson et al., 2012). Consequently, ARF that has dramatically declined in developed countries over the past 30-40 years remains high in LMICs (Ayoub, 1992, Carapetis and Currie, 2001, Watkins et al., 2009, Alipour et al., 2016, Carapetis et al., 2005, Tibazarwa et al., 2008, Nkomo, 2007, Longo-Mbenza et al., 1998). Interest in RHD in LMICs has grown over the past decade in the wake of a 2007 landmark report that demonstrated a high prevalence of RHD (30 per 1000) among school children in Mozambique; similar findings have been identified in countries like Uganda, Cameroon, and Malawi (Cilliers, 2015, Marijon et al., 2012, Beaton et al., 2012, Jingi et al., 2013, Kennedy and Miller, 2013).

RHD in South Africa

There have been several published studies of RHD in South Africa over the past few decades. The prevalence of RHD was estimated using auscultation-based screening in Johannesburg (1976) and Cape Town (1981), where it was found to affect about seven in 1000 in school children (Zühlke et

al., 2015b,). The most recent prevalence study was conducted among school children in Cape Town in 2016 using cardiac ultrasound-based screening; this study found that 20 in 1000 learners were affected (Engel et al., 2015). The prevalence and incidence of symptomatic RHD is higher in adults, whereas it often remains asymptomatic during childhood earlier in the course of the disease (Zühlke et al., 2015b). Despite these findings, there has been some progress on RHD in South Africa, including declines in ARF amongst children in Soweto and in Limpopo province(Cilliers, 2015, Cilliers, 2014). The RHD mortality rate in South Africa decreased from 1.27 per 100,000 population in the year 1997 to 0.7 per 100,000 in 2012 (Zühlke et al., 2015b).

Objectives of the study

The specific objectives of this study are to develop survey instruments to:

1. estimate the direct cost of RHD from the patient perspective
2. determine the impact of RHD on the economic and social welfare of the household measuring productivity and quality of life.
3. examine the household coping mechanisms associated with RHD

Mini literature

Previous studies of the economic impact of RHD

The economic impact of RHD has been quantified by relatively few studies, none of which have been conducted in South Africa (Terreri et al., 2001, Soudarssanane et al., 2007, Koech and Ngeno, 2014). The major costs of RHD to households include out-of-pocket direct costs like laboratory tests, transportation, consultations, and hospital costs, as well as indirect costs like lost wages/salary due to absenteeism from work and loss of productivity of the caregiver and patient in general (Terreri et al., 2001, Soudarssanane et al., 2007, Koech and Ngeno, 2014, Robertson

and Mayosi, 2008). In some households, RHD is likely to affect educational attainment and thus employment opportunities (Koech and Ngeno, 2014). For example, in Kenya and Brazil, 67% and 22% (respectively) of children with RHD drop out of school (Terreri et al., 2001, Koech and Ngeno, 2014). This literature remains sparse and to date has failed to capture the full range of economic consequences, described below, that RHD can produce in affected households.

1.2. Theoretical framework

Methods for measuring the economic burden of disease

The economic burden of disease can be measured using several approaches. The most frequently used is the "cost of illness" (COI) approach, which estimates the highest amount that could be potentially saved or gained by eradicating a disease (Segel, 2006b). It also assesses the cost impact of disease at the country, region, community, or individual level (Suhrcke et al., 2006b). COI studies ideally take a societal perspective on costs that incorporates health system costs and microeconomic effects on households. From an economic point of view, COI encompass the effects of disease-related disability on overall health status and quality of life (QoL) – i.e., productivity – as well as the financial effects (health-related expenditures) of untimely death, disability or injury due to corresponding disease and/ or its comorbidities (Jo, 2014). Over the past thirty years, studies on COI have informed health policy debates by illustrating the extent of the impact that an illness has on society in general (Rice, 2000, Segel, 2006b, Jo, 2014).

In addition to the aim of measuring economic costs, COI often aim to assess the effect of ill-health and health-related expenditure on the consumption possibilities of households. Ill health tends to increase the household expenditure on health services and reduce household expenditure on non-health related goods; very high levels of health-related expenditure can induce households to

liquidate assets, borrow formally or informally, or deplete savings (WHO, 2009). Further, ill health reduces the productivity and leisure time of other household members who look after a sick household member. These indirect household effects can be classified in three categories: (1) changes in consumption and savings, (2) effects on labour supply and labour productivity, and (3) effects on educational attainment and human capital accumulation. These categories serve to differentiate between the effects on the sick individual and the effects on other household members (Suhrcke et al., 2006a).Finally, the economic impact of disease is often not limited to the current time period. Health services and goods may be paid for via a loan or the sale of household assets (i.e. dis-savings), and the reduced household income, savings and assets resulting from the consumption of health services and goods may in turn drain investment in (physical, financial and human) capital, influencing consumption possibilities in the future (WHO, 2009).To assess the cost of illness, the household is the preferred unit of analysis for two reasons. Firstly, decisions about medical treatment and financial coping mechanisms are often based on negotiations within the household, though not necessarily from an equal bargaining position. Secondly, illness costs are incurred by caregivers as well as the sick individual, and all costs fall on the household budget (Russell, 2004, Berman et al., 1994, Sauerborn et al., 1995).

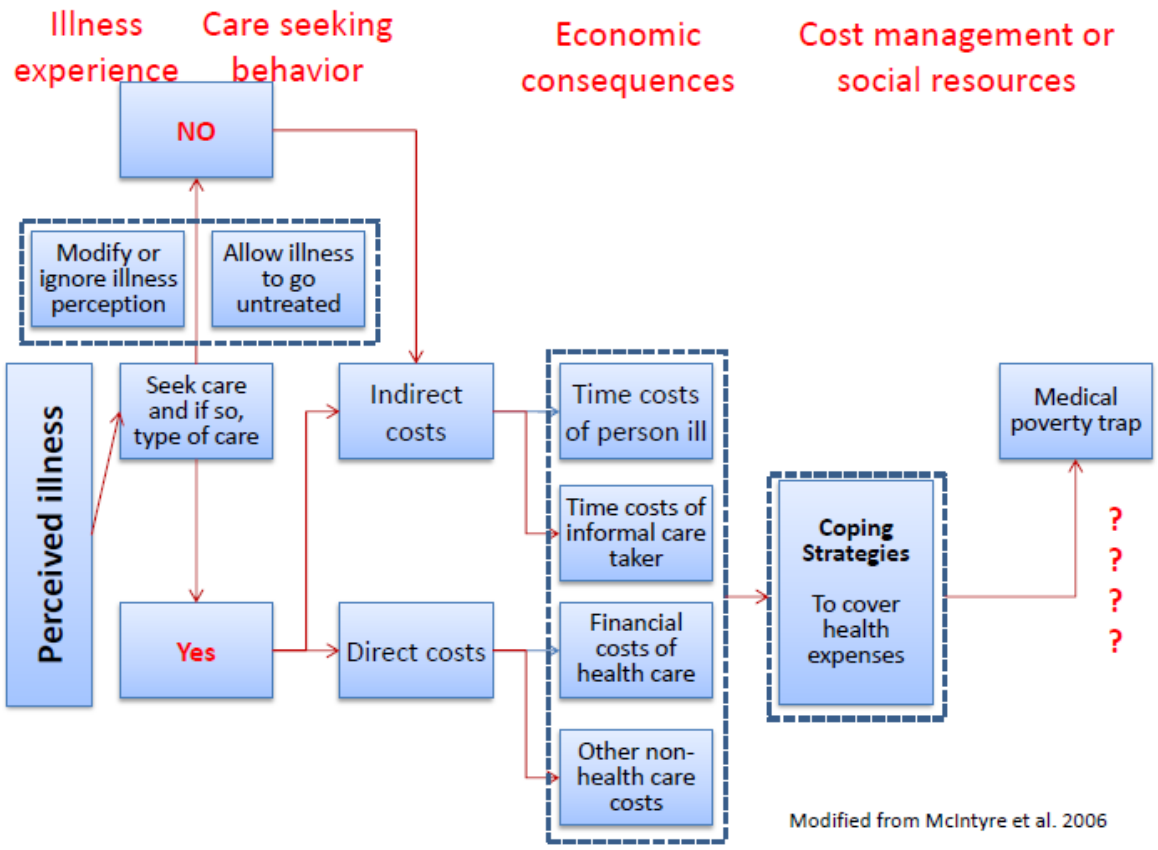


Figure 2: Overview of the economic consequences of illness. Adapted from: (McIntyre et al., 2006)

Figure 2 above explains the analytical framework for the study on cost of illness. This describe the evolving experience of LMICs associated economic consequence of illness. The economic consequence considered the impact of diverse types of cost including direct out-of-pocket payment, direct medical cost, direct non-medical cost, and indirect cost on healthcare. Households are affected directly or indirectly as one or more member of the household has ill-health. There are also cost on caregiver which inform the household and individual on how they cope with the implication of all this cost.

Costs

The objective of COI studies is to identify and measure all the costs of a particular disease, including the direct, indirect, and intangible dimensions (Byford et al., 2000). COI studies usually measure economic costs, which are the sum of opportunity costs (i.e., the lost benefits of devoting resources to other activities when they are employed in one activity) and accounting costs (i.e., cash outlays). As discussed above, economic costs can be classified as direct or indirect. Intangible costs, such as the value of pain, anxiety, and suffering, are also important from a social standpoint, but these are omitted from COI studies due to measurement challenges (Segel, 2006b, Rice D et al., Hodgson and Meiners, 1982, Cooper and Rice, 1976).

Direct costs

Direct costs are the sum of medical and non-medical costs and may include both the financial cost of resources as well as in some cases opportunity costs (e.g., of capital). Medical costs include expenditures on medical care for inpatient and outpatient care, rehabilitation, and nursing home care, and emergency care, as well as the associated consultation fees, diagnostic tests, prescription drugs and drug sundries, and medical supplies. Non-medical costs include transportation, property losses, relocation expenses, food and lodging while ill, and informal care of any kind (Segel, 2006b, Jo, 2014, Rice, 2000, Kirschstein, 2000, Hodgson and Meiners, 1982).

The importance of catastrophic health expenditure

Catastrophic health expenditure as a metric is usually expressed as the presence of direct costs exceeding some threshold level of household expenditure. Some regard direct costs greater than 10% of total household expenditure as likely to be catastrophic for the household, whereas others use a threshold of 40% of non-food expenditure. In either case, health expenditure above this level is likely to force household members to reduce consumption of other essentials and potentially

coping mechanisms such as depletion of savings, sale of assets, or incurment of debt (Russell, 2004, Prescott and Pradhan, 1999, Ranson, 2002). In addition, the financial risk of disease may accrue over time pushing a household deeper into poverty. This can occur even if direct costs are low, when the associated coping mechanisms involve other household members, e.g. labour substitution, productivity loss due to caregiving, and loss of income if the patient is the major bread winner of the household. This phenomenon is likely to play a factor in diseases of poverty like RHD where the government provides care basically for free, but there are other costs to households resulting from reduced educational attainment and employment. Poor households affected by RHD are probably held back by direct nonmedical and indirect costs including lack of access to social grand from the government (WHO, 2001).

Indirect costs

Indirect costs are always opportunity costs and include household productivity effects such as lost wages (or equivalent value of time) for patient and caregivers (Segel, 2006b, Russell, 2004). In COI studies, indirect costs represent the other side of costs, reflecting productivity loss from premature mortality and disability that are borne by patients and their families. The commonly used method to calculate indirect cost in cost of illness study is human capital approach (Wang et al., 2016). Among children and working-age adults, illness carries a cost due to "absenteeism" and "presenteeism" in the education and labour sectors. There are three ways of measuring indirect costs: the human capital approach, the friction cost method, and the willingness to pay method (Segel, 2006b, Drummond and Jefferson, 1996).

Household Coping Strategies

Coping strategies can be defined as actions that aim to manage the costs of an event or process (e.g., illness) that threatens the welfare of one or more members of the household (Russell, 2004). Coping strategies seek to sustain the economic viability and sustainability of the household (Russell, 2004, Sauerborn et al., 1996). Coping strategies can be in response to direct costs (e.g., borrowing from friends or relatives, or taking out formal loans) or indirect costs (e.g., intra-household labour substitution). They can vary from cost prevention strategies (e.g., ignoring illness, non-treatment) to cost management strategies (e.g., borrowing, selling assets, or labour substitution). Rural households are more likely to use savings than sell assets, and credit markets are more accessible to urban households than to rural ones (Russell, 2004, Sparrow et al., 2014). Other coping strategies that have been documented include changing productive activities, receiving in-kind help from friends and relatives, delaying payment to private health care providers, being exempted from medical fees, receiving financial support from children, receiving reimbursement from medical schemes, and receiving social relief (Ding et al., 2008, Qiu and Li, 2008). Different diseases probably result in different coping mechanisms based on the severity of such illness, whether it is acute or chronic, and whether it is recurrent/relapsing or progressive (leading to steadily deteriorating health) (Ding et al., 2008).

1.3. Methods

The primary aim of this study is to develop and pilot individual and household cost data collection instruments that can measure the household economic impact of RHD.

This study is very relevant to the global NCD research and policy agenda. RHD is a neglected disease of poverty that disproportionately affects children and working-age adults, in whom the economic impact of the condition is likely to be very high. Since there has been no research on the

household economic impact of RHD in African countries, this study will be a novel contribution to the literature and will inform policy and advocacy efforts.

Data Source: the REMEDY study

The Global Rheumatic Heart Disease Registry (The REMEDY study) is a multi-center, international, hospital-based prospective registry of patients with RHD. It is designed as a cohort study to document the disease characteristics and outcomes of individuals with RHD across many countries (Karthikeyan et al., 2012, Zühlke et al., 2015a). REMEDY Patients were enrolled across 25 sites in 12 African countries as well as in, Yemen and India; enrolment was based on a primary diagnosis of symptomatic RHD based on clinical and echocardiographic criteria (Zühlke et al., 2015a, Fever, 2004).

Study population and sampling approach

The study population will be a series of households affected RHD. These households will include patients (index cases) their caregivers and other household members. The target sample size will focus on recruiting participant from total of 500 patients in REMEDY study conducted in Groote Schuur Hospital (GSH) and Red Cross Children's Hospital (RXH) in Cape Town. These two sites have about 500 participants in total. We will sample index cases from the REMEDY database using a stratified approach -- The REMEDY study includes about 500 participants. This study is cost intensive and could not stretch further financially, so the sample size was set at 100. We will randomly sample 100 participants as follows. The REMEDY investigators will randomly sample 100 names from their database and provide us with contact details. We will work with a research nurse on REMEDY to call these individuals and invite them to participate in this "sub study" of REMEDY. Names and contact details of individuals who refuse to participate will be destroyed.

Once we have 100 participants, we will keep their names and contact details in a secure location. All study materials, including consent forms and data collection instruments, will be kept in a secure location as well. This sample size has been chosen to balance feasibility and precision and to align with a parallel study of the cost of RHD to the health system that aims to sample medical records from 100 REMEDY participants. Assuming an average total cost of US$ 100 per patient per year with a variance of US$ 900 (i.e., uncertainty range of about +/- 30% of the mean), a sample size of 100 will provide a 5% margin of error.

Inclusion criteria

The inclusion criteria in this study are:

1. REMEDY participants who are available/ reachable by mobile and willing to take part in the study will be included.
2. Heads of household or other members designated as decision-makers will be included

Exclusion criteria

1. Individuals under age 18

Data collection instruments and procedures

Instruments used

Two sets of questionnaires are developed (Individual and Household questionnaire). The individual question consists of all the necessary variables: demographic, income and sources of income, cost of illness variable (direct medical cost and direct non-medical cost), indirect cost and coping mechanism. The cost section focusses on the outpatient and inpatient for hospitalization. The household questionnaire also has demographic, income etc. The questionnaires developed: (1) is directed to the index participant (REMEDY participant) and (2) is directed to the household representative. The questionnaires will be completed by data collection experts hired to conduct

the research. (The questionnaire is not self-completed.) Both questionnaires do attempt to capture the impact of illness on caregivers; however, we will only seek information on caregivers from the index participant and household representative since we cannot feasibly interview all individuals in the household who may provide care for the patient with RHD. The questionnaires will first be piloted to ensure that questions are simple and easy to understand by the respondents. Following the interview, respondents will be asked about the clarity of the questionnaire and their understanding, comprehension of the questionnaire from the translator point of view. Several consent forms will be provided in the household questionnaire, consent will be taken from the HH head/respondent including other HH members (spouse, parent, children etc.) that may participate during the data collection process. Variables from NIDS, SAGE and EQ-5D questionnaires adopted in the design of both the individual and household questionnaire.

Eq-5d score

A standardized instrument which was developed by the EuroQol Group to measure health related quality of life, with descriptive system which has 5 dimensions mobility, self-care, usual activities, pain/discomfort and anxiety/depression. The EQ VAS records the patient's self-rated health on a vertical visual analogue scale. EQ-5D is not only useable in public health but wide range of health treatment and condition. It is always used as quantitative measure of health outcome that reflects the patient's own judgement. The scores can be presented as a health profile or can be converted to a single summary index number (utility) reflecting preferability compared to other health profiles.

Recruitment Strategy

The recruitment process will be for the index case, the REMEDY participant. This person will undergo the individual questionnaire (Appendix 6.4). In addition, we are clarifying that we will ask one household member to serve as a representative to answer the household questionnaire (Appendix 6.3). The preferred respondent will be the head of household or their spouse, but we will accept participation of whatever household member can reliably answer on behalf of the household (i.e., reliably discuss household finances and decision-making). If such a person is not available, we will ask the index participant to complete the household questionnaire and note this in the data set. We clarify that no other individuals in the household will participate in the survey.

Table 1: Type of costs and behaviors

Major type of cost	**Behaviors**	**Whom to measure them**
Direct medical cost	out-of-pocket payments on consultations, medications, tests,	Individual patient and household
Direct non-medical cost	Time cost, accommodation, food and transportation	Individual patient, caregiver and household
Indirect cost	Productivity loss, income reduction, loss of job	Individual patient, caregiver and household

Coping Strategies	Loan, assets sold and caregiver productivity loss	Individual patient, caregiver and household

Data analysis and management

The main outcomes for the study will be;

1. The average yearly cost of RHD to the household, including the breakdown between direct and indirect costs
2. The prevalence of coping strategies (intra-household labor substitution, borrowing, selling assets, etc.)
3. Other aspects of RHD that influence household economic dynamics

The interview guide will be pre-coded for ease of data entry. Data will be transferred from data collection forms into an electronic database (Microsoft Access or other) and cleaned. There will be double entry of data to cross-check any errors during the data collection and entry processes. The data will be described using descriptive statistics: means and standard deviation for normally distributed continuous variables and medians and interquartile range for non-normally distributed continuous variables. Categorical variables will be summarized using proportions and differences in households will be compared using chi-squared tests or Fisher's exact tests if one or more cells have an expected frequency less than five. Everything will be done at 95% level of confidence. Continuous variables will be assessed for normality using histograms. Multiple linear regression will be used to identify predictors of increased cost (e.g., severity of disease, patient age, household dependency ratio, etc.). Multiple logistic regression will be used to identify predictors of coping strategies (like the above factors). Qualitative findings from the open-ended questionnaire will be synthesized using thematic analysis.

Reporting of results

A copy of the results of this study will be submitted to the university database. The work will then be published in a peer reviewed journal and in a written policy brief.

Validity and Reliability of Measuring Instruments

The instruments will be piloted on the first few patients to check for clarity of the questions and reproducibility of answers. Any revisions to the instruments will be submitted to HREC for approval. The interview setting, and conduct will be comparable to avoid any differing in responses. Fixed and closed rooms will be used to avoid noise and other distractions to ensure privacy and confidentiality of the participants.

Standardizing the questionnaire and other interview guidelines will ensure that both questionnaires (individual patient and Household) are reliably designed. The data collector will be a fluent speaker of the patient's preferred language and will ensure that the questionnaire is administered in the same way to each respondent/research participant. In addition, constant supervision will be provided by the principal investigator.

Pilot Survey

The study will be pretested before the main data collection process. The pretesting of the questionnaire helps in the planning for logistics and appraising the adequacy of the recruited data collectors to conduct the field work (Joubert et al., 2007). One of the main method of assessing the reliability of a study's instruments is by comparing the responses given by the respondent during the pre-tests (Taylor and Weisberg, 1989). The pilot study will be pretested in few households to check for potential issues of consistency, sensitivity, format, wording and clarity of questions, instructions and any other factors that might have a negative bearing on data collection and analysis

process. It is assumed that pretesting the questionnaire on few households will be sufficient for validation. After pretesting, necessary adjustments and refinements to the instruments will be made before commencing main data collection.

Ethical and legal consideration

Potential Risk

This study will entail minimal risk to participants. Potential risks and discomforts will be limited to psychological distress related to discussing illness or personal economic or financial circumstances. There will be no direct benefits to the research participants, but having the opportunity to 'tell their stories' and to have someone to listen to them may be therapeutic and satisfying for them. Since the findings of the study will be published, it may strengthen the health system response to RHD including better financing arrangements and more equitable services.

Information sheet and informed consent forms

Participation in the study will be voluntary. An information and consent document containing the overview and objectives of the study will be read out to all participants prior to any interview. Upon understanding the study information, individuals who wish to volunteer to participate in the study will be required to acknowledge their participation by signing the statement of consent on the informed consent document.

Confidentiality

To maintain confidentiality, the data collection instruments will use unique identifiers so that the identity of the participants remains anonymous. A link file containing unique identifiers will be constructed based on the household roster and will be stored in a secure location separate from the data collection instruments. All electronic data will be stored in the researcher's personal computer

and will only be accessible to the researcher, supervisors and other members of the larger team. Data will be disposed after publication of the study findings.

Informed consent (or assent) will be obtained from all participants (household members) prior to data collection. Consent will be obtained in the participants' language of preference using a translator if necessary. Ethical approval will be sought from the Human Research Ethics Committee (HREC) at the University of Cape Town.

Proposed time schedule or duration

The project will be spread across Eight-month period from conception to final report. The Gantt chart below shows the summary of key milestones to be accomplished with the final report and policy brief being submitted in early October 2017.

1.4. Ethical Issue

A field worker will be hired through the Health Economics Unit who is trained in research practices and ethics and is fluent in all local languages and understands data collection documents to be able to properly interpret the details of study to all respondents before their participation. Interaction will be made between the principal investigator and the field worker before the commencement of the data collection process on how to interact with the participants. Issues that will be clarified included the following:

- The purpose of the study.
- That participation would be on a voluntary basis.
- That the participant is free to withdraw from the study at any time.

- To give information about the use of data collection instruments and duration of each interview, Assurance of confidentiality via coded identity and other means.
- To discuss potential benefits of the study outcomes.
- To obtain informed consent prior to the commencement of the interview.
- The main emphasis will be placed on the points below: - Consent form

All participants / respondent will be given a copy consent forms to read for themselves, which they were free to accept or refuse to sign. There will be no undue influence on the prospective participants. The subjects will be notified of their right to refuse or withdraw from the study if they wished. Participants will also be informed of their right to ask any questions and stop the study process at any point in time for clarification or better understanding of the question. Consent forms is developed in English but the data collectors will communicate to them in their native languages. The consent form will be given to respondents to sign before the commencement of the data collection process. (See appendix no.6) Finally, the field worker will ask the participants to summarize the information on the consent form in their own words to check for understanding.

Table 2: Activity schedule for the proposed study

YEAR MONTH	**2016(DEC) - 2017(JAN)**	**2017 FEB**	**2017 MARCH**	**2017 APRIL**	**2017 AUG**	**2017 SEP**	**2017 NOV**	**2017 DEC**	**2018 (JAN - FEB)**

Proposal development									
Submission for research ethics approval									
Pilot study (literature review)									
Data Collection									
Data cleaning/									
Analysis /Report written									
Submission of report									

1.5. References

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1.6. Protocol Appendices

Appendices A: Information and consent Form

Research Study: The Household Burden of Rheumatic Heart (RHD) Disease in South Africa

E53, Room 46, Old main Building, Groote Schuur Hospital Observatory.

Investigators

Oyebamiji Oyeleke; Master of Public Health (Health Economics) University of Cape Town, Dr. Olufunke Alaba Health Economics Unit, Department of Public Health and Family Medicine University of Cape Town, Dr. David A. Watkins Department of Medicine, University of Cape Town, Division of General Internal Medicine, University of Washington.

Investigators' statement

We are asking you to be in a research study. The purpose of this consent form is to give you the information you will need to help you decide whether to be in the study. Please read the form carefully. You may ask questions about the purpose of the research, what we would ask you to do, the possible risks and benefits, your rights as a volunteer, and anything else about the research or this form that is not clear. When all your questions have been answered, you can decide if you want to be in the study or not. This process is called "informed consent."

Purpose of this study

You are being asked to participate in a research study of; The Household Burden of Rheumatic Heart Disease (RHD) In South Africa. The purpose of the study is to investigate the economic consequences of RHD may impose on household budget and household activities. You are selected as a possible participant in this study because you are part of the REMEDY study that was done. You are one of the 100 participants that have been selected to participate in the research. In total, 100 Participant who are part of the REMEDY registry study conducted in Groote Schuur Hospital and Red Cross War Memorial Children Hospital will be selected to participate in the research.

Study procedures

You can be in this study because you are taking part in the REMEDY study.

We will contact you REMEDY participants by calling each and every participant on phone by (research nurse), to Set up time and place to conduct survey (preferably at the patient's residence); note to the patient the need for another household representative to be present at that time (research nurse), meeting the patient and household representative at the specified place at time (principal investigator and field worker), obtain informed consent from participants (field worker), conduct individual survey (field worker), to review individual survey for completeness and accuracy (field

worker), thank participants for their time (field worker and principal investigator), store all hard copies of study materials in secure location (principal investigator), at earliest convenience, provide participants with copies of consent forms (research nurse) and finally, extract data from study materials into electronic database (principal investigator or other qualified team member).

Potential Risk and discomfort

This study will entail minimal risk to participants. Potential risks and discomforts will be limited to psychological distress related to discussing illness or personal economic or financial circumstances. There will be no direct benefits to the research participants but having the opportunity to 'tell their stories' and to have someone to listen to them may be therapeutic and satisfying for them. Since the findings of the study will be published, it may strengthen the health system response to RHD including better financing arrangements and more equitable services.

Other information

Taking part in this study is voluntary. You can stop at any time. Your choice about taking part in this study will not affect your future medical care.

The researchers have procedures to protect the confidentiality of study records. We will keep track of your study information by using the study code that you have been assigned as a participant of the Household burden of Rheumatic Heart Disease (RHD) in South Africa. All electronic data will be stored in the researcher's personal computer and will only be accessible to the researcher, supervisors and other members of the larger team. Data will be disposed after publication of the study findings.

Benefits and/or compensation

There are no direct benefits to you participating in this study. This project aims to understand the burden of RHD and the impact on households. This information will be valuable to a range of different people, including policies makers who can use this information in decision-making. We cannot and do not guarantee or promise that you will receive any benefits from this study.

Subject's statement

This study has been explained to me. I have read this consent form in full or it has been read to me in the presence of a witness. I volunteer to take part in this research. I have had a chance to ask questions. If I have questions later about the research I can ask one of the investigators listed above at the contact number addressed above. If I have questions about my rights as a research subject, I can call Ms Lamees Emjedi with the Human Research Ethics Committee at 021 406 6338. I will receive a copy of this consent form.

Subject name	**Subject signature**	**Date**
Witness name	**Witness signature**	**Date**
Investigator name	**Investigator signature**	**Date**

Appendix :B Data collection procedures

The following is an outline of procedures that will help you get started on the Appendix:

1. Contact REMEDY participant by phone (research nurse)

2. Set up time and place to conduct survey (preferably at the patient's residence); note to the patient the need for another household representative to be present at that time (research nurse)
3. Meet the patient and household representative at the specified place at time (principal investigator and field worker)
4. Obtain informed consent from participants (field worker)
5. Conduct individual survey (field worker)
6. Review individual survey for completeness and accuracy (field worker)
7. Conduct household individual survey (field worker)
8. Review household individual survey for completeness and accuracy (field worker)
9. Thank participants for their time (field worker and principal investigator)
10. Store all hard copies of study materials in secure location (principal investigator)
11. At earliest convenience, provide participants with copies of consent forms (research nurse)

Extract data from study materials into electronic database (principal investigator or another qualified team member)

2. LITERATURE REVIEW

2.1. Introduction

This section aims to provide a detailed theoretical, methodological and empirical review of literatures on chronic diseases, cost of illness (COI), economic burden at household level in Africa especially South Africa. The Cost of illness (COI) at household level examines the direct and

indirect cost of resources used for the treatment of an illness/disease, coping strategies implored by the households and the impoverishment impact of the health expenses**.**

2.2. Background

Non-communicable diseases (NCDs) in low and middle-income countries account for about 77% of mortality, 85% of total burden of disease and several economic losses due to the reduction in productivity (WHO, 2005, Tagoe, 2012, Finkelstein et al., 2014). In 2008, about 36 million people died from NCDs including cancer (21%), cardiovascular diseases (48%), chronic respiratory diseases (12%) and diabetes (3%); chronic obstructive pulmonary disorder (COPD) accounted for about 4% of global burden of disease and about 8.3% of chronic disease (WHO, 2014, Health, 2013, Nundy and Han, 2012, Finkelstein et al., 2014, Alwan, 2011, Cruz, 2007, Yoo et al., 2016). Non-communicable diseases account for 44.1% and 44.7% of deaths among males and females respectively that are below 70 years of age in developing countries (Siegel et al., 2011). Findings report that the range of hypertension prevalence is between 14% - 40% among those between 35 to 65 years of age and about only 27% controls their blood pressure (Ordúñez et al., 2001).

2.3. Burden of chronic disease in South Africa

Non-communicable diseases also known as chronic diseases have increased in the last 15 years propelled by different risk factors such as obesity, physical inactivity, and diabetes (Heerden et al., 2017, Marquez and Farrington, 2013) in the rural and the urban area of South Africa. In 2004, 28% of total burden of disease was caused by non-communicable diseases as measured by Disability Adjusted Life (DALY) (Mayosi et al., 2009). Global burden of disease estimates

performed in 2010 calculating the number of individuals living with Rheumatic heart disease (RHD), an NCD was at least 34.2 million, with 10.1 million disability-adjusted life years lost (de Dassel et al., 2015).

In the few epidemiological studies conducted in South Africa, most of the recorded antenatal mortality were related to RHD with heart failure as the most common presentation (Sliwa et al., 2014, Pillay, 2008). Furthermore, a recent systematic review on the incidence, prevalence, and outcomes of RHD in South Africa in the past 20 years reported a prevalence of 20.2 cases of asymptomatic RHD per 1,000 school children (Zühlke et al., 2014, Zühlke et al., 2015).

2.4. Economic Burden

Cardiovascular diseases (CVD), diabetes and other related NCDs are not only a public health issue but also an economic problem in the 21st century (Zimmet et al., 2001) with huge negative impact on the economic activities of people and national health, leading to premature morbidity and mortality associated to NCDs in low and middle income countries with serious financial burden as a result of cost incurred due to prevention and treatment across different households (HH) (Zimmet et al., 2001, Yusuf et al., 2001, Gaziano, 2008). People with most cases of type 2 diabetes in 2010 rose from 150-220 million, and was projected to rise to 300 million in 2025 (Zimmet et al., 2001, King et al., 1998).

Cardiovascular disease recorded high rate of death in women and men, and causes the poor to become the most vulnerable in both the developed and developing countries (Yusuf et al., 2001). Africa and Asia are experiencing the incidence of RHD at a high level, recording an estimate of less than one to more than 15 per 1000 per year which led to about 30% of CVD inpatient admission (Mendez and Cowie, 2001). Whereas, CVD as the second leading cause of death was

projected to be more than double in the 1990 and 2020 after HIV/AIDS (Gaziano, 2008). The cost of CVD differs across countries in sub-Saharan Africa which South Africa happens to be the only one to have been estimated.

The cost of cardiovascular diseases in the United States is on the order of 2% of the gross domestic product (Heart and stroke statistics, 2002). In Africa, CVDs as a percentage of GDP is 6.3%, with Republic of Congo to be 2.5% and Malawi recorded one of the highest GDP of 12.9% (Gaziano, 2008). Furthermore, a study on Economic burden and the cost-effectiveness of treatment of cardiovascular diseases in Africa explains that government, private sectors and individuals are the ones that bears the financial cost burden impose at the HH due to CVD. The cost burden are associated to indirect cost i.e. productivity loss due to workers affected with valvular heart disease (Gaziano, 2008).

A study reported in Canada showed that 21% of the cost of illness are attributable to cardiovascular diseases with a total of US$ 12 billion annually (Health in the Americas, 2002). Since there are severe cases of type 2 diabetes, directing funding on NCDs could be cost intensive, looking at the impact of premature morbidity and mortality that could overshoot healthcare budget of developing countries (Zimmet et al., 2001). Therefore, the annual cost of diabetes in Latin America and the Caribbean was predicted to be at US$65.2 billion (2000) (Stephens and Joubert, 2001). The highest costs are attributed to permanent disabilities due to complications from diabetes (Barcelo et al, 2003). Kang et al., 2016 demonstrated that patients are frequently diagnosed with multiple respiratory disorders and the mean annual cost for patients with a respiratory disease was US$8,853 with lost productivity being the main contributor to overall costs (Kang et al., 2016). This was consistent with other studies which show that patients with concomitant respiratory disease have greater morbidity and high health care resource use (Bousquet et al., 2005).

2.4.1. Burden of Rheumatic Heart Disease

An important but neglected NCD is rheumatic fever and rheumatic heart disease (ARF/RHD) the leading causes of heart failure (Watkins et al., 2016). Rheumatic heart disease (RHD) has become major cause of cardiovascular disease among children and working-age adults in LMICs. RHD results from recurrent episodes of acute rheumatic fever (ARF), a delayed complication of sore throat due to group A streptococcal infection, which mostly affects children aged 5-14 years (Sliwa et al., 2010, Otto, 2004, Cilliers, 2014).

There is paucity of data regarding the prevalence and incidence of GAS pharyngitis in South Africa Incidence rates of ARF are poorly documented in most low and middle-income countries. However, (Van Zyl et al., 1981) reported an overall prevalence of 33.2% with a significant difference between rates for Blacks (45%) and Whites (23.2%) in a study conducted in Pretoria on 232 patients (Van Zyl et al., 1981). In another study conducted in a Black community in Bloemfontein, 42% of the population has Group A Streptococcus GAS positive result was obtained (Irlam et al., 2013). In the few epidemiological studies conducted in South Africa, most of the recorded antenatal mortality were related to RHD with heart failure as the most common presentation (Soma-Pillay et al., 2008, Sliwa et al., 2014). Furthermore, a recent systematic review of the incidence, prevalence, and outcomes of RHD in South Africa in the past 20 years reported a prevalence of 20.2 cases of asymptomatic RHD per 1,000 school children (Zühlke et al., 2014, Zühlke et al., 2015b).

Table 1: ***Characteristics of Articles selected for literature review***

Authors	Subject of study	location	Methodology	Results

Foster et al., 2015	Tuberculosis	South Africa	Estimated the out-of-pocket costs incurred by individuals, examined reliance on social networks to mediate a catastrophic fiscal impact on the household	Patients incurred the greatest share of TB episode costs (41%) prior to starting treatment, with the largest portion of these costs being due to income loss. Poorer patients incurred higher direct costs during treatment than those who were less poor. Indirect costs accounted for 52% of total episode cost.
Govender et al. 2007	CVDs and diabetes	India and Pakistan	Adopted a societal perspective by incorporating the impact on the individual, the household, and the health and economic sectors.	In both countries, there was a paucity of systematic efforts to measure the economic and social impact of CVDs and diabetes.
Finkelstein et al., 2014	Cardiovascular Diseases (hypertension, diabetes, heart problems and stroke)	Indonesia	Performed econometric analyses based on four waves of the Indonesian Family Life Survey (IFLS). The average daily labour rate was equivalent in value to the lost days of primary activity	Heart problems exerted the greatest economic burden on households, costing Int$1.56 billion in OOP and indirect burden in 2010 followed by hypertension (Int$1.36 billion), diabetes (Int$0.81billion) and stroke (Int$0.29 billion).
Russell 2004	Malaria, Tuberculosis, and Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome	Developing countries	Reviewed studies that measured the economic costs and consequences of illness for patients and their families, focusing on all illnesses, malaria, tuberculosis (TB), and HIV/AIDS.	Direct and indirect costs of illness for malaria were less than 10% of the household income, but still significant when combined with the costs of other illnesses. The costs of TB and HIV/AIDS were catastrophic for households (more than 10% of the income).
Le et al., 2012	Hypertension	China	Prevalence-based cost-of-illness method was used to estimate the economic burden of hypertension.	On average, males had higher overall direct, indirect and intangible costs of hypertension than females. Both indirect and intangible costs decreased with age, whereas direct costs increased with age. The incidence of household catastrophic health payment and household impoverishment because of hypertension was 8.9% and 4.1%, respectively.
Le et al., 2015	Coronary heart disease	China	Prevalence based cost-of-illness approach was used to estimate the economic burden of CHD. Multilevel linear regression was used to model the variation in costs of CHD.	Males were more likely to have a higher economic burden of CHD than females. A positive association was found between the individual's level of education and the economic burden of CHD. Residence in a higher-income community was associated with higher costs related to CHD.
Min Hu, PhD Candidate,Wen Chen, PhD 2009	Chronic Hepatitis B (CHB)-Related Diseases	Beijing and Guangzhou, China	The rate of outpatient visits and average cost per visit reported by the patients was used to measure the outpatient expenditure per patient while the inpatient cost was calculated through annual rate of hospitalization and average expenditure for different types of hospitals. The Human Capital Approach was employed to measure the work loss cost due to productivity.	CHB-related diseases impose a substantial economic burden on patients, families, and the society in China urban areas.

Lu et al., 2013	Hepatitis B virus related diseases	Shandong, China	Direct medical costs included total outpatient, inpatient, and self-treatment expenditures; direct nonmedical costs included spending on nutritional supplements, transportation, and nursing per patient	For patients with or without health insurance, direct out-of-pocket cost of all HBV-related diseases except acute hepatitis B exceeded 40.00% of the patient's disposable household income, making it a catastrophic expenditure for the household.
Wang et al., 2016	Chronic non-communicable diseases	Malawi	A cost-of-illness method was applied to estimate the economic burden of CNCDs. Indicators of catastrophic spending and impoverishment were used to estimate the economic burden imposed by CNCDs on households.	Using a threshold of 10 % of household non-food expenditure, 21.3 % of all households with at least one household member reporting a CNCD and seeking care for such a condition incurred catastrophic spending due to CNCDs. The poorest households were more likely to incur catastrophic spending due to CNCDs. An additional 1.7 % of households reporting a CNCD fell under the international poverty line once considering direct costs due to CNCDs.
Ghoshal et al., 2016	Respiratory Diseases (asthma, allergic rhinitis (AR), chronic obstructive pulmonary disease (COPD), and rhinosinusitis)	India	Costs, indirect and direct, that contributed to treatment for each of the four respiratory diseases were calculated.	Asthma was the most frequent primary diagnosis followed by AR, COPD, and rhinosinusitis. A total of 335 (33.5%) patients were diagnosed with combinations of the four respiratory diseases; the most frequently diagnosed combinations were asthma/AR and rhinosinusitis/AR. Cough or coughing up sputum was the primary reason for the current visit by patients diagnosed with asthma and COPD while AR patients reported a watery, runny nose, and sneezing; patients with rhinosinusitis primarily reported a coloured nasal discharge. The biggest cost component was productivity loss.
Duraisamy et al., 2006	PLHA and households	South India	Multiple regression analysis was used to examine the determinants of direct costs. Other tests included One-way ANOVA (F-test), Mann-Whitney U and the Kruskal-Wallis test performed to test for statistically significant differences in the distributions and median.	Direct costs and financial burden of care and support services increased with the stage of disease. The financial burden was disproportionately more on low-income households.
Abegunde et al., 2007	Chronic diseases	23 countries	Simple models were used to project future mortality and burden of disease trends	Results showed that population growth and ageing will drive a substantial increase in the numbers of deaths from chronic disease globally, and particularly in low income and middle-income countries.
Lee et al., 2016	Heart failure	South Korea	Subgroup analyses of the costs consisting of direct costs (i.e., medical and non-medical costs) and indirect costs (i.e., productivity loss cost due to morbidity and premature death) were conducted by age group, history of HF hospitalization, and type of	A high percentage (68.5 %) of socioeconomic burden consisted of medical costs, caregiver's cost, productivity loss costs due to premature death and morbidity, and transportation costs. The HF patients with prior hospitalization due to HF annually spent 9.7 times more for National-Health-Insurance-covered medical costs compared

			universal health security program enrolled in	to HF patients who were not previously hospitalized.
Tagoe, 2012	Chronic diseases	Ghana	Measures of direct and indirect burden of chronic diseases at the household levels were constructed and assessed using bivariate and multivariate analyses.	The relatively high direct cost of illness among households with person(s) living with NCDs and the associated high indirect burden of illness placed undue stress on households.
Arredondo and Reyes 2013	Diabetes	Mexico	The Box-Jenkins technique were used for developing probabilistic models for the estimation of epidemiological changes.	In terms of health disparities, these data show clearly that there is a problem related to equity and poor health care accessibility in the different sectors of the Mexican population and according to the social group to which the patients with diabetes and their families belong to.
Ogah et al., 2014	Heart Failure	Abeokuta, Southwest Nigeria	Outpatient and inpatient costs were computed including personnel, diagnostic and treatment resources used for their management over a 12-month period. Indirect costs were also calculated. The annual cost per person was then calculated.	The economic burden of HF in Nigeria was found to be particularly high considering, the relatively young age of affected cases, a minimum wage of 18,000 Naira ($US120) per month and considerable component of out-of-pocket spending for those affected.
Nugent 2008	Chronic Diseases in Developing Countries Health and Economic Burdens	USA	Rising average age of the population and changing epidemiologic profile of the population are two main trends decomposed from the increasing prevalence of chronic disease in developing countries	Variability in the prevalence of chronic disease was found both at the country level and within countries as differences in risk factors were observed. This upward trend was forecast to continue as epidemiologic profiles and age structures of developing countries further shift.
Mahal et al., 2008	HIV/AIDS	Nigeria	Propensity score matching was used for comparing HIV-positive people with a control group with similar observed characteristics.	HIV was associated with significantly increased morbidity, healthcare utilization, public health facility use, lost work time and family time devoted to care-giving.
Sylvia C. Robles 2004	Chronic disease	USA	A public health response must bridge two approaches based on health promotion, addressing the determinants of risk factors and disease; and clinical cost-effective interventions and then integrate prevention and control of noncommunicable diseases in comprehensive programs.	Application of this framework and the use of appropriate methods contributed to elucidate the overall system dynamics in various settings.
Foo et al., 2016	COPD	Brazil, France, Germany, Italy, Japan, Mexico, the Netherlands [NL], Russia,	Direct cost measures were based on exacerbations of COPD, contacts with healthcare professionals, and COPD medications. Indirect costs were calculated from work loss values using the Work Productivity and	Total societal costs per patient varied widely but a consistent pattern across countries showed greater costs among those with increased burden of COPD (symptoms, health status and more severe

		South Korea [SK], Spain, the United Kingdom [UK], and the United States of America [USA]	Activity Impairment scale. Combined direct and indirect costs estimated the total societal costs per patient.	disease) and a greater number of comorbidities.

2.5. Methods for Literature Review

2.5.1. Search strategy

Multifaceted Boolean searches of the Medline bibliographic database using the PubMed interface (National Library of Medicine) Google scholar and the Scopus search yielded nothing, so it was discarded. The literature search result from PubMed was used simultaneously with Google scholar.

2.5.2. Inclusion criteria

- All published articles written in English from LMICs reporting on household economic impact/consequence of RHD chronic diseases with any kind of disease specifically.
- Literature on alignment of the objective with the review
- Study with adult of above 18 years of age was given preference
- Study published in the last 15 years was mostly prioritized.
- Quantitative studies or/and observational studies

2.5.3. Exclusion criteria

1. Randomized control trials, qualitative studies.

- Any study from high income countries
- Articles that focus only on Children under 18

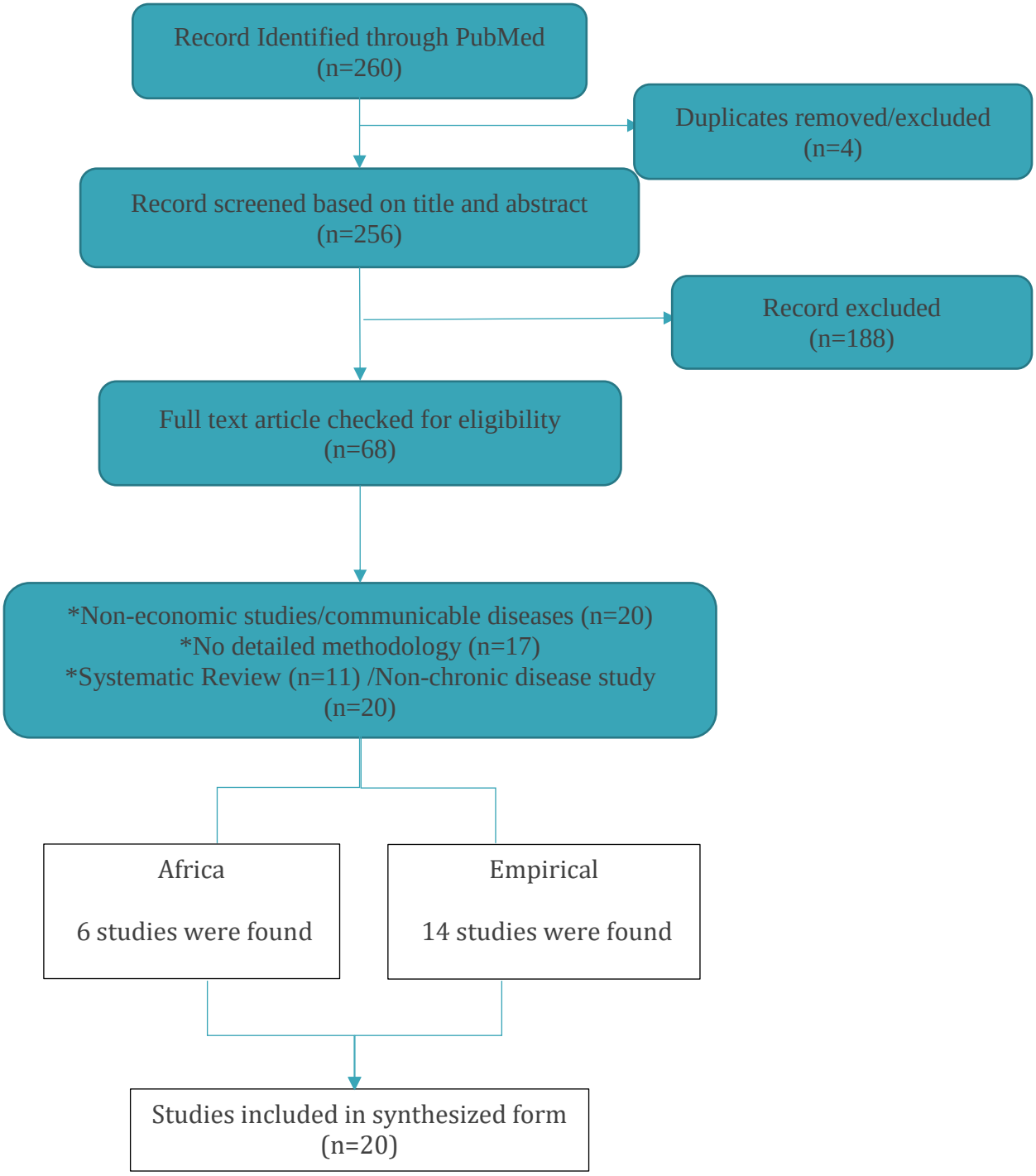

Figure 1: Flow chat diagram for the systematic review

2.6. Methodological Review

One method to estimate the economic burden on households is cost of illness studies. Comparability of cost of illness studies can be very hard to conduct because of various definitions and methods they used to measure and quantify different cost in different literature. Studies explain COI approach attributed essentially to public health by seeing cost in the light of society being a healthy place to live and will have a corresponding effect on the reduction of medical treatment. COI studies have given a price on mortality and morbidity related to any risk factor to measure expenditure on health that can be saved if there is no case of illness compared to the general understanding of economic way of costing which have the tendency to exaggerate the true cost of all morbidity and mortality associated with disease (Suhrcke et al., 2006b). In economic assessment of cost, there is always a comparative event between the present situation and the alternative situation that is contrary to the previous one. This study is viewed to be difficult to measure because dissimilar cost could be difficult to measure and methodology applied in COI studies does not address causality (Suhrcke et al., 2006b, Russell, 2004). Chronic diseases and risk factor cost are identified but do not specify that both were the reason why the cost happened. Several diseases have its peculiarity and differences in COI. In a study of costing of hypertension in rural China, their finding may have had a direct influence on the household due to several components of costs that was included for analysis in such study. Direct health care cost was majorly focused on, and indirect and tangible cost were ignored (Le et al., 2012). Some other studies assessed direct medical cost that included all cost.

2.6.1. Cost of RHD inpatient and outpatient visit

2.6.1.1 Inpatient Cost

Inpatient cost generally refers to any medical service, direct cost transport, food, medications, consultation, accommodation and laboratory that is payed during admission into a hospital. Also, I*ndirect costs* are *expenses* from the cessation or reduction of work productivity because of the morbidity and mortality associated with a given disease (Wolf and Colditz, 1998). Inpatient cost tends to be directed towards more serious diseases and trauma that need one or more days of overnight stay at a hospital

2.6.1.2 Outpatient Cost

Outpatient cost are direct and indirect cost incurred by patient during hospital visit without an overnight stay and can be aggregated as cost accrued for round trip per visit, food, medications, consultation and laboratory cost incurred by patient visit and productivity loss associated to productivity cost (value of time to seek care) which include household economic cost (Russell, 2004, Drummond et al., 2015).

2.7. Cost of ill-health

The impact of disease varies, including physiological, social and economic effects, while some diseases are temporary and affect current earnings, others are long-term like RHD, NCDS and affects both current and future earning and the dynamics of the household. Several reviews have been conducted on the Cost of illness (COI) at household level that accesses the indirect and direct cost (i.e. opportunity cost of the resources used for the treatment of such disease) of a particular illness/disease (Segel, 2006b).

2.7.1. Direct cost

Direct cost is typically defined as out of pocket payment incurred during the cause of seeking treatment for an illness episode. Russell, 2004, also categorize direct cost into main groups name; direct medical and direct non-medical costs. Direct cost can also be defined as cost incurred as a direct payment of medical cost associated with ill-health that is borne by health care sector, and non-medical cost such as transport, special food cost incurred by the patient and their HH/ families (Leardini et al., 2002, Duraisamy et al., 2006).

2.7.1.1. Direct medical cost

Direct medical cost are household expenditure associated with treatment seeking attitude when ill (Russell, 2004). Direct cost can further be categorised as medical related costs and non-medical costs (Hutchinson et al., 2006). Direct costs can also be called over-the-counter payment of medication, and consultation, prescription, diagnostic tests and hospital accommodation cost (Segel, 2006a) .

2.7.1.2. Direct non-medical Cost

Direct non-medical cost are cost associated with transport, expenditure on special food and accommodation burn by patients to visit health providers, including household cost incurred and cost of accompanying caregiver (Le et al., 2012, Wang et al., 2016). Also, direct non-medical cost stated by Russell 2004, are associated to special food supply and factors related to distance, availability and user fee policy. Direct non-medical costs include travel costs, costs of special food, caregivers' costs and costs of queuing at the health facility.

2.7.2. Indirect Cost

Indirect cost is productivity cost (value of time to seek care) which include household economic cost and productivity effect (loss of wages) incurred by an individual and household/caregiver's due to an illness episode (Segel, 2006b, Russell, 2004, Foster et al., 2015, Drummond et al., 2015, Barter et al., 2012). Indirect cost model entails mortality and morbidity due to amount of income cost due to disability i.e. productivity loss due to absenteeism from work, caregiving to patient by household member associated with productivity loss due to morbidity and premature death (Lee et al., 2016). Households experience the consequences of indirect cost such as children school dropout, reduction in food consumption and household loss of wellbeing, inability to purchase household essentials so as to care or attend to the sick household member (Nugent et al., 2011). Indirect cost are very high in developing countries compared to direct cost on health in different households due to access in treatment of disease, but in developed countries direct costs are higher than indirect costs (Nugent et al., 2011). WHO study discussed about chronic diseases and loss of economic output due to cardiovascular disease, stroke and diabetes of about $1.25 trillion in five developing countries in the year 2015. India had an estimation of about $336billion, Russian $300 billion and China $557 billion (Nugent et al., 2011, Atlas, 2013). Ghoshal et al., 2016 explained the impact of presenteeism over absenteeism, because it was more significant to lost productivity in the study conducted on economic cost of respiratory disease in India. To value the time loss from premature mortality and disability that is attributable to patients with chronic diseases in households, human capital approach is the most commonly used method. (Wang et al., 2016, Foster et al., 2015, Tarricone, 2006, Russell, 2004, Pritchard and Sculpher, 2000, Le et al., 2012). Studies around the COI in several low-income countries measured household indirect cost. A study in Sri Lanka described a very high direct cost for outpatient services in urban locations. A different scenario was reported in Burkina Faso where direct cost was recorded lower compared to high

indirect cost from the total cost (69%) and time loss by caregiver was equivalent to loss by sick individual. (Russell, 2004).

2.7.2.1. Methodological approach to measure indirect cost

Indirect cost can be measured in three major ways: the human capital approach (HCA), friction cost method (FCM), and willingness to pay (WTP) method (Segel, 2006b, Drummond and Jefferson, 1996, Segel, 2006a). Research shows that in developing countries, HCA is mostly used in COI compared to the WTP and FCM (Wang et al., 2016, Wyss et al., 2001, Asenso-Okyere and Dzator, 1997, Sauerborn et al., 1991, Konradsen et al., 1997, Sawert et al., 1997, Segel, 2011).

2.7.2.1.1. Human Capital Approach

The most commonly used approach to calculate indirect cost is COI studies, and it estimates how human life is valued and quantifies such value produced by an individual lifetime as a function of the individual earnings (Wang et al., 2016). Explaining the method of valuing the productivity cost of HCA is the existing neoclassical economic theory; which state that profit maximizing firm/organization employ workers up to a point where their marginal contribution to production equals to their gross wage. Therefore, the human capital approach involves placing a monetary value on a human life; this approach can be used to estimate the value of an individual to his community according to the amount of income the individual earns (Drummond et al., 2005). Also, HCA explains the process of giving value to potential productivity loss (de Santé, 2012).

Therefore, Human capital approach (HCA) method can be used to calculate productivity loss costs due to morbidity and issue of premature deaths.

Advantages of HCA. HCA allows essential insight not available to the previous versions of neoclassical economics. Looking at Marxian and Ricardian traditional way of treating labour as a produced means of production who has its characteristics focus on the economic forces, HCA discards the assumption of homogenous labour and focus its attention on the differentiation of the labour force. Finally, it gathers simple social institutions such as schooling and family, subverted as basic cultural scene into main economic analysis (Bowles and Gintis, 1975).

Disadvantages of HCA. The human capital approach (HCA) fails to recognize the value of pain and suffering that can be avoided through medical means as well as the value of leisure time. HCA does not consider the value an individual receives from the pleasure of life itself or the pleasure. Using the human capital approach, a person who is continually unemployed but still lives and breathes each day has effectively a zero value of life and may be also subject to market imperfections like race and other forms of discrimination (Bowles and Gintis, 1975). There is always causality between human and income which when combined, increases returns to investments in HC associated with imperfect credit market that leads to poverty trap. Poor people are unable to put their investment in HC that could lead to low income and keep them impoverished. Looking at the human capital theory with the assumption of earning wage that reflect human productivity, It was argued that the effects of reduced worker productivity can be translated into low income earnings in the labour market (Sicherman, 1991).

Several studies across sub-Saharan African countries and other LMIC countries have used HCA method to calculate indirect cost. A study on heart failure in aging society in South Korea used this method to account for premature death due to loss of productivity because people who are sick and above the age of 65 are less productive and no longer contribute to the society (Lee et al.,

2016). In Latin America, indirect cost of chronic diseases was calculated using HCA, monetary cost of diabetes related death. (Arredondo and Reyes, 2013). Another study conducted in Nigeria on heart failure estimated indirect cost by calculating average annual earnings on an individual patients based of their work-related group to get the average daily earnings (Ogah et al., 2014). The value of lost productivity because of illness can be measured by amount of forgone wages. Although HCA have been criticized by several economists in valuation of indirect cost, it's still the most used approach in the estimation of direct cost compared to the rigorous willingness to pay and friction method. In a country where unemployment is very high, HCA does not give the value of productivity and does not reflect the true value of productivity because the assumption of perfect competition is unrealistic given that the empirical evidence explains that there is imperfection in labour market (Drummond, 2002). In this study, most of the patient are unemployed so, there is shortcoming in the use of HCA because they do not produce anything.

2.7.2.1.2. Willingness to pay

Willingness to pay approach (WTP) is used in the estimation of indirect cost of illness (Segel, 2006b). WTP method is employed in research to know how much an individual is willing to spend to avoid illness. It also explains that the value of lost production can be derived by analyzing related preference to risk factor. Research on the economic burden of hypertension in rural south-west China shows that WTP are geared towards men and decline with age because men at working age are more productive and they are assumed to generate more income, but the older they get the less productive they are (Le et al., 2012). The more the household earn high income, the more they are willing to pay more to avoid ill health. Furthermore, WTP method describes value that households attach monetarily to a product to avoid illness or the value they attach if they are to accept the risk of illness. Wang et al., 2016 explained the shortfall of the study in Malawi that the

method may induce individual/or respondent to estimate differently (over estimation or underestimation) than what the actual estimate they would be willing to pay in a real life situation (Sawert et al., 1997).

2.7.2.1.3. *Friction cost method*

This approach helps in the reduction of overestimation of direct cost with the assumption that there is likelihood of replacing any patients who missed work time due to prolonged ill health, instead of keeping the placement unoccupied until the return of the sick patient or alternatively the time taken to restore firm production to normal operating due to replacement or unavailability (Foo et al., 2016, Koopmanschap et al., 1995). Segel, 2006a described FCM to estimate the COI from the understanding of firm and government where people work and earn monthly wages. This accounted for the alternative taken in other to keep a certain operation going while waiting for a substitute (Segel, 2006a).

2.7.3. Drivers of Cost

Drivers of cost are any factor that causes a change in the cost of an activity and bring out the consumption effect of firm resources. Also, they are associated with health expenditure with the underlying effect of sickness episode (Babad and Balachandran, 1993). Empirical studies hardly disaggregate total direct medical costs into the core cost drivers such as; user charges, consultation fees, diagnostic tests or drugs supply which account for total out of pocket payment from different households (Russell S, 2004).

Household income and age are very important in the direct cost of illness (Russell, 2004, WHO, 2009, Le et al., 2015).

In Sierra Leone, the poor household incurred over 50% of direct medical and non-medical cost on doctor's visit as well as other Asian countries such as Thailand, China, India and in Sri Lanka. Mean direct cost burden for the illness was 6.5% out of the monthly income with median of about 1.3% including doctors visit; transportation cost to health facilities could raise mean above the median (Russell, 2004, Fabricant et al., 1999, Wilkes et al., 1997, Pannarunothai and Mills, 1997, Mongkolsmai, 1993, Mishra et al., 1993). A South India study recorded that about 40% of the annual income of a patient living with Tuberculosis was channelled to healthcare (Kumarasamy et al., 2007). Also, cost of illness study conducted on hypertensive patients in the rural area of Yunnan province in China in 2010 measured the total direct per unit cost for male as 542.1 and female 454.7 with overall total cost of illness of 53.4%. Direct costs of illness estimation are generally perceived to be a simple exercise on the surface, given that the cost components are easily quantified in monetary terms. The non-medical cost are accommodation cost, transport, food and all care seeking behaviour of the sick patient and their caregiver (Wang et al., 2016). Conceptually, to estimate the direct medical costs of treatment, one of three methods can be applied: The bottom-up approach, top down approach and econometric estimation (Segel, 2006b). The bottom-up approach in COI explains the input from the data that include the government, patient medical charts and interviews conducted on both the patients and medical staff. Furthermore, bottom-up approach estimates the direct medical costs e.g. cost of drugs supply by multiplying the unit cost by the used while the top-down approach estimates the COI by multiplying the average total health care spending by the proportion of the health services used by the type of diseases measured (Sam et al., 2009). The econometric approach gives the total estimated direct COI as there is a difference between the cost of treatment between patient that are chronically ill and those who are not.(Segel, 2006b).

2.7.3.1. Health care expenditure as a proportion of household income-impoverishment

The healthcare spending is seen as being catastrophic when there is a need for household to reduce their basic expenditure in other to cope with health care cost for a certain period of time (Xu et al., 2003). Households tend to have rapid and immediate diminishing effects on household budget and household income. If the diminishing effects are sufficiently large, it is argued that the probability of household economic decline into poverty rises. Although there is little consensus as to the exact level of health expenditure that significantly diminishes economic welfare, it is widely accepted that direct cost expenditure exceeding a certain threshold of household income can impoverish the household. Also, in a household headed by people with disabilities or chronic diseases, unemployed and especially people without health insurance are more likely to face financial hardship than other households without impediment (Chuma et al., 2007, Kaplan et al., 1996). A study conducted in 89 countries globally suggested that 150 million people suffers financial catastrophe yearly due to payment of health care services (Xu et al., 2007). Income spent on other household food and non-food expenditure is more reasonable compared to income spent on ill-health of one or more of the HH member. However, wealthy HH are less likely to incur high cost of healthcare that will impoverish them no matter the threshold compared to poor household that is paying for their healthcare out of pocket (Su et al., 2006). Paying for medical fees, user charges, purchase of medicine, diagnostic test and charges on public care out of pocket by income earner in the household can be catastrophic and can deepen that household into poverty (Kruk et al., 2008, McIntyre et al., 2006)

2.8. Coping Strategy

The review on coping strategy explain how households respond to the consequences of illness based on the differences in decision they take to tackle such illnesses and the magnitude or severity of the sickness by focusing on direct and indirect cost shouldered by the household (Russell, 2004, Masiiwa, 2013). Coping strategy is defined as the decision household take to manage the costs incurred in a sickness episode that impends the welfare of one or more members of the household (Russell, 2004). Additionally, COI to households may be compounded for individual and household member without financial security. This financial security can be insurance to help the poor household from incurring catastrophic health care expenditure (Leive and Xu, 2008). When there is no health insurance for poor household in low income countries, people are forced to pay high OOP for health care. Household employs different methods of coping due to the severity of disease and majorly productivity loss due to ill health. Long term chronic diseases such as TB lead household members to quitting their job or have someone take their place while they treat themselves (Russell, 2004). Also, households adopt coping mechanisms due to economic consequence of ill health by sourcing for money to mitigate such economic shock of direct cost (e.g. borrowing) and indirect cost (intra household labour substitution) (Russell, 2004, Buvé et al., 2002). The study carried out in India by (Duraisamy et al., 2006) reported about 67% of patient had to borrow, while 16% said they made use of their income savings. In order to cope with indirect and direct cost, households are compelled to result to cost prevention method (e.g., ignoring illness, non-treatment) and cost management strategies e.g., borrowing from their various social networks ,selling assets, or labor substitution and take loan (Alamgir et al., 2010, Sauerborn et al., 1996). As highlighted in Foster et al., 2015 study, TB patients at chronic stage in South Africa depends on the household members and/or caregiver to borrow money for their care (Foster et al., 2015).

2.9 Empirical Review: COI Studies from Household Perspective

Household experience on impoverishment resulting from the effect of medical cost have become a major challenge. This has brought the upsurge in research to estimate the household different cost of illnesses over the years (Hu et al., 2008, Damme et al., 2004). Economic cost of illness is said to be aggregate of direct costs (transport round-trip cost incurred from hospital or any health facilities) and other medical/consultation cost, indirect cost, intangible cost associated with emotional stress and physical pain experience due to illness (Segel, 2006b, Foster et al., 2015). Also, due to the burden of disease, household may incur direct medical costs related to the type of illness or direct non-medical costs incurred to other costs associated with falling ill but not necessarily related to the illness. Therefore, studies across cost of illness breakdown illness cost into direct and indirect medical cost associated to the whatsoever expenditure incurred by different households.

Recently in developing countries, unhealthy behaviours that lead to chronic diseases are common among people of all income levels and such behaviours are increasingly more likely among lower-income people in countries above a certain income threshold. However, there is a difference in the burden enforced by chronic diseases in rich versus poor countries, in that, more morbidity and mortality from chronic diseases occurs before age 60 in low- and middle-income countries than in high-income countries. This burden is attributed to personal lifestyle change, physical activity and poor diet (Nugent, 2008).

Figure 2 below shows the household impact of chronic disease related NCDs in the poor LMIC

2.9.1. Cardiovascular disease

Cardiovascular disease in African countries has become a major public health challenge. African studies examined cardiovascular and heart related disease recorded that there are little or no data

describing the economic impact in sub-Saharan African countries. In a cohort of about 239 cardiac problem conducted in Abeokuta Nigeria, the total inpatient care cost was 46% from the total health care expenditure (Ogah et al., 2014). Also, transport cost was recorded very high due to OOP payment from their monthly follow up visit.

Another population based household health survey conducted in rural Malawi in 2012 shows the chronic cardiovascular disease (CCVD) was recorded to have borne higher direct, indirect and total cost than other comorbidities (Wang et al., 2016). CCVD was recorded higher for mean monthly cost of about 74% of medical cost. More of this indication is associated to the record articulated with global indices of NCD (Wang et al., 2016, Bloom, 2011). Furthermore, in a multi country study conducted on cardiovascular mortality in 2001,sub-Saharan African countries recorded 30% of 95% uncertainty interval compared to the high income countries including the Asian countries (Abegunde et al., 2007, Mathers et al., 2006).

2.9.2 Other non-communicable diseases in Africa

Other non-communicable diseases are recorded across studies in low income countries, but Africa is yet to explored in full the research on NCDs at present. However, the impact of other NCDs (CVD, Diabetes, cancer etc) are very high with the increase in infectious diseases (HIV/AIDS) and TB that is about reaching epidemic stage stated by the World Health Report 2001. The high impact of NCDs is wide spreading across Africa with Age-specific death highest in South Africa, Nigeria and Egypt (Abegunde et al., 2007). Study shows in Malawi that people incur direct cost on the treatment care of diseases like cervical cancer (cervical and breast), heart failure, diabetes, hypertension despite the free treatment plan which could not offer adequate financial protection against CNCDs related cost (Wang et al., 2016). HH suffer from the impact of NCDs due to long

term effect. In Ethiopia 2006, projection was made in achieving the global goal of adding 2% annual reduction in chronic disease related mortality estimated losses due to diabetes, stroke coronary heart disease ranges from 20-30 million US dollars and likely double if there is no prevention till the year 2015. This may have very high negative economic impact on African countries.

Conceptual framework

The evolving experience of poverty at household level in low middle-income countries is described in Figure 2. People in LMICs faces diverse types of modifiable risk factors/ unhealthy behavior such as (physical inactivity, tobacco use and harmful use of alcohol) which leads to loss of income in the household (Heerden et al., 2017, Marquez and Farrington, 2013). Several LMICs countries suffers health related losses due to NCDs, which accounted for 90% of global burden of disease and recorded 12% of global health spending which in turn reduces access to effective and equitable health care services (Aikins and Agyemang, 2015, Peters et al., 2008)

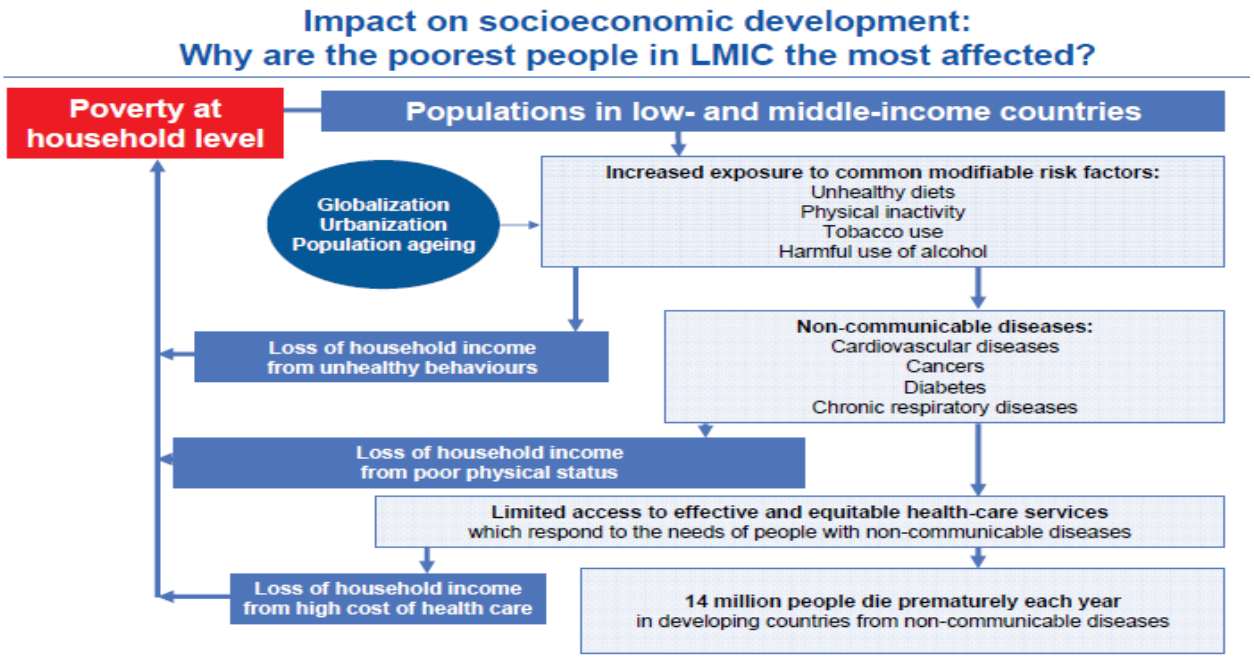

Figure 2: Adapted from: (Aikins and Agyemang, 2015)

2.10. Conclusion

Burden of chronic diseases in Africa have become a public health issue and need urgent attention. Chronic diseases (CDs) have been seen to not only be a health issue but also an economic problem that affects both the developed and developing nations. There is numerous household cost of illness studies that investigate the economic consequences of CVD, malaria, diabetes, HIV and tuberculosis. Furthermore, household cost of illness is estimated using direct and indirect cost. The estimated household economic impact of RHD is very relevant to the global NCD research and policy agenda, knowing that RHD is a neglected disease of poverty that disproportionately affects children and working-age adults in LMICs where the economic impact of the condition is very high and that when faced with the economic consequences of illness at HH level, they adopted coping strategies (borrowing from social network, sold property etc.). Since there are no prior

research on the household economic impact of RHD in African countries, and thereby limited in the global hemisphere, this study will be a novel contribution to the literature and will inform policy.

2.11. References

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JOURNAL ARTICLE

RESEARCH ARTICLE

The household economic impact of Rheumatic Heart Disease (RHD) in South Africa

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Abstract

Background: Rheumatic Heart Disease (RHD) is an incurable and often costly condition. It is an important cause of cardiovascular death and disability in South Africa that predominately affects poor and socially vulnerable populations. Due to the paucity of data describing its economic impact, we conducted a survey to investigate the economic consequences of RHD among South African households.

Methods: A cost-of-illness study was undertaken among 100 households affected by RHD in Cape Town. Healthcare costs, including direct and indirect costs, were estimated from a patient (household) perspective. The prevalence of coping strategies was also assessed, including both cost prevention and cost management strategies. Economic costs were valued in 2017 South African rand (ZAR).

Result: One hundred index patients with RHD were included; supplementary socioeconomic data on household members (n = 479) were also collected. Healthcare costs totalled ZAR 123,000 (USD 9400) (ZAR 1200 per patient per year (USD 90)), comprising ZAR 56,000 (USD 4200) in direct costs (all of which were direct non-medical costs) and ZAR 67,000 (USD 5000) in indirect costs.

Total inpatient (52% of direct costs and 39% of indirect costs) and outpatient (48% of direct costs and 61% of indirect costs) costs were estimated at ZAR 55,000 (USD 4200) and ZAR 68,000 (USD 5200) respectively. At 10% and 40% threshold, four and eight percent of households incurred catastrophic health expenditure. Coping behaviours were frequent and included taking out loans (17% of households), receiving gifts from others (15%), and selling assets (2%). The estimated economic value of these behaviours was estimated at ZAR 40,000 (USD 3000). The total cost of RHD to the average affected household is valued at about ZAR 1600 (USD 100) annually. The estimated economic value of these behaviours was ZAR 40,000 (USD 3000).

Conclusions: The economic impact of RHD in South Africa is substantial despite government efforts to provide free care. The total cost of RHD to the average affected household is valued at about ZAR 1600 (USD 100) annually. A broader and more robust range of social policies will be required to mitigate non-medical and indirect costs and reduce distortions in household economic activity.

Keywords: Economic burden; cost of illness; direct cost; coping mechanism, Non-communicable disease

3.1.BACKGROUND

Chronic, non-communicable diseases in South Africa have become a public health issue requiring urgent attention. One neglected non-communicable disease is rheumatic heart disease (RHD), a major cause of cardiovascular disease among children and working-age adults in low- and middle-income countries (Watkins et al., 2016b). RHD is a condition of poverty that results from recurrent episodes of acute rheumatic fever (ARF), a delayed complication of sore throat due to group A streptococcal infection, which mostly affects children aged 5-14 years (Sliwa et al., 2010, Cilliers, 2014, Otto, 2004). It is estimated that in 2015 there were 320,000 deaths from RHD and 33 million people living with the condition globally (Watkins et al., 2017b). RHD can complicate pregnancy,

and high maternal and foetal death rates have been noted in some South African studies (Sliwa et al., 2014, Soma-Pillay et al., 2008). A recent systematic review of the incidence, prevalence, and outcomes of RHD in South Africa over the past 20 years estimated a prevalence of 20.2 cases of RHD per 1,000 school-aged children (Zühlke et al., 2014, Zühlke et al., 2015a).

The economic burden of diseases refers to the economic (opportunity) costs that ill health poses for individuals, households, healthcare systems, and societies at large (National Collaborating Centre for Infectious Diseases, 2016). Economic burden of disease studies seeks to measure the direct and indirect costs incurred due to illnesses or injuries. To estimate the economic burden of disease, four approaches can be taken. The cost of illness (COI) method estimates the direct and indirect cost of illness for a certain population in a given time frame (Ugaz, 2009). COI studies include the sum of all personal medical costs of care, including direct and indirect (opportunity) costs, the latter of which usually focus on productivity losses (Ugaz, 2009, Abegunde et al., 2007). Economic growth models assess the impact of ill health on a country's gross domestic product (GDP) as mediated by changes in labour supply, saving rate, capital accumulation, productivity, and income and investment (Ugaz, 2009). The value of a statistical life (VSL) approach measures willingness to pay to avoid an increased risk of death and then calculates the welfare losses associated with increased mortality (Bloom et al., 2017). A variant on the VSL approach, the full income approach, looks at the societal value of welfare losses from ill health (or welfare gains from improved health) valued in monetary terms, including changes in national income (GDP) (Andrade, 2009).

The COI approach was developed by Rice et al. as a method for estimating the microeconomic impact of any kind of disease (Ugaz, 2009). COI studies have been popular in the medical

literature, particularly for chronic diseases like cardiovascular disease (Ogah et al., 2014). These studies have also been conducted for cancers (Wang et al., 2016) and for HIV (WHO, 2015, De Vries et al., 2007). Beyond quantifying costs, some studies look at the impacts of ill health on household spending, purchase and sale of assets, and intra-household labour supply (Yamano and Jayne, 2004, Mujinja and Over, 1993, Menon et al., 1998). This extended use of COI can highlight the economic consequences of chronic diseases in nuanced ways and provide insight into the knock-on effects of diseases on household economic activity. A recent review found very little published evidence on the economic impact of RHD in low- and middle-income countries, including countries in Africa where RHD is highly endemic (Watkins et al., 2017a, Prabhakaran et al., 2017). Understanding the economic impact of RHD is very relevant to global and national research and policy agendas, especially as the non-communicable disease agenda broadens to include more "neglected" conditions like RHD (Bukhman et al., 2015). Because RHD affects income-vulnerable populations and – disproportionately to other noncommunicable diseases – children and working-age adults, it is likely that the economic impact of the condition is very high relative to its impact on population health. The present study is a COI study that looks at the impact of RHD in the Western Cape Province, taking a patient and household perspective on costs.

3.2. METHODS AND MEASUREMENTS

Theoretical considerations

A conceptual model of the household economic impact of illness was proposed by McIntyre and colleagues (McIntyre et al., 2006). This study adopts and extends that framework, represented in Figure 1.

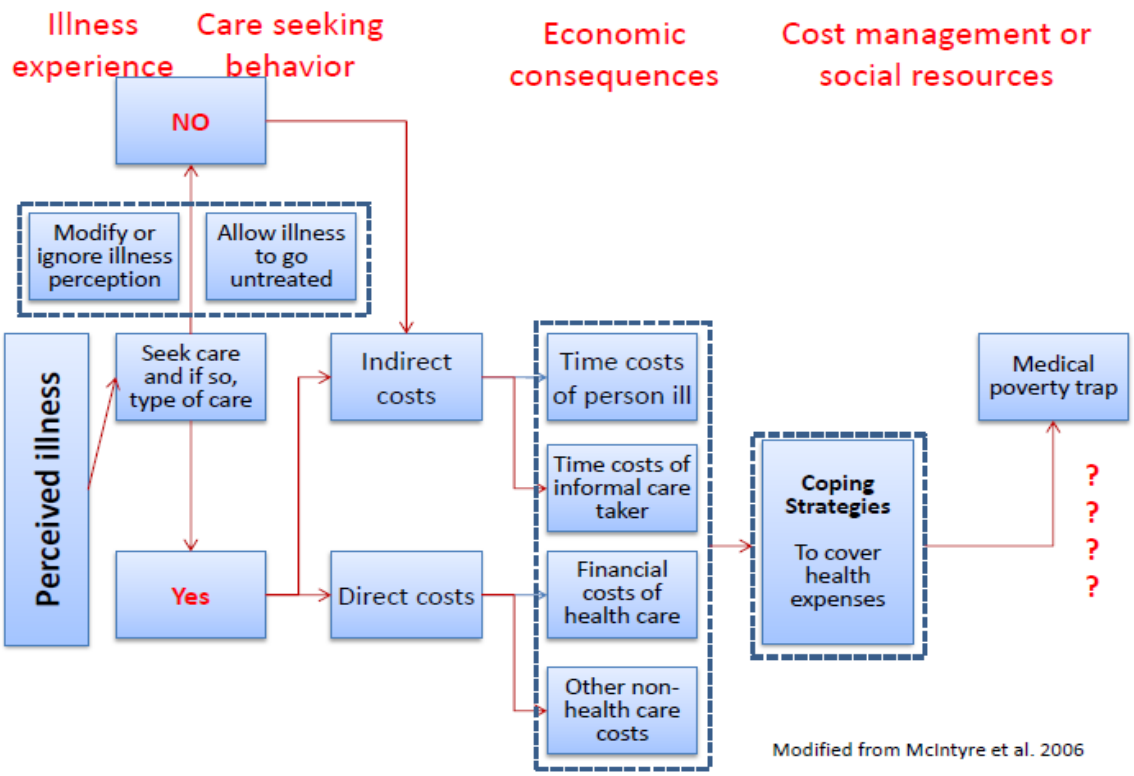

Figure 1. Conceptual model of the household economic impact of ill health. Adapted from: (McIntyre et al., 2006)

This study focusses on measuring direct costs, indirect costs, and economic behaviors (coping strategies) that lead to medical impoverishment which leads to poverty trap.

Direct costs

Direct costs comprise both medical and non-medical costs, which may include both the financial cost of resources as well as opportunity costs (e.g., of capital items). The total direct cost of illness is the sum of all direct medical costs and all direct non-medical costs. The direct medical costs

include cost of consultations, tariffs (for inpatients), drugs/medicines, vitamins/supplements, and laboratory tests and radiology studies. The direct non-medical direct costs of seeking healthcare included the cost of special food, transport to get to health facilities, and household purchases for healthcare. In this study, I asked about direct medical costs expecting "no" as a response, since public healthcare is generally free for poor people in South Africa. (Kruk et al., 2008).

Indirect Costs

The most commonly used method to calculate indirect cost in COI studies is human capital approach (Wang et al., 2016). Implicit in the human capital approach is the assumption that changes in health status of household members can be reflected by losses in productivity and losses in income generation. The value of lost income can be estimated using the prevailing average wage rate and applying it to the time lost by the patient or caregiver when engaged in RHD-related activities:

Indirect cost (inpatient care) = Number of inpatient days ÷ number of days worked per month × monthly average wage

Indirect cost (outpatient care) = Number of outpatient hours missed from work ÷ number of hours worked per month × monthly average wage

Given that the majority of individuals with RHD are unemployed (see below), average productivity losses can be estimated using a proxy for opportunity cost among the poor, the minimum wage. South Africa's new official minimum wage is ZAR 3500 per month, which can be converted to hourly lost productive time by assuming 20 days' work per month and 8 hours' work per day (Zhang et al., 2011).

Coping Mechanisms

I also assessed the coping mechanisms employed in response to the economic burden of RHD (Figure 1). These included both patient and household behaviors. Coping strategies can be a clear response to direct costs (e.g., borrowing from friends or relatives, or taking out formal loans) or indirect costs (e.g., intra-household labor substitution) and can be cost prevention strategies (e.g., ignoring illness, non-treatment) to cost management strategies (e.g., borrowing, selling assets, or labor substitution).

Methods and data sources

This study was a follow-on study from the Global Rheumatic Heart Disease Registry (REMEDY), which was a multi-center, international, hospital-based prospective registry of patients with RHD. It was designed as a cohort study to document the disease characteristics and outcomes of individuals with RHD across many countries (Karthikeyan et al., 2012, Zühlke et al., 2015a). REMEDY participants were enrolled across 25 sites in 12 African countries as well as in Yemen and India; enrolment was based on a primary diagnosis of symptomatic RHD based on clinical and echocardiographic criteria (Zühlke et al., 2015a, Fever, 2004). I recruited participants in the REMEDY study who were resident in Cape Town and received care at Groote Schuur Hospital (GSH). This study made use of patient and household member surveys to estimate the economic consequences of RHD among households in which REMEDY participants reside. The conceptual framework (Figure 1) was used as a guide during the analysis. This framework allowed me to track the various economic consequences of RHD experienced directly and indirectly by patients and their households.

Study population and sampling approach

This study was carried out between January 2017 and February 2018. The units of analysis were households affected RHD, including REMEDY registry participants (index cases), their caregivers, and other household members. The target sample size focused on recruiting 100 REMEDY participants receiving care at GSH since some patient have already grown from children to adult. So, children that were just recruited were not sampled. This sample size was chosen to balance feasibility and precision and to align with a parallel study of the cost of RHD to the health system that aimed to sample medical records from the same 100 REMEDY participants. I expected that our sample size of 100 would allow for an approximately 5% margin of error on key estimates such as cost of care. I screened participants for recruitment by randomly sampling names and associated contact details from the REMEDY database.

Recruitment Strategy

I worked closely with the REMEDY data management officer to recruit participants in this sub-study. Patients who answered the recruitment call and agreed to participate were visited at their residence with their primary caregiver or any household member older than eighteen years who is also a caregiver. Names and contact details for individuals who were not reachable or/and chose not to participate were destroyed, and new participants were recruited until 100 participants in total had consented to participate. Names and contact details of consenting participants were kept confidential at the REMEDY office.

Data collection instruments and procedures

The recruitment process identified the index patient, to whom I administered a structured questionnaire that included demographic, health, and economic data (appendix A). The individual

questionnaire included RHD-specific cost of illness variables, e.g., direct medical cost and direct non-medical cost, indirect costs, and coping mechanisms (see below). The cost section looked at both outpatient and inpatient costs over the past 12 months. All cost estimates were obtained via patient or household member self-report and were asked during data collection in 2017, implying a default currency/year of July 2017 South African rand (ZAR) converted to (USD) for the cost estimates in this study. Thereafter, one household member was invited to serve as a representative to answer a structured questionnaire on household demographic, health, and economic data (appendix). The household questionnaire also elicited the respondent's assessment of the ways in which the household had coped with the cost of RHD, e.g., intra-household labor substitution or sale of assets (see below). Preference were given to head of household or their spouse, but I accepted participation of any reliable household member that was able to reflect on the total welfare of the household (i.e., reliably discuss household finances and decision-making). Research assistants who were data collection experts were hired to administer the questionnaires in the language that participants preferred (usually Afrikaans or isiXhosa).

3.3.DATA ANALYSIS

Data were entered in Epi-Info then exported to Microsoft Excel 2016 and STATA 13 (StataCorp 2013) for analysis. I estimated the average yearly cost of RHD to the index patient and household, including the share due to direct and indirect costs and to inpatient and outpatient care. I then estimated the prevalence of coping strategies (intra-household labor substitution, borrowing, selling assets, etc) for RHD. Drivers of total cost were assessed using ordinary least squares models, and predictors of coping mechanisms were assessed using logistic regression models. The independent variables assessed in these models were: age, patient EQ-5D score, household number

of persons with multi-morbidity, gender, number of inpatient admissions, educational attainment, employment status, household assets, and marital status.

Ethical approval was provided by the University of Cape Town.

3.4. RESULTS

Demographic characteristics

Table 1 presents the demographic characteristics of the participants in this study. There were 200 adult respondents in total: 100 index patients with RHD and 100 household members representing 479 individuals without RHD residing in these 100 households. Sixty-seven percent of index patients were female compared with 58% of household members. The mean patient and household member ages were 48 and 43 years respectively. Over four-fifths of patients and household members were currently unemployed, though roughly the same proportions had achieved secondary education.

Many household members were affected by multimorbidity, defined as the presence of two or more chronic health conditions. Table 1 shows about a quarter of household members had multimorbidity as compared with 5% of index patients with RHD. Nearly all patients and household members were uninsured. The average household and individual patient monthly income was estimated (by self-report) at ZAR 3000 (USD 200) and ZAR 2000 (USD 150), respectively. Total household expenditure (food and non-food) was estimated at ZAR 2700 (USD 200), with ZAR 1000 (USD 70) being non-food expenditure. The questionnaire also asked about household assets. We used principal component analysis to create a household wealth indicator variable based on the first principal component (data not shown; see regression analyses below).

Table 1. Baseline characteristics of sampled patients and households

Characteristic	***Patients***	***Household Members with 100 RHD patients*** ***N=479***
Mean household size	5.79 *(min = 2; max = 9)*	
Female Gender, n (%)	*67(67)*	*277(58)*
Educational Level (%)		
Grade 1-3	*3(3)*	*23(5)*
Grade 4-6	*11(11)*	*28(6)*
Grade 7-12	*81(81)*	*402(84)*
Undergraduate	*4(4)*	*14(3)*
Marital status (%)		
Single	*36(36)*	*201(42)*
Married	*56(56)*	*234(49)*
Divorced/ Widow/widower	*8(8)*	*38(8)*
Lack of Employment (%)	*84(84)*	*387(81)*
Multimorbidity		
Prevalence of Multimorbidity (%)	*5*	*23*
Lack of Medical Aid, n (%)	*99(99)*	*469(98)*

Age Distribution			
Patient		***Household Member***	
20-35	*16(16)*	*20-35*	*148(31)*
36-45	*45(45)*	*36-45*	*143(30)*
46-55	*29(29)*	*46-55*	*86(18)*
55+	*10(10)*	*56-71+*	*100(21)*
Patient Age, Mean±S.D	*48±13*	***Household Member Age, Mean±S.D***	*43±13*
Household Income and Expenditure (ZAR)			
Average monthly household income		*3000 (USD 220)*	
Total expenditure		*2700 (USD 200)*	
Average monthly household expenditure, food		*1700 (USD 130)*	
Average monthly household expenditure, non-food		*1000 (USD 70)*	

Direct medical and direct non-medical costs

Table 2 demonstrates the estimated total costs (sum of direct and indirect costs) represented as the total costs (in the sample of 100 index patients) and average cost per index patient. Direct medical cost was estimated to ZAR 0, because all patients were exempt from medical fees. Total direct non-medical cost for outpatient and inpatient visits was estimated to be ZAR 27,000 (USD 2000)

and 29,000 (USD 2200) (respectively) over 302 and 74 encounters (respectively), an average of ZAR 270 (USD 20) and ZAR 290 (USD 20) per patient (respectively).

Indirect costs

Indirect costs incurred over the 302 outpatient encounters and 74 hospital admissions were estimated to be ZAR 41,000 (USD 3000) and ZAR 26,000 (USD 2000) (respectively), an average of ZAR 410 (USD 30) and ZAR 260 (USD 20) per patient (respectively).

Table 2. Estimated cost of RHD to patients

Cost component	***Aggregate costs among 100 participants***			***Average per-patient cost***		
	Total	***Outpatient visit n=302***	***Inpatient visit n=74***	***Total***	***Average per Outpatient***	***Average per Inpatient***
Direct medical cost	*0*	*0*	*0*	*0*	*0*	*0*
Direct non-medical	*56,000* (USD 4200)	*27,000* (USD 2000)	*29,000* (USD 2200)	*560* (USD 42)	*270* (USD 20)	*290* (USD 22)
Indirect cost	*67,000* (USD 5100)	*41,000* (USD 3000)	*26,000* (USD 2000)	*670* (USD 51)	*410* (USD 31)	*260* (USD 19)
Total cost	*123,000* (USD 9400)	*68,000* (USD 5200)	*55,000* (USD 4200)	*1230* (USD 94)	*680* (USD 52)	*550* (USD 42)

The prevalence of catastrophic health expenditure in this sample was calculated using two approaches (Table 3). The prevalence of RHD-related expenditure exceeding 10% of total household expenditure was estimated at 8%. The prevalence of RHD-related expenditure exceeding 40% of non-food expenditure was estimated at 4%.

Coping Strategies

Direct costs posed a significant burden to households, stimulating a range of coping responses among a minority of households (Table 3). Seventeen percent of households took out loans at mean of ZAR 1200 (USD 90) per loan (range ZAR 100 to ZAR 7000) (USD 7 to 500). Fifteen percent received financial gifts at an average of ZAR 800 (USD 60) per gift. Two percent sold assets valued at ZAR 5600 (USD 400) on average. Five percent engaged in multiple coping strategies.

To cope with the indirect costs of illness, 15% of household caregivers changed jobs and 10% worked extra hours. About 4% of household members dropped out of school. Four percent adopted more than one coping strategy. A considerable share of participants reported that they had reduced education to take care of the affected patient. Most of the caregivers of patients with RHD were spouses and children, and 6 % were heads of household.

The total economic value of all these coping strategies across the entire sample was estimated to be ZAR 40,000 (USD 3000), with an average per-patient economic value of coping of ZAR 1100 (USD 80).

Table 3. Coping strategies among patients with RHD

		Obs N=100	*Mean (Rand)*	*Std.Dev*	*Min*	*Max*

Strategies to cope with direct costs	*Take a loan*	*17*	*1200 (USD 90)*	*1800 (USD 130)*	*100 (USD 7)*	*7000(USD 500)*
	Gift of financial assistance	*15*	*800(USD 60)*	*600 (USD 45)*	*250(USD 19)*	*2150(USD 95)*
	Sale of property	*2*	*5600(USD 420)*	*6000 (USD 460)*	*1200(USD 91)*	*10000(USD 760)*
	Multiple	*5*	*8000(USD 600)*	*18000 (USD 1370)*	*100(USD 7)*	*7000(USD 5000)*
		Total No of HH in %	*Mean persons*	*Std dev of persons*	*Min*	*Max*
Strategies to cope with indirect costs	*Caregiver change job*	*15*	*1.9*	*0.33*	*1*	*2*
	Work extra hour	*10*	*1.9*	*0.36*	*1*	*2*
	School drop out	*4*	*1.9*	*0.30*	*1*	*2*
	Multiple	*4*	*3*	*0*	*1*	*4*

Intrahousehold Burden (Caregiver)	
Head of the household	*6*
Primary caregiver (%)	
Spouse	*39*
Own child	*31*
Mother/father	*9*
(Others)	*15*
What caregiver gave up in taking care of RHD patient….	***Frequency (n = 100)***
forgo employment	*15*
Reduced education	*44*
Work extra hour	*10*
Reduce hour work	*11*
Multiple	*3*

Total number of patients with catastrophic Spending *>10* *>40*	*8* *4*
Total economic value of coping in the sample ZAR 40,000	*Average economic value of coping mechanisms per patient ZAR 1100 (USD 80)*
Proportion of HH coded 1 for prevalence of coping (%)	*34*

Predictors of high cost and coping strategies

We performed two sets of regression analyses to explore potential predictors of high total cost (Table 4) and of the use of any coping strategies (Table 5). The number of persons with multimorbidity in a household, number of household asset and the number of inpatient admissions were found to be significantly associated with total cost; the number of inpatient admissions was found to be significantly associated with the use of one or more coping strategies. It should be noted that the study was not designed specifically to estimate any of these associations, and the small sample size and low event rate makes it quite possible that the analysis was underpowered to detect other important associations. This shows an increase in total cost at 95% confidence interval.

Table 4. Predictors of high cost

Independent variable	**Point estimate of coefficient**	**95% confidence interval of coefficient**
Age		
36-45	-0.21	[-0.39, 0.35]
46-55	0.21	[-0.21, 0.64]
55+	0.15	[-0.25, 0.56]
Patient EQ-5D score	-2.01	[-4.12, 0.09]
Household number of persons with multimorbidity	0.43	[0.23, 0.64]**
Gender		
female	-0.10	[-0.39, 0.19]
Number of inpatient admission	0.02	[0.02, 0.03]**
Education		
grade 4-6	-0.03	[-0.91, 0.84]
grade 7-12	0.16	[-0.50, 0.53]
undergraduate	0.26	[-0.79, 1.33]
Household asset measure (see text for details)	0.14	[0.05, 0 .23]**
Lack of employment	-0.13	[-0.49, 0.23]
Marital status		

Single separated/divorced/ widow/widower	-0.5 0.5	[0.01, 0.07] [-0.2, 0.3]

Table 5. Predictors of the use of a coping strategy

LIST OF COVARIATES	**POINT ESTIMATE OF BETA**	**95% CON FIDENCE INTERVAL OF BETA**
Age 36-45 46-55 55+	 -0.04 0.14 -0.09	 [-1.10, 1.01] [-1.05, 1.34] [-1.26 , 1.07]
Education grade 4-6 grade 7-12 undergraduate	 0 -1.04 0	 [-4.62, 1.04] [-2.89, 0.80] [-2.71, 3.28]
EQ-5D score	-0.15	[-0.63, 0 .33]
Household number of persons with multimorbidity	1.07	[-0.34, 2.47]
Number of inpatient admission	0.02	[0.02, 0.32]**
Lack of employment	-0.73	[-1.25, -0.20]

Marital status Single Divorced/widow/widower	 -0.34 -0.36	 [-2.05, 1.36] [-0.48, 0.64]
Household asset measure (see text for details)	-0.22	[-0.60, 0.15]
Female gender	0.09	[-0.74, 0.92]

*** is used to know if any independent variable is statistically significant at 95% CI ***

3.5. DISCUSSION

The findings confirm that RHD mostly affects productive individuals of working age, although because of their illness and conditions of poverty, unemployment is very high. This is the major finding of your work-In monetary terms, a little more than half of the total cost of RHD care was indirect, consistent with studies of other chronic diseases (Russell, 2004, Segel, 2006a, Wang et al., 2016, Ogah et al., 2014, Tharkar et al., 2010) Although the government of South Africa provides extremely low-cost health care services to low-income households, covering the cost of nearly all persons affected by RHD, the direct non-medical and indirect costs in this study were high. This finding is consistent with studies conducted in Zambia and Malawi on other health conditions: though essential health services are provided free of charge, households still incur significant costs (Russell, 2004, Lara R., 2009), Wang et al., 2016).

Direct (non-medical) costs and indirect costs of RHD were estimated to be ZAR 560 (USD 42) and ZAR 670 (USD 51) (respectively) per patient yearly. Among those pushed into financial hardship, the economic cost of coping strategies contributed an additional ZAR 1100 (USD 80). In total, the overall annual economic impact of RHD in this sample of 100 households affected by

RHD was estimated at ZAR 160,000 (USD 12000) (ZAR 1600 (USD 120) per household), representing 4.4% of annual household income or 4.9% of annual household expenditure. This is similar to a study of HIV/AIDS and tuberculosis in which annual direct costs were estimated to be between 2.5% and 7.0% of income (Russell, 2004).

This study underscores that it is insufficient to look at direct and indirect costs alone; understanding the impact of coping strategies is crucial to getting a full picture of the economic impact of illness (Sauerborn et al., 1996, Russell, 2004, McIntyre and Thiede, 2003). About 17% of households affected by RHD took out loans or engaged in other coping activities, with 5% employing more than one strategy (Sauerborn et al., 1996). Again, these findings are broadly consistent with studies of HIV/AIDS and tuberculosis that show how households struggle with direct and indirect costs and deplete assets, leading to or reinforcing poverty traps (Russell, 2004, Sauerborn et al., 1996). This study also shows that it is not just patients who are affected: significant numbers of caregivers in this study had to give up educational or employment opportunities in order to provide care. Other caregivers would work extra hours to compensate for losses elsewhere in the household or the cost of healthcare itself. Since RHD is a chronic condition, these effects on caregivers are probably long-lasting in most cases.(Segel, 2006a)

Finally, we found that the number of inpatient admissions was significantly associated with both total cost and coping strategies. This result is not surprising, since direct and indirect costs are probably correlated with length of stay, and high costs (e.g., of surgical care) are more likely to trigger coping strategies. The finding that higher levels of household multimorbidity were associated with increased total costs is less intuitive and deserves further investigation in a future study.

Study limitations

- This prevalence-based estimate looks at the current cost across a one-year period. If costs extend more than a year period, which they likely do, then incidence-based estimates will provide more robust information about costs
- This study was limited by sample size (100 participants and households), which may have led to false negative results in the regression analyses. This study only focussed on the urban area of Cape Town, so its generalisability is limited. A cross-province comparison study, capturing both rural and urban areas of South Africa, would likely lead to more representative estimates
- Recall bias due to overestimation or underestimation of indirect costs might have occurred because of over-reporting or under-reporting of time loss, particularly for events that occurred more than 30 days ago
- As it is recognized in economic evaluation literature, minimum wage might not be a true reflection of informal section in South Africa.

Policy recommendations

These findings point at clear gaps in financial protection and call for further investments not just free healthcare and disability grants, but a range of social protection programs, such as transportation subsidies, remuneration for caregivers, and remediation of lost opportunities for employment and education. These costs are likely to be substantial, and evidence is needed on which government programs are most effective and efficient at providing social protection at affordable and sustainable costs.

3.6.COMPETING INTERESTS

There was no conflict of interest for the Author

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4. POLICY BRIEF

POLICY BRIEF

The household economic impact of Rheumatic Heart Disease (RHD) in South Africa

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INTRODUCTION

Rheumatic heart disease (RHD) is a frequent cause of cardiovascular disease among children and working-age adults in LMICs. RHD results from repeated episodes of acute rheumatic fever (ARF), a delayed complication of sore throat due to group A streptococcal infection, which mostly afflicts children aged 5-14 years. The risk factors for RHD include poverty, overcrowding, malnutrition, poor sanitation, and low educational attainment, as well as poor access to primary care for treatment of sore throat. A recent systematic review of the epidemiology of RHD in South Africa found favorable trends in mortality since the 1990s, probably owing to better access to surgical care for severe disease, but persistently high rates of disease incidence and prevalence, suggesting insufficient progress on addressing the social determinants of RHD.

The study of the household economic impact of RHD is very relevant to the South African noncommunicable disease research and policy agenda. This chronic health condition disproportionately affects learners and wage-earners, so its economic impact– including its effects on educational attainment and productivity – is likely to be very high. To date, there has been no research on the household economic impact of RHD in South Africa (or other African countries,

for that matter), so the findings presented below represent a novel contribution to the literature and can inform policy and advocacy efforts.

RESEARCH OBJECTIVE

The objective of this study was to estimate the direct and indirect cost of RHD from the patient perspective and explore the impact of RHD on the economic well-being of affected households, including coping mechanisms to address the cost of RHD.

METHOD

A cross sectional cost-of-illness study from the patient perspective was conducted among 100 households affected by RHD. Index cases with RHD were identified from the REMEDY study site at Groote Schuur Hospital (GSH) in Cape Town. (REMEDY is a two-year, multi-country cohort study of patients affected by RHD.) Heads of household or other household members designated as decision-makers (i.e., able to respond to economic questions on behalf of all household members) were also included.

Two data collection instruments were designed and administered, one to the 100 index cases, and another to 100 household representatives responding on behalf of 479 household members. The average yearly cost of RHD to the household was estimated, including the breakdown between direct and indirect costs. The prevalence of coping strategies – such as intra-household labor substitution, borrowing, and selling assets – was also estimated. Predictors of cost and of coping were also assessed using regression analyses. Children were not included in this study because the REMEDY patient folders used are adult folder who could respond to contact calls and available to

be visited at their residence. Furthermore, this is the first stage of this study, further study would investigate on children and can compare both children and adult results for policy making.

FINDINGS

Estimates of direct and indirect cost

- Annual direct costs were ZAR 560 per patient. These were all non-medical costs such as food and transportation. Annual indirect costs were ZAR 670 per patient. Total annual costs were ZAR 1200 per patient. A higher number of inpatient admissions and higher levels of household chronic health conditions were predictors of higher total costs.

Coping strategies

- The prevalence of catastrophic health expenditure was between 4% and 8% depending on the method used. About 34% of households engaged in some type of coping mechanism, including taking out loans (17%), receiving gifts (15%), or selling assets (2%). Five percent of households engaged in more than one coping mechanism. The average economic value of coping strategies among those engaging in them was ZAR1100. A higher number of inpatient admissions was a predictor of engaging in coping strategies.

Other findings

- About 15% of household caregivers changed their jobs and 10% worked extra hours to provide care for individuals with RHD. Four percent dropped out of school, and another 4% gave up employment

- Most of the caregivers are spouses and children of the patient in the household and about 6 % of household head became caregiver to take care of the RHD patients. Aggregate of all HH coping strategies and average per patient in the sample was estimated by adding all the coping strategies adopted each by the caregivers to be ZAR 40000 ZAR 7000 respectively.

POLICY IMPLICATIONS

- This study underscores the importance of RHD prevention to reduce both health and economic consequences to poor households

- It also reinforces previous literature (i.e., on other diseases) on the importance of direct non-medical costs in the South African context (Meyer-Rath and Ritchie, 2007)

- These findings point at clear gaps in financial protection and call for further investments – not just free healthcare and disability grants, but a range of social protection programs, such as transportation subsidies, remuneration for caregivers, and remediation of lost opportunities for employment and education. These costs are likely to be substantial, and evidence is needed on which government programs are most effective and efficient at providing social protection at affordable and sustainable costs.

5. APPENDICES

APPENDIX A: RESEARCH QUESTIONNAIRE

HOUSEHOLD BURDEN OF RHD PILOT QUESTIONNAIRE (2017)

SECTION A: PATIENT INFORMATION	
A01. State/ province name: _____ Code ☐☐	A02. AREA name: _____ Code ☐☐
A03. EA Name: _____ Code ☐☐☐☐	A 04. EA sector: *Urban = 1, Rural = 2* ☐
A05. Household number: ☐☐	A06. Name of head of household: _____
A07. Interviewer's name: _____ Code ☐☐	A08. Supervisor's name: _____ Code ☐☐
A09. Date of interview (DD/MM/YY): ☐☐ / ☐☐ / ☐☐	
A10. Interviewer record of visits to the respondent	

Visit number	a) Date (DD/MM/YY)	b) Time started (24 hours' time)	c) Time ended (24 hours' time)	d) Interview status *(Male=1 Female= 2)*
I	☐☐ / ☐☐ / ☐☐	☐☐☐☐	☐☐ ☐☐	☐

Ii	☐☐ / ☐☐ / ☐☐	☐☐☐☐	☐☐ ☐☐	☐
Iii	☐☐ / ☐☐ / ☐☐	☐☐☐☐	☐☐ ☐☐	☐

Column d

Completed = 1, Partially completed = 2, Refused = 3, No suitable respondent at home = 4, No contact = 5

Household member number	a) Do you have any questions right now? *Yes = 1, No = 2*	b) Are you willing to proceed with this interview? *Yes = 1, No = 2*
01	☐	☐

SECTION B: DEMOGRAPHIC

Line no	**Relationship**	**Sex**	**Age**	**Employment**	**Employment**	**Marital Status**	**Ever attended school**	**Medical Aid**	**Medical Aid**	**Highest Grade**	**List of Code**
B01	**B02**	**B03**	**B04**	**B05**	**B06**	**B07**	**B8**	**B9**	**B10**	**B11**	
Members line No	What is (Name) relationship to Head of Household *(see code 1)*	Male = 1 Female = 2	How old is (NAME) in completed years? *Record "00" if <1yr If*	Are you currently employed? Yes = 1 No=2 If No = 2 (skip → B07)	Which of this best describe your work? See code 3	What is (NAME) present marital status? Married = 1 Separated/ Divorced = 2 Single = 3 Widow/widower = 4 Single parent = 5 Don't know	Has (NAME) ever attended formal school Yes = 1 No = 2	Does anyone I this household have medical aid?	Does this medical aid cover the treatment for a patient with RHD?	What is the highest grade (NAME) Completed? *(See code 2)*	**Code 1** Head = 10 Spouse = 11 Own child = 12 Stepchild =13 Grandchild = 14

			age≥ 95 record 95			= 7 No response = 9	(skip → Section C)	Yes = 1 No = 2 Don't know = 99	Yes = 1 No = 2 Don't know = 99		Mother/Father = 15 Mother/Father-in-law =16 Grandparent = 17 Maid/Nanny = 18 Non-relative = 19 Other relative = 88 Don't know = 97 No response = 99
[02]	☐☐	☐	☐☐	☐	☐	☐	☐	☐	☐	☐☐	
[03]	☐☐	☐	☐☐	☐	☐	☐	☐	☐	☐	☐☐	
[04]	☐☐	☐	☐☐	☐	☐	☐	☐	☐	☐	☐☐	
[05]	☐☐	☐	☐☐	☐	☐	☐	☐	☐	☐	☐☐	
[06]	☐☐	☐	☐☐	☐	☐	☐	☐	☐	☐	☐☐	
[07]	☐☐	☐	☐☐	☐	☐	☐	☐	☐	☐	☐☐	**Code 2** No education = 10 Foundation phase Grade R/0 = 11 Grade 1-3= 12 Intermediate phase Grade 4-6 = 13 Senior

											phase Grade 7-12 = 14 Tertiary phase Undergraduate = 15 Postgraduate = 16 Other = 88 Don't know = 97 No response = 99 **Code 3** Full time salary=1 Per time=2 Self-employed=3

SECTION C: OTHER CHRONIC HEALTH CONDITION

A list has been provided below for HH members answering question D01 (D01a-e). Household members can list more than one category if applicable

For the line below. We want to know about the health condition of specific household members. So, line A is person 1, line B is person 2……. Line E, person 5

	QUESTION	CODING CATEGORIES	ANSWER

D01	Does anyone in this house currently suffer from any one/more of this condition? HIV Cancer Diabetes Tuberculosis Heart disease Lung disease Others specify	Yes =1 No=2	☐
A		Cancer=1 Diabetes=2 Hiv=3 Tuberculosis=4 Heart disease=5 Lung disease=6 Others specify	☐☐☐ ☐
B		Cancer=1 Diabetes=2 Hiv=3 Tuberculosis=4 Heart disease=5 Lung disease=6 Others specify	☐☐☐ ☐
C		Cancer=1 Diabetes=2 Hiv=3 Tuberculosis=4 Heart disease=5 Lung disease=6 Others specify	☐☐☐ ☐
D		Cancer=1 Diabetes=2 Hiv=3 Tuberculosis=4 Heart disease=5 Lung disease=6 Others specify	☐☐☐ ☐

E		Cancer=1 Diabetes=2 Hiv=3 Tuberculosis=4 Heart disease=5 Lung disease=6 Others specify	☐☐☐ ☐

SECTION D: HOUSEHOLD INCOME

	QUESTION	CODING CATEGORIES	ANSWER
E01	How much in total wages do you receive per month?		_____ R/month
E02	How much grant do you receive per month from?		
A	*Disability grant*		_____ R/month
B	*State (South Africa government) old age grant*		_____ R/month
C	*Child support grant*		_____ R/month
D	*Foster care grant*		_____ R/month
E	*Care dependency grant*		_____ R/month
F	*War veteran pension*		_____ R/month
G	*Inheritance*		_____ R/month
I	*Sale of household good*		_____ R/month
J	*Other Specify …….*		_____ R/month
E03	How much non-grant do you receive per month from?		_____ R/month

SECTION E: HOUSEHOLD INCOME CONTINUATION

For the list E06 (A-D) below. We want to know other income earners in this household. **So, line A is person 1, line B is person 2……. Line D, person 5**

	QUESTION	CODING CATEGORIES	ANSWER
E04	Who is the primary income earner in the household?	Patient = 1 Wife/mother = 2 Husband/father = 3 Extended family = 4 Son/daughter = 5 Other (specify):……..	☐
E05	How much income does the primary income earner earn?		_____R
E06	Does anyone else earn income? If yes, list below	Yes=1 No=2	☐
A		Patient = 1 Wife/mother = 2 Husband/father = 3 Extended family = 4 Son/daughter = 5 Other (specify):……..	☐
B		Patient = 1 Wife/mother = 2 Husband/father = 3 Extended family = 4 Son/daughter = 5 Other (specify):……..	☐
C		Patient = 1 Wife/mother = 2 Husband/father = 3 Extended family = 4 Son/daughter = 5 Other (specify):……..	☐
D		Patient = 1 Wife/mother = 2 Husband/father = 3 Extended family = 4 Son/daughter = 5 Other (specify):……..	☐

E07	Was your household income substantially higher before patient was diagnosed with RHD? If No, (skip → F)	Yes= 1 No=2	☐
E08	How much more per month?		_____R

SECTION F: HOUSEHOLD ASSETS

	QUESTION	CODING CATEGORIES	ANSWER
F01	How does your household dispose sewages/ refuse?	Waste vehicle collectors=1 Public incinerator=2 Public grounds=3 Others (specify)	☐
F02	How is the drainage system in your household?	Running =1 Stagnant =2	☐
F03	What kind of toilet facility do members of your household use?	Flush to piped sewer system = 10 Flush to septic tank = 11 Flush to pit latrine = 12 Flush to somewhere else = 13 Flush, don't know where = 14 Ventilated improved pit latrine = 15 Pit latrine with slab = 16 Pit latrine without slab/open pit = 17 Composting toilet = 18 Bucket toilet = 19 Hanging toilet/hanging latrine = 20 No facility, bush, field = 21 Other = 88	☐☐
F04	Do you share this toilet facility with other households?	Yes = 1 No = 2	☐
F05	Does your household have:		

	Electricity? Radio? Television? Mobile telephone? Non-mobile telephone? Refrigerator? Cable TV? Generating set? Air conditioner? Computer? Electric iron? Fan?	Yes = 1 No = 2	Electricity ☐ Radio ☐ Television ☐ Mobile telephone ☐ Non-mobile telephone ☐ Refrigerator ☐ Cable TV ☐ Generating set ☐ Air conditioner ☐ Computer ☐ Electric iron ☐ Fan ☐
F09	What material is used to construct the floor of your house?	Earth/sand = 10 Dung = 11 Wood planks = 12 Parquet or polished wood = 13 Vinyl or asphalt strips = 14 Ceramic tiles = 15 Cement = 16 Carpet = 17 Other = 98 Don't know = 97 Refuses to respond = 99	☐☐
F10	What material is used to construct the roof of your house?	No roof = 10 Thatch/palm leaf = 11 Sod = 12 Rustic mat = 13 Palm/bamboo = 14 Wood planks = 15 Cardboard = 16 Corrugated iron sheets = 17 Metal = 18 Wood = 19 Calamine/cement fiber = 20 Other = 98 Don't know = 97	☐☐

		Refuses to respond = 99	
F11	What material is used to construct the exterior walls of your house?	No walls = 10 Cane/palm/trunks = 11 Dirt = 12 Rudimentary walls = 13 Bamboo with mud = 14 Stone with mud = 15 Uncovered adobe = 16 Plywood = 17 Cardboard = 18 Reused walls = 19 Cement = 20 Stone with limit/cement = 21 Bricks = 22 Cement blocks = 23 Uncovered adobe = 24 Wood planks/shingles = 25 Other = 98 Don't know = 97 Refuses to respond = 99	☐☐
F12	How many rooms are used for sleeping in your household?		Number of rooms ☐☐
F13	How many people sleep together in a room in your household?	One person=1 Two persons=2 Three persons=3 Four persons =4 Five persons=5 Others = 23	☐

F14	Does any member of this household own? A watch? A bicycle? A motorcycle or motor scooter? An animal-drawn cart? A car or truck? A boat with a motor? A canoe?	Yes = 1 No = 2	Watch ☐ Bicycle ☐ Motorcycle/Scooter ☐ Animal-drawn cart ☐ Car/Truck ☐ Boat with motor ☐ Canoe ☐

F15	Does any member of this household own any agricultural land?	Yes = 1 No = 2 → 17	☐
F16	How many plot/acres/hectares of agricultural land do members of this household own? IF 95 OR MORE, CIRCLE '9950'		95 or more plots/acres/hectares = 9950 Don't know = 9998 Enter amount: Plot ☐☐.☐ Acres ☐☐.☐ Hectares ☐☐.☐
F17	Does this household own any livestock, herds, other farm animals, or poultry?	Yes = 1 No = 2 → 18	☐
F18	How many of the following animals does this household own? IF NONE, ENTER '00' IF MORE THAN 95, ENTER '95' IF UNKNOWN, ENTER '98' Milk cows or bulls? Horses, donkeys, or mules? Goats? Sheep? Chickens/Ducks? Pigs? Other (specify) _____ Other (specify) _____		Cows/Bulls ☐☐ Horses/Donkeys/Mules ☐☐ Goats ☐☐ Sheep ☐☐ Chickens/Ducks ☐☐ Pigs ☐☐ Other ☐☐ Other ☐☐

SECTION GA: HOUSEHOLD EXPENDITURE (FOOD)

	QUESTION	CODING CATEGORIES	ANSWER
FOOD EXPENDITURE: *Now we would like to ask questions about some specific food that may have been eaten in the* ***LAST30 DAYS****. It should* ***not*** *include food that has been bought for resale or exchanged for commercial purposes.*			
GA01	Within the last 30 days, what was the total food expenditure of your household?	Amount Refuse Other (specify): _____	_____R
GA02	Within the last 30 days, did you receive any foodstuffs as payment	Yes = 1 No = 2 Refuse=3 Don't know = 99	☐
GA03	Within the last 30 days, did you by any chance produce /grow/ gather any foodstuffs?	Yes = 1 No = 2 Refuse=3 Don't know = 99	☐
GA04	Within the last 30 days, did you eat food from your own stock shop or bought at the mall?	Yes = 1 (own stock shop) No = 2 (stock shop) Don't know = 99	☐

		Yes = 1 (mall) No = 2 (mall) Don't know = 99	

SECTION GB: HOUSEHOLD EXPENDITURE (NON-FOOD)

*In this part of the questionnaire, we would like to ask questions about some specific household items on which the household may have spent money in the **LAST 30 DAYS** and how much was spent on these items. It should **not** include items that has been bought for resale or exchanged for commercial purposes.*

For each of the items below, tick "**none**" if nothing was spent on this item, otherwise enter the value

Line code	**QUESTION**	CB01	CG02
GB01	Within the last 30 days, what was the total non-food expenditure of your household?	Amount Refuse Other (specify): _____	_____R
	Transport Cost:	Within the last 30 days, did anybody in the household spend money on [...]?	

		If No, skip to next. Yes	No	In the last 30 days, how much was spent on [...]? Amount in Rands
a	Car payments excluding insurance	1	2	
b	Petrol, oil and car service	1	2	
c	Buses, taxis, trains and air tickets including transport to school, work etc.	1	2	
	Energy, water and municipal rates			
d	Water	1	2	
e	Electricity	1	2	
f	Other energy sources such as wood, paraffin, charcoal/coal, candles, gas, purchasing/charging batteries and diesel oil for generators	1	2	

g	Levies, for example sectional title, share block and timeshare	1	2	
h	Municipal rates	1	2	
	Household items:			
i	Kitchen equipment, like pots and pans, cutlery and crockery	1	2	
j	Home maintenance and repairs to the dwelling	1	2	
k	Bedding, sheets, blankets and towels	1	2	
	Miscellaneous:	1	2	
l	Washing powder, dishwashing liquid, polish and all household cleaners	1	2	
m	Religious and membership dues of organisations, donations to charity	1	2	

n	Pets	1 2	
o	Others specify	1 2	

HOUSEHOLD EXPENDITURE CONTINUATION

GBO2	What was the total food expenditure of this household in the last 30 days?	Amount=1 Refuse=09 Don't know=3	_____R
GB03	Would you say the total food expenditure for this household in the last 30 days was		
a	More than or less than R1200?	More than =01 About equal =02 Less than =03 Refused =04 Don't know=99	☐
b	More than or less than R750?	More than =01 About equal =02 Less than =03 Refused =04 Don't know=99	☐
c	More than or less than R500?	More than =01 About equal =02 Less than =03	☐

		Refused =04 Don’t know=99	
d	More than or less than R750?	More than =01 About equal =02 Less than =03 Refused =04 Don’t know=99	☐
e	More than or less than R 1800?	More than =01 About equal =02 Less than =03 Refused =04 Don’t know=99	☐
f	More than or less than R 3000?	More than =01 About equal =02 Less than =03 Refused =04 Don’t know=99	☐
g	More than or less than R5000?	More than =01 About equal =02 Less than =03 Refused =04 Don’t know=99	☐

SECTION H: INTRAHOLUSEHOLD BURDEN (CAREGIVING)

	QUESTION	CODING CATEGORIES	ANSWER
H01	Who is the primary caregiver of the person with RHD in this household?		See code 1
H02	What did the caregiver give up to take care of the RHD patient?	School Job Reduced education Others specify	_____
H03	Did the primary caregiver had to forgo his/her employment or work to become a caregiver to the RHD patient?	Yes = 1 No = 2 Don't know = 99	☐

H04	As the person significantly reduced the number of hour worked to be a caregiver?	Yes = 1 No = 2 Don't know = 99	If No/ don't know >>I01 ☐
H05	If answer to question H03 is YES, How Much? If NO, (skip → Section I)		_____R
H06	Has anyone else in the house had to take an extra job or work or extra hour to compensate for the RHD patient?		☐

SECTION I: HOUSEHOLD COPING STRATEGIES

	QUESTION	CODING CATEGORIES	ANSWER
I01	What kind of coping strategies has the household member put in place		Take a job

	Drop out of school _____ Other please specify		
In the last 12 month, has your household had to do any of this thing (……) due to the patient with RHD?			
I02	Spend savings?	Yes = 1 No = 2 Don't know = 99	☐ How much? _____R
I03	Borrowed from financial institutions or agencies (microfinance schemes, banks…)?	Yes = 1 No = 2 Don't know = 99	☐ How much? _____R
I04	Sold items (land, property, furniture, livestock, jewellery…)?	Yes = 1 No = 2 Don't know = 99	☐ How much? _____R
I05	Borrow from relatives or friends from outside the household?	Yes = 1 No = 2 Don't know = 99	☐ How much? _____R

I06	Spend current income of any household members (salaries, pensions, paid benefits…)?	Yes = 1 No = 2 Don't know = 99	☐ How much? _____R
	What other impacts does RHD has on your household financially or economically?	_____	

APPENDIX: A Individual Patient burden of RHD SURVEY

INDIVIDUAL BURDEN OF RHD QUESTIONNAIRE (2017)

SECTION A: PATIENT INFORMATION	
A01. State/ province name: _____ __	A02. AREA name: _____

Code ☐☐	Code ☐☐
A03. EA Name: _____ ____ Code ☐☐☐☐	A 04. EA sector: *Urban = 1, Rural = 2* ☐
A05. Household number: ☐☐	A06. Name of head of household: _____ _____
A07. Interviewer's name: _____ Code ☐☐	A08. Supervisor's name: _____ Code ☐☐
A09. Date of interview (DD/MM/YY): ☐☐ / ☐☐ / ☐☐	
A10. Interviewer record of visits to the respondent	

Visit number	a) Date (DD/MM/YY)	b) Time started (24 hours' time)	c) Time ended (24 hours' time)	d) Interview status *(Male/Female)*
i	☐☐/☐☐/☐☐	☐☐☐☐	☐☐☐☐	☐
ii	☐☐/☐☐/☐☐	☐☐☐☐	☐☐☐☐	☐
iii	☐☐/☐☐/☐☐	☐☐☐☐	☐☐☐☐	☐

Column d

Completed = 1, Partially completed = 2, Refused = 3, No suitable respondent at home = 4, No contact = 5

Individual member number	a) Do you have any questions right now? *Yes = 1, No = 2*	b) Are you willing to proceed with this interview? *Yes = 1, No = 2*
201	☐	☐

ECTION B: DEMOGRAPHIC

B01	Sex	Male=1 Female=2	☐
B02	What is your date of birth?		_ __/__ __/__ __ __ __ (day/month/year)
B03	Marital Status	Married=1 Living with partner=2 Single/never married=3 Widow/widower=4 Separate=5 Divorced=6 Other specify=99	☐
B04	**Ever attended school**	Has (NAME) ever attended formal school Yes = 1 No = 2 (skip → B07a)	☐

B05	**Highest Grade**	What is the highest grade (NAME) Completed? No education = 10 Foundation phase Grade R/0 = 11 Grade 1-3= 12 Intermediate phase Grade 4-6 = 13 Senior phase Grade 7-12 = 14 Tertiary phase Undergraduate = 15 Postgraduate = 16 Other = 88 Don’t know = 97 No response = 99	☐

B06a	**Employment**	Are you currently employed? Yes = 1 No=2 If No, (skip →Section C)	☐
B06b	**Employment**	Which of this best describe your work? Full time salary=1 Per time=2 Self-employed=3	☐

SECTION C: DISABILITY (EQ-5D)

By placing a tick in one box in each group below, please indicate which statements best describe your own health state today.

Mobility

I have no problems in walking about ☐

I have some problems in walking about ☐

I am confined to bed ☐

Self-Care

I have no problems with self-care ☐

I have some problems washing or dressing myself ☐

I am unable to wash or dress myself ☐

Usual Activities (*e.g. work, study, housework, family or leisure activities)*

I have no problems with performing my usual activities ☐

I have some problems with performing my usual activities ☐

I am unable to perform my usual activities ☐

Pain/Discomfort

I have no pain or discomfort ☐

I have moderate pain or discomfort ☐

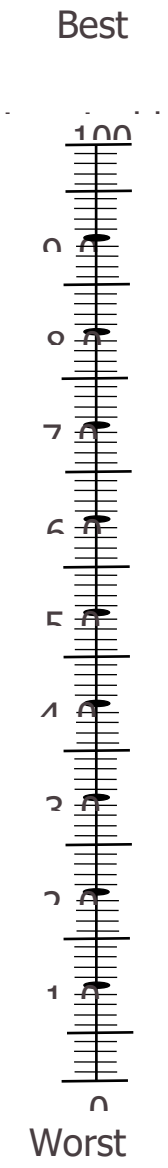
I have extreme pain or discomfort ☐

Anxiety/Depression

I am not anxious or depressed ☐

I am moderately anxious or depressed ☐

I am extremely anxious or depressed ☐



To help people say how good or bad a health state is, we have drawn a scale (rather like a thermometer) on which the best state you can imagine is marked 100 and the worst state you can imagine is marked 0.

We would like you to indicate on this scale how good or bad your own health is today, in your opinion. Please do this by drawing a line from the box below to whichever point on the scale indicates how good or bad your health state is today.

Your own health state

SECTION D: INDIVIDUAL PATIENT INCOME, EXPENDITURES AND MEDICAL AID

	QUESTION	CODING CATEGORIES	ANSWER
D01	How much in total wages do you receive per month?		_____ R/month
D02	How much grant do you receive per month from?		
A	*Disability grant*		_____ R/month
B	*State (South Africa government) old age grant*		_____ R/month
C	*Child support grant*		_____ R/month
D	*Foster care grant*		_____ R/month
E	*Care dependency grant*		_____ R/month

F	*War veteran pension*		_____ R/month
G	*Inheritance*		_____ R/month
I	*Sale of household good*		_____ R/month
J	*Other Specify …….*		_____ R/month
D03	How much non-grant do you receive per month from?		_____ R/month
D04	**MEDICAL AID**		
A	Do you have medical aid cover?	Yes = 1 No = 2 Don't know = 99	☐
B	Is your medical aid sufficient for the treatment of RHD?	Yes = 1 No = 2 Don't know = 99	☐
C	Do you face any challenge related to your medical aid cover?		_____

SECTION E: INPATIENT COSTS

	QUESTION	CODING CATEGORIES	ANSWER
E01	"To your knowledge, have you been hospitalized for RHD within the past 12 months?"	Yes = 1 No = 2 Don't know = 99	☐
If answer to question E01 is YES>> question 2. If NO, >> section F			
E02	Thinking back to your most resent hospitalization for RHD,		
A	Approximately when were you admitted (month/year) and discharged (month/year)		_____month/year
B	Do you pay out of pocket (OOP) for your RHD hospitalization?	Yes = 1 No = 2 Don't know = 99	☐

	How much in total do you pay OOP for you RHD hospitalization ?		_____R
C	How much was spent on,	Laboratory test (blood, scan, x-tray etc)	_____ R
		Consultation (doctors visit)	_____ R
		Hospitalization (No of bed)	_____ R
		Drug supply	_____ R
C	How much was spent on,…	Transport	_____ R
		Accommodation	_____ R
		Food cost	_____ R
Da	On average, how many hours/days of work did you miss during you visit to the hospital?		_____ hours
B	Did anyone accompany	Yes = 1	☐

	you to the hospital during your last visit?	No = 2	
C	Did the accompany person missed school/work because of this hospital visit?	Yes = 1 No = 2	☐
D	On average how much did the accompanying person lost per hour for staying with you		_____ R
E03	Thinking about the last hospitalization before that one,		
A	Approximately when were you admitted (month/year) and discharged (month/year)		_____(month/year)
B	Do you pay out of pocket (OOP) for your RHD hospitalization?	Yes = 1 No = 2 Don't know = 99	☐

	How much in total do you pay OOP for you RHD hospitalization ?		_____R
B	Approximately how much was spent in sub-total on (question **D03C)** below?		_____ R
C	How much was spent on	Laboratory test (blood, scan, x-tray etc.)	_____ R
		Consultation (doctors visit)	_____ R
		Hospitalization (No of bed)	_____ R
		Drug supply	_____ R
C	How much was spent on.	Transport	_____ R
		Accommodation	_____ R

		Food cost	_____ R
Da	On average, how many hours/days of work did you miss during you visit to the hospital?		_____ hours
B	Did anyone accompany you to the hospital during your last visit?	Yes = 1 No = 2	☐
C	Did the accompany person missed school/work because of this hospital visit?	Yes = 1 No = 2	☐
D	On average how much did the accompanying person lost per hour/days for staying with you		_____ R
E04	Thinking back to the hospitalization before that,		
A	Approximately when were you admitted (month/year) and		_____month/year

	discharged (month/year)		
B	Do you pay out of pocket (OOP) for your RHD hospitalization ?	Yes = 1 No = 2 Don't know = 99	☐
	How much in total do you pay OOP for you RHD hospitalization ?		_____R
B	How much was spent on.	Laboratory test (blood, scan, x-tray etc)	_____ R
		Consultation (doctors visit)	_____ R
		Hospitalization (No of bed)	_____ R
		Drug supply	_____ R
C	How much was spent on.	Transport	_____ R

		Accommodation	_____ R
		Food cost	_____ R
Da	On average, how many hours/days of work did you miss during you visit to the hospital?		_____ hours
B	Did anyone accompany you to the hospital during your last visit?	Yes = 1 No = 2	☐
C	Did the accompany person missed school/work because of this hospital visit?	Yes = 1 No = 2	☐
D	On average how much did the accompanying person lost per hour/days for staying with you		_____ R
E05	Thinking back to the hospitalization before that,		

A	Approximately when were you admitted (month/year) and discharged (month/year)		_____month/days
B	Do you pay out of pocket (OOP) for your RHD hospitalization ?	Yes = 1 No = 2 Don't know = 99	☐
	How much in total do you pay OOP for you RHD hospitalization ?		_____R
B	How much was spent on.	Laboratory test (blood, scan, x-tray etc.)	_____ R
		Consultation (doctors visit)	_____ R
		Hospitalization (No of bed)	_____ R
		Drug supply	_____ R

C	how much was spent on,	Transport	_____ R
		Accommodation	_____ R
		Food cost	_____ R
Da	On average, how many hours/days of work did you miss during you visit to the hospital?		_____ hours
B	Did anyone accompany you to the hospital during your last visit?	Yes = 1 No = 2	☐
C	Did the accompany person missed school/work because of this hospital visit?	Yes = 1 No = 2	☐
D	On average how much did the accompanying person lost per hour/days for staying with you		_____ R

EO 6	Thinking about the last hospitalization before that one,		
A	Approximately when were you admitted (month/year) and discharged (month/year)		_____month/year
B	Do you pay out of pocket (OOP) for your RHD hospitalization ?	Yes = 1 No = 2 Don't know = 99	☐
	How much in total do you pay OOP for you RHD hospitalization ?		_____R
B	How much was spent on,	Laboratory test (blood, scan, x-tray etc)	_____ R
		Consultation (doctors visit)	_____ R
		Hospitalization	_____ R

		(No of bed)	
		Drug supply	_____ R
C	how much was spent on,	Transport	_____ R
		Accommodation	_____ R
		Food cost	_____ R
Da	On average, how many hours/days of work did you miss during you visit to the hospital?		_____ hours
B	Did anyone accompany you to the hospital during your last visit?	Yes = 1 No = 2	☐
C	Did the accompany person missed school/work because of this hospital visit?	Yes = 1 No = 2	☐
D	On average how much did the accompanying		_____ R

	person lost per hour/days for staying with you		

SECTION F: CLINIC VISITS

	QUESTION	CODING CATEGORIES	ANSWER
F01	have you been to clinic for RHD in the past 12 months	Yes = 1 No = 2 Don't know = 99	☐
If answer to question F01 is YES>> question 2. If NO, >> section G			
F02	Thinking back to your most recent clinic visit…		
A	What month/year did you visit?		_____month/year
B	Do you pay out of pocket (OOP) for your RHD clinic visit?	Yes = 1 No = 2 Don't know = 99	☐

	How much in total do you pay OOP for you RHD clinic visit?		_____R
B	How much was spent on	Laboratory test (blood, scan, x-tray etc)	_____ R
		Consultation (doctors visit)	_____ R
		Hospitalization (No of bed)	_____ R
		Drug supply	_____ R
C	How much was spent on.	Transport	_____ R
		Accommodation	_____ R
		Food cost	_____ R
Da	On average, how many hours/days of work did you miss during you		_____ hours

	visit to the hospital?		
B	Did anyone accompany you to the clinic during your last visit?	Yes = 1 No = 2	☐
C	Did the accompany person missed school/work because of this hospital visit?	Yes = 1 No = 2	☐
D	On average how much did the accompanying person lost per hour/days for staying with you		_____ R
F03	Thinking about the last clinic visit before that one		
A	What month/year did you visit?		_____month/year
B	Do you pay out of pocket (OOP) for your RHD clinic visit?	Yes = 1 No = 2 Don't know = 99	☐

	How much in total do you pay OOP for you RHD clinic visit?		_____R
B	How much was spent on	Laboratory test (blood, scan, x-tray etc)	_____ R
		Consultation (doctors visit)	_____ R
		Hospitalization (No of bed)	_____ R
		Drug supply	_____ R
C	How much was spent on.	Transport	_____ R
		Accommodation	_____ R
		Food cost	_____ R
Da	On average, how many hours/days of work did you miss during you visit to the hospital?		_____ hours

B	Did anyone accompany you to the hospital during your last visit?	Yes = 1 No = 2	☐
C	Did the accompany person missed school/work because of this hospital visit?	Yes = 1 No = 2	☐
D	On average how much did the accompanying person lost per hour/days for staying with you		_____ R
F04	Thinking about the last visit before that one,		
A	what month/year did you visit?		_____month/year
B	Do you pay out of pocket (OOP) for your RHD clinic visit?	Yes = 1 No = 2 Don't know = 99	☐

	How much in total do you pay OOP for you RHD clinic visit?		_____R
B	how much was spent on	Laboratory test (blood, scan, x-tray etc.)	_____ R
		Consultation (doctors visit)	_____ R
		Hospitalization (No of bed)	_____ R
		Drug supply	_____ R
C	how much was spent on.	Transport	_____ R
		Accommodation	_____ R
		Food cost	_____ R
Da	On average, how many hours/days of work did you miss during you visit to the hospital?		_____ hours
B	Did anyone accompany you to the hospital	Yes = 1 No = 2	☐

	during your last visit?		
C	Did the accompany person missed school/work because of this hospital visit?	Yes = 1 No = 2	☐
D	On average how much did the accompanying person lost per hour/days for staying with you		_____ R
F05	Thinking about the last visit before that one,		
A	what month/year did you visit?		_____month/year
B	Do you pay out of pocket (OOP) for your RHD clinic visit?	Yes = 1 No = 2 Don't know = 99	☐
	How much in total do you pay OOP for you		_____R

	RHD clinic visit?		
		Consultation (doctors visit)	_____ R
		Hospitalization (No of bed)	_____ R
		Drug supply	_____ R
C	how much was spent on,	Transport	_____ R
		Accommodation	_____ R
		Food cost	_____ R
Da	On average, how many hours/days of work did you miss during you visit to the hospital?		_____ hours
B	Did anyone accompany you to the hospital during your last visit?	Yes = 1 No = 2	☐
C	Did the accompany person missed school/work	Yes = 1 No = 2	☐

	because of this hospital visit?		
D	On average how much did the accompanying person lost per hour/days for staying with you		_____ R

SECTION G: COPING STRATEGIES

	QUESTION	CODING CATEGORIES	ANSWER
G01	In the past year, have you ever had to take out a loan to pay for medical expenses related to RHD?"	Yes =1 No = 2 Don't know=99	☐
G02	how much was the loan worth?		_____ R
G03	Does the loan have interest?	Yes =1 No = 2 Don't know=99	☐ If No >> K06
G04	What is the interest rate on the loan? (%)		_____%

G05	Did you receive gifts or financial assistance from friends and family?	Yes =1 No = 2 Don't know=99	☐
G06	If answer to K06 is Yes, Was it a loan or a gift?	Loan=1 Gift=2	☐
G07	How much does the loan/gift worth?		_____ R
LABOUR SUBSTITUTION			
G07	Did your caregiver had to change their job or take another one in other to pay for your medical care?	Yes =1 No = 2 Don't know=99	☐
G08	Did anyone in your family had to work extra hour to pay for the medical care?	Yes =1 No = 2 Don't know=99	☐
G09	Does anyone have to drop out of school and take a job to assist in the payment?	Yes =1 No = 2 Don't know=99	
ASSETS			
G10a	Have you sold any of your property to finance the cost of the RHD illness?	Yes =1 No = 2 Don't know=99	☐
G10b	If Yes, what did you sell?	Land = 1 Livestock = 2	☐☐☐

	Mark the most appropriate	Transport/vehicle = 3 Household item = 4 Farm produce =5 Other (specify):	
C	What is the estimated market value of the property you sold?		_____ R
D	How much did you earn from the sale of your property?		_____ R
G11	Does the caregiver lose time when taking of RHD patient in this household?	Yes =1 No = 2 Don't know=99	☐ If NO >> G13
G12	How do you make up for the time loss? Please specify		_____
G13	Is there anything else you'd like to tell me about?	_____	

APPENDIX B: Official letter of ethical approval from University of Cape Town Faculty of Health Sciences Research Ethics Committee

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room 253-46 Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6492
Email: sumayah.arlefdien@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

07 August 2017

HREC REF:435/2017

Dr O Alaba
Health Economics Unit
Public Health & Family Medicine
Falmouth Building-FHS

Dear Dr Alaba

PROJECT TITLE: THE HOUSEHOLD BURDEN OF RHEUMATIC HEART DISEASE (RHD) IN SOUTH AFRICA -(Master's candidate-Dr O Oyebamiji) sub-study linked to 028/2006

Thank you for your response letter, addressing the issues raised by the Human Research Ethics Committee (HREC).

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

Approval is granted for one year until the 30 August 2018.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

We acknowledge that the student: - Dr O Oyebamiji will also be involved in this study.

Please quote the HREC REF in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for **all** studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval before the research may occur.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE

Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938

HREC 435/2017

This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Convention on Harmonisation Good Clinical Practice (ICH GCP), South African Good Clinical Practice Guidelines (DoH 2006), based on the Association of the British Pharmaceutical Industry Guidelines (ABPI),and Declaration of Helsinki (2013) guidelines.
The Human Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

APPENDIX C: UCT IRD ASAP ETHICAL APPROVAL 2007

UNIVERSITY OF CAPE TOWN

Health Sciences Faculty
Research Ethics Committee
Room E53-24 Groote Schuur Hospital Old Main Building
Observatory 7925
Telephone [021] 406 6338 • Facsimile [021] 406 6471
e-mail: preaward@curr.uct.ac.za

13 January 2006

REC REF: 028/2006

Prof SM Mayosi
Department of Medicine

Dear Prof Mayosi

PAN AFRICAN SOCIETY OF CARDIOLOGY RHEUMATIC FEVER/RHEUMATIC HEART DISEASE PREVENTION PROGRAMME IN AFRCAN NATIONS: THE ASAP PROJECT

Thank you for submitting your study to the Research Ethics Committee for review. It is a pleasure to inform you that the committee has formally approved the above mentioned study. Authorisation to establish a RF/RHD registry and to establish a South African Demonstration site in Cape Town is granted.

Please quote the REC. REF in all your correspondence.

Yours sincerely

PROF. T ZABOW
CHAIRPERSON

Signed by candidate

kbrown