TREATMENT SEEKING BEHAVIOUR AFTER THE ONSET OF FEVER AMONG UNDER-FIVE CHILDREN IN DODOMA REGION, TANZANIA

Telemu Kassile

PhD (Economics) Dissertation
University of Dar es Salaam
October 2015

TREATMENT SEEKING BEHAVIOUR AFTER THE ONSET FEVER AMONG UNDER-FIVE CHILDREN IN DODOMA REGION, TANZANIA

By

Telemu Kassile

A Dissertation Submitted in Partial Fulfilment of the Requirements for the Degree of Doctor of Philosophy (Economics) of the University of Dar es Salaam

University of Dar es Salaam
October 2015

CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance by the University of Dar es Salaam a dissertation entitled: ***Treatment Seeking Behaviour after the Onset of Fever among Under-five Children in Dodoma Region, Tanzania***, in partial fulfilment of the requirements for the degree of Doctor of Philosophy (Economics) of the University of Dar es Salaam.

.....

Prof. Razack Lokina

(Supervisor)

Date: 13 Oct. 2015

.....

Prof. Phares Mujinja

(Supervisor)

Date: 13th October 2015

DECLARATION

AND

COPYRIGHT

I, **Telemu Kassile,** declare that this dissertation is my own original work and that it has not been presented and will not be presented to any other University for a similar or any other degree award.

Signature.....

ACKNOWLEDGEMENTS

I wish to earnestly thank the Lord for His blessings in my life thus far and more specific for giving me the opportunity to pursue Doctoral studies at the University of Dar es Salaam. Special appreciations are due to my supervisors Prof. Razack Lokina and Prof. Phares Mujinja. Their constructive critiques and enthusiastic guidance across stages from inception of proposal development through writing of the dissertation are well appreciated. Whenever I thought of their zest felt that I needed to read as many as possible literature in almost every aspect of my research study. I remain extremely grateful to their helpful comments all through the pursuit of my PhD dissertation.

This study would have not reached this stage without the information provided by the respondents who freely chose to participate in the study. The precious time they spent responding to the questions during the course of data collection is exceptionally appreciated. Special thanks are due to the ward/village executive officers as well as hamlet/ten-cell leaders in all the study districts for facilitating the implementation of data collection in their respective local administrative units. Many thanks should go to the Regional Administrative Secretary (RAS) for Dodoma region for granting permission for the study to be done there. I feel indebted for the assistance made by the research assistants. Their devotion and perseverance throughout the data collection process are invaluably appreciated. I wish to memorize their names: Edson Mwangosi,

Elipokea Sarakikya, Gaston Mbilinyi, Imani Salim, John Jonas, Lewanga Msafiri, Ngutunyi Chacha, Ngutunyi Joseph, and Nyirezu Gulinja.

A study involving household survey requires careful design and for this reason and in heart feelings, I recognize the constructive comments and suggestions given by Dr. Godwin M. Naimani on the preliminary draft of sampling scheme for my research proposal that shed light for me to have a sound design. In this connection, I also extend thanks to Dr. James M. Ciera for furnishing me with very useful literature, which gave me a deep understanding on how to execute sample size calculation for my study.

Special thanks to my employer (Sokoine University of Agriculture-SUA) firstly, for granting me permission to pursue PhD studies. Secondly, for financing my studies at the University of Dar es Salaam (UDSM) through the Institutional Transformation and Capacity Building component of the Programme for Agricultural and Natural Resources Transformation for Improved Livelihoods (PANTIL). In this regard, I extend my earnest gratitude to the PANTIL Steering Committee for its confidence in granting me the scholarship whose results will immensely benefit the students, the wider university community, and the nation at large. In addition, I acknowledge with gratitude the African Economic Research Consortium (AERC) through the Bill and Melinda Gates Foundation Attachment Grant for awarding me a grant that enabled me carry out a one-year academic attachment at the Ministry of Health and Social Welfare (MoHSW) Headquarters in Dar es Salaam. In connection to this financial support, I am thankful to

the then Director of Policy and Planning and Acting Permanent Secretary of MoHSW, Ms. Regina. L. Kikuli for accepting my request for place of attachment at the Ministry. This opportunity resulted into several practical gains in my PhD research work. Many thanks are also sent to Mr. Honest Anicetus, MoHSW for his questions and critical comments while I was attached at the MoHSW. He enlightened me to understand key issues relating to malaria research, especially those addressing under-five children in the context of Tanzania.

My wife Dr. Nyangi Chacha tirelessly prayed for me and encouraged me throughout my engagement in this PhD work. My children Mercy and Kassile missed my closest care and endured this condition throughout the whole period of my class work, fieldwork, and time for writing this dissertation.

The list of people from whom I have benefited much in one way or another in my PhD studies is too long to finish. To mention some, I would like to recognize the lecturers and all staff members in the Department of Economics at the UDSM and at the Joint Facility for Electives (JFE) organized by AERC for their academic and administrative support. However, on behalf, let me mention the following: Profs. Adolf Mkenda, Ammon V.Y. Mbelle, Asmerom Kidane, Festus O. Egwaikhide, Fidelis P. Mtatifikolo, Godius Kahyarara, Kevin Denny, Humphrey P.B. Moshi, Nehemiah E. Osoro, Richard Watuwa, Robert Mabele, Tafah Edokat, Kidane, and Tomson Ogwang; Drs. Aloyce S. Hepelwa, Badayi Sani, Eliab G. Luvanda, Elizabeth J. Z. Robinson, Eva Deuchert, Joel

Silas, Jehovaness Aikaeli, Otieno Osoro, and Rosalia Vazquez-Alvarez. Fellow students in the Collaborative PhD Programme in Economics at the UDSM and at JFE are also deeply thanked for their support and encouragements during the course of my PhD studies. Finally yet importantly, I am deeply indebted to Dr. Mubyazi for his helpful comments and suggestions on the previous draft of the dissertation. Comments and suggestions given by participants during the advanced seminar for my PhD study at the Department of Economics, UDSM are all highly appreciated.

DEDICATION

This work is dedicated to all people who are devoted in fighting against childhood illnesses in all resource-poor settings around the world, Tanzania inclusive and to my family, relatives, and friends.

LIST OF ABBREVIATIONS

ACT	Artemisinin-based Combination Therapy
ADDOs	Accredited Drug Dispensing Outlets
AERC	African Economic Research Consortium
AIC	Akaike Information Criteria
CHBM	Children's Health Belief Model
DHS	Demographic and Health Survey
FBOs	Faith-Based Organisations
GLMM	Generalized Linear Mixed Models
HBM	Health Belief Model
HBS	Household Budget Survey
ICC	Intra-class Correlation
IIPS	International Institute for Population Sciences
IMCI	Integrated Management of Childhood Illness
IMR	Infant Mortality Rate
IPD	Inpatient Department
IRS	Indoor-residual spraying
ITNs	Insecticide Treated Nets
JFE	Joint Facility for Electives
LRT	Likelihood Ratio Test
MCA	Multiple Correspondence Analysis
ML	Maximum Likelihood

MLM	Multilevel Modelling
MNL	Multinomial Logit
MoHSW	Ministry of Health and Social Welfare
MoS	Measure of Size
MQL	Marginal Quasi-likelihood
NBS	National Bureau of Statistics
NMMTSP	National Malaria Medium-Term Strategic Plan
NMNL	Nested Multinomial Logit
OPD	Outpatient Department
PANTIL	Programme for Agricultural and Natural Resources Transformation for Improved Livelihoods
PCA	Principal Component Analysis
PHB	Preventive Health Behaviour
PHC	Population and Housing Census
PPS	Probability Proportional to Size
PQL	Penalized Quasi-likelihood
PSUs	Primary Sampling Units
RAS	Regional Administrative Secretary
RBM	Roll Back Malaria
REML	Restricted or Residual Maximum Likelihood
REPL	Restricted or Residual Pseudo-likelihood
SES	Socio-economic Status

SRS	Simple Random Sampling
SRSWR	Simple Random Sampling Without Replacement
SSA	sub-Saharan Africa
SSU	Secondary Sampling Unit
SUA	Sokoine University of Agriculture
TDHS	Tanzania Demographic and Health Survey
THDR	Tanzania Human Development Report
THMIS	Tanzania HIV/AIDS and Malaria Indicator Survey
TPB	Theory of Planned Behaviour
TSAM	Tanzania Service Availability Mapping
TSPA	Tanzania Service Provision Assessment
U5MR	Under-five Mortality Rate
UDSM	University of Dar es Salaam
WHO	World Health Organisation

ABSTRACT

Fever is a major indicator of malaria and one of the frequently reported causes of under-five children caretakers' visits to health care facilities. Timely recognition and management of malaria with an effective drug is an essential element of control of the disease. In Tanzania, despite improvement in access to health care services, still many people seek care when it is too late or not at all. This study examined caretakers' responses to an episode of fever among under-five children in Dodoma region. Data on treatment seeking behaviour of caretakers of 1390 under-five children from 1027 households were collected using a structured questionnaire. Multilevel modelling and duration analysis approaches were employed. The findings show that 329 (23.7 percent) of the total children in the study had fever within the previous four weeks preceding the date of the survey. Of these, 74.8 percent were perceived by their caretakers to have some chances for harmful effects of fever to occur. Secondary education and above of caretakers was associated with decreased beliefs about the occurrence of harmful effects of fever. Meanwhile, 54 percent of the 287 children with fever whose caretakers sought treatment received medical care late. Major factors associated with delayed medical care seeking include number of under-five children in the household, relationship of child to head of household, place of residence, and distance to health facility. Study findings suggest that programmes to improve family planning and access to health facilities are required for better healthcare and development of children. This includes empowering caretakers with the ability to deal with febrile illnesses and ensuring constant supply of essential drugs especially in lower-level public health facilities.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Fever continues to be a public health problem of major concern in sub-Saharan Africa (SSA) (Nnedu *et al.*, 2010). It is one of the most important causes for caretakers of under-five children to visit health care facilities (Alex-Hart and Frank-Briggs, 2011; Demir and Sekreter, 2012; Walsh and Edwards, 2006). It is a frequently reported symptom in many childhood illnesses (Oshikoya and Senbanjo, 2008) including malaria, diarrhoea, pneumonia, measles, polio, and tuberculosis (Novignon and Nonvignon, 2012). However, malaria accounts for the majority of the childhood fever in many developing countries particularly in SSA (Uzochukwu *et al.*, 2008).

According to the World Health Organisation (WHO), in 2013, 198 million cases and 584,000 deaths of malaria occurred worldwide. The burden of malaria is particularly huge in the WHO African Region, where an estimated 90 percent of all malaria deaths occur, and largely among under-five children who account for 78 percent of all deaths (WHO, 2014).

In Tanzania, statistics from national representative surveys show that malaria prevalence has decreased from 18.1 percent in 2008 to 9.5 percent in 2012. During the same period, malaria prevalence among under-five children in Dodoma region declined from 12.5

percent in 2008 to 2.5 percent in 2012 (Table 1.1). Children in rural areas are about three times more likely to have malaria parasites than their counterparts in urban areas are (THMIS, 2013).

Since 1970s, there have been several initiatives designed with a view to improving the coverage and quality[1] of public health services. Masanja *et al.* (2008) note for example, that between 1999 and 2004 a number of important improvements, which were geared towards achieving a gain in child survival took place. These improvements include scaling-up of integrated management of childhood illness (IMCI) strategy, insecticide treated nets (ITNs), vitamin A supplementation, immunization, and exclusive breastfeeding, amongst others (Masanja *et al.*, 2008). In this respect, the family and community component of the IMCI emphasize on facilitating communities to promptly recognize and seek suitable care for childhood illnesses (Ukwaja *et al.* 2012). These interventions have been associated to overall reduction in both infant and under-five mortality rates in Tanzania (Masanja *et al.*, 2008).

Notwithstanding the observed notable decline, malaria continues to be a major and challenging disease that demonstrates close linkages between ecosystems, livelihoods, and health systems (Mboera *et al.*, 2013). It remains to be the leading cause of morbidity

[1] Quality is generally a difficult concept to quantify. However, in quality of life studies, it often entails different types of measures mostly of ordinal type and, which may not necessarily have same interpretation across different groups of people and contexts (Lindsey, 2001). However, in the context of health care availability of child-specific services, medical doctors, functioning equipment, beds, and essential drugs, among others, have been frequently used to proxy quality (for details on different dimensions of quality see for example, Lavy *et al.*, 1996; Asenso-Okyere *et al.* (1996); Mwabu *et al.*, 1993; Canaviri, 2007; Wagstaff *et al.*, 2004).

and mortality rates officially reported especially among under-five children (MoHSW, 2011).

Table 1.1: Prevalence of fever and malaria in Dodoma and Mainland Tanzania

Prevalence of fever (percent)		Children 6-59 months who tested positive for malaria (percent) according to RTD[2]		
Dodoma	Mainland Tanzania	Dodoma	Mainland Tanzania	Source
27.9	24.2	n.a	n.a	TDHS (2005)
19.5	19.0	12.5	18.1	THMIS (2008)
32.2	23.0	n.a	n.a	TDHS (2011)
7.1	20.5	2.5	9.5	THMIS (2013)

Most malaria-related deaths occur at home without receiving relevant medical care, and when care is sought, it is often delayed (Mwenesi, 2005). Several factors have been identified to affect the utilization of health care services in developing countries. The factors that are often cited in the literature include health care seeking behaviour and socio-economic status (SES) (Getahun *et al.*, 2010). For children, the success of malaria control is dependent mostly on the behaviour of their primary caretakers (McCombie, 1996). In addition, the success of malaria control in the under-five children depends on the understanding and participation of their caretakers (Okoko and Yamuah, 2006). Moreover, the involvement of caretakers in malaria control activities is dependent on a multifaceted and indistinct interaction between cultural factors on one hand and malaria-related knowledge, attitude, and practice on the other hand (ibid).

[2] n.a means not applicable. The survey did not measure the presence of malaria pasites among children age 6-59 months.

For health conditions particularly those which can progress to severe and fatal complications within few hours of onset of symptoms, timing of the decision to seek medical care is necessary (Teerawichitchainan and Phillips, 2008). This is especially important in low-income countries where promoting access to and utilization of health care services is one of the primary policy objectives (Sepehri *et al.*, 2008). A review by Pokhrel and Sauerborn (2004) revealed that many empirical studies on health care services utilization in developing countries have focused relatively more attention on factors related to choice of type of health care provider conditional on the illness (Pokhrel and Sauerborn, 2004). Whereas proper health care seeking decision-making has the potential of reducing mortality among children, timely and proper health care seeking in an event of illness has been identified as one of the practices in which there is the least intervention experience (Hill *et al.*, 2003).

This study examined caretakers' treatment seeking behaviour after the onset of fever among under-five children. It focused on perceptions of caretakers with different socio-economic status on the harmful effects of fever in under-five children. Understanding how critical SES-related factors are associated with caretakers' beliefs about the harmful effects of fever can increase our understanding of the actual pathways underlying the observed parental responses to an episode of suspected malaria infection. In addition, the study examined factors associated with delay in treatment seeking among under-five children with fever.

Important questions in this study were: (i) Why some caretakers are better able to recognize symptoms of illnesses than others are? (ii) When individuals are confronted with similar symptoms, why do some caretakers interpret or perceive the symptoms as indicative of an illness and others do not? (iii) Why would other caretakers recognize that some symptoms need professional or non-professional care? (iv) How long (in relation to the WHO's recommendation of treating malaria within 24 hours of symptom onset) do the majority of caretakers of under-five children wait before first seeking treatment or advice for fever in Dodoma region? (v) What prompts the decision to seek health care? Is it perceived severity of symptom or expected consequences (morbidity or mortality, social or economic) or both? (vi) Is there greater promptness in seeking treatment for fever than in seeking treatment for other febrile illnesses? Adapted from Heller (1982) is the question: are the principal consumers of health care services for under-five children being the households in which the symptoms are perceived to be severe? In the viewpoint of the present study, all these questions could be broadly summarized into one question and this is: When do primary caretakers of under-five children seek treatment for symptoms of malaria?

1.2 Statement of the Research Problem

In an attempt to improve health outcomes, especially of vulnerable groups, Tanzania provides free health services for children under the age of five and pregnant women in all government/public health facilities (James *et al.*, 2005; Savigny *et al.*, 2004; Mubyazi *et al.*, 2010). The removal of user fees has been noted to increase services utilization

especially among the poor in many countries in recent years (Johnson *et al.*, 2012). In addition, access to health services has been improved in the country (MoHSW, 2006)[3].

Despite of the above, statistics show that many people in Tanzania still do not seek medical care or do so when it is too late (MoHSW, 2006). For example, latest estimates from the 2011-2012 Tanzania HIV/AIDS and Malaria Indicator survey show that of the under-five children with fever and who took an antimalarial drug, only 38 percent received the drug within 24 hours of onset of fever. Policies aimed to expand access to and use of existing prevention, management, and control measures are recommended towards a successful reduction of the burden of malaria (Kramer *et al.* 2009). Moreover, it is widely acknowledged that interventions, which increase individuals' involvement in medical care and which increase knowledge of symptoms and outcomes will ease appropriate health care seeking and services use (Shaw *et al.*, 2008). In the context of Tanzania, there is a dearth of evidence as to why there are still delays in seeking treatment for an illness episode of a suspected malaria infection among under-five children. Meanwhile, perception of caretakers with different socio-economic status on the harmful outcome of fever among under-five children has not been addressed. Therefore, the present study was designed with a view to filling the identified knowledge gap.

[3] Access to health services has been improved in different ways. According to Tanzania Service Provision Assessment (TSPA, 2007) in most parts of the country, a significant proportion of the population live within 5 km from a health facility.

1.3 Research Objectives

1.3.1 General Objective

The main objective of the study was to examine caretakers' treatment seeking behaviour after the onset of fever among under-five children in Dodoma region, Tanzania.

1.3.2 Specific Objectives

The specific objectives of the study were to:

(i) Examine socioeconomic differences in beliefs about the harmful outcomes of fever among under-five children;

(ii) Determine the extent of delay in treatment seeking for fever among under-five children; and

(iii) Determine factors associated with delay in treatment seeking for fever among under-five children.

1.4 Hypotheses

The study endeavoured to test the following hypotheses that are clustered within the decision-making process of the demand for health care framework:

(i) Caretakers who do perceive their under-five children as being likely to experience the harmful effects of fever differ from those who do not in major socioeconomic characteristics.

(ii) The majority of caretakers of under-five children in Dodoma region do not seek treatment for fever within 24 hours of symptom onset.

(iii) Caretakers who do seek early care for fever for their under-five children differ in socio-demographic and economic characteristics from those who do not.

(iv) Believing that fever is a sign of a severe illness is associated with promptness in seeking treatment for under-five children.

(v) Household and community socioeconomic characteristics are associated with promptness in treatment seeking for fever for under-five children.

(vi) There is greater promptness in seeking treatment for fever than in seeking treatment for other febrile illnesses.

1.5 Significance of the Study

The present study has three significant purposes. The first is to contribute knowledge to the existing literature on the subject of treatment seeking behaviour for under-five children in an event of a suspected malaria infection. The second is to demonstrate the extent of socioeconomic differences in beliefs about the occurrence of harmful effects of fever in under-five children and the extent to which perceptions of malaria symptoms influence caretakers' decision-making process with emphasis on treatment seeking delays. This information would provide useful insights into the designing of effective intervention programmes or strategies aiming at promoting efficient utilization of health care resources in the communities. In addition, knowledge on what affects prompt health care seeking for fever can equally guide the designing of interventions geared towards reducing severe morbidity and chances of mortality among under-five children through

ensuring timely health care given the context in which the decisions are made. The third and last purpose is that since factors that influence individuals' decisions in circumstances of an illness may vary across geographical and cultural contexts even within a country, thus the findings of this study may provide a basis for a widespread study in the country on the aspects examined in the present study.

1.6 Limitations of the Study

Interpretations of the results of the present study are subject to several limitations. The first and most pronounced limitation is associated with the study design. Because of the cross-sectional nature of the study, it was not feasible to estimate causal-and-effect-effect relationships, hence make casual inferences about the relationship between the dependent variables and a set of explanatory variables used in the study. For example, it is not definite if the observed treatment seeking behaviour of caretakers in the study was the same before the study was undertaken or would remain the same after the study.

The second limitation is related to the measurement (reliance on caretakers' reports of past events) of fever. In this situation, the reported responses are likely not to be free from elements of subjectivity as Sepehri *et al.* (2008) noted. As argued elsewhere, the responses might be subject to recall bias (Pillai *et al.*, 2003). In this respect, other authors have argued that recall bias may vary depending on caretakers' level of education and economic status (Kahabuka *et al.*, 2013). Accordingly, in the absence of medical examination, the reported incidences of malaria-related illnesses in this study

may be overestimates of the actual values in Dodoma region. Overdiagnosis and treatment of malaria has been reported in several African countries including Nigeria (Oladosu and Oyibo, 2013), Tanzania (Reyburn *et al.*, 2004; Chandler *et al.*, 2008; Harchut *et al.* 2013) and Mozambique (Hume *et al.*, 2008). However, other authors such as Andaleeb (2008) have argued that health-related events such as hospital visit for treatment represent very important events, which cannot be easily forgotten.

The third limitation is associated with generalization of the study findings to all regions in Tanzania. Although the study utilized a probability and a representative sample of districts in Dodoma region, hence, the findings can be generalizable at the regional level; the same findings cannot be generalized at the national level. This is primarily because it is not certain if the health-related behaviours of caretakers, characteristics of households, and communities included in this study are generalizable to all caretakers, households, and communities countrywide in Mainland Tanzania.

1.7 Organisation of the Rest of the Dissertation

The rest of the dissertation is organized as follows. Chapter 2 provides an overview of the levels and trends in malaria prevention and case management in under-five children in Dodoma region. Chapter 3 examines socioeconomic differences in beliefs about the harmful outcomes of fever among under-five children. Chapter 4 provides an examination of the extent of delay in treatment seeking for fever among under-five children. Chapter 5 presents an examination of factors associated with delay in treatment

seeking for fever among under-five children. Chapter 6 concludes the study, provides policy implications based on the findings of the study, and gives areas for further study.

CHAPTER TWO

AN OVERVIEW OF MALARIA PREVENTION AND MANAGEMENT IN UNDER-FIVE CHILDREN IN DODOMA REGION

2.1 Introduction

The overarching objective of this chapter was to provide an understanding of the levels and trends in prevention and management of fever in under-five children in Dodoma region relative to the Roll Back Malaria (RBM) initiative. Where appropriate, a comparison with national (Mainland Tanzania) coverage was carried out with a view to providing an understanding of regional inequality in the two aspects (prevention and case management) of interest in this chapter. That is, the goal was to provide an understanding of whether progress in the prevention and management of fever among under-five children is achieved uniformly across regions in Tanzania.

In view of the above account, in this chapter, the progress of two malaria related indicators: number of under-five children sleeping under an ITN the previous night and number of under-five children with fever receiving antimalarial medicines timely were examined. Specifically, the chapter focused on examining the magnitude of the gap between ownership and use of ITNs among under-five children and the percentage of under-five children with fever getting appropriate treatment timely in the context of Dodoma region.

However, in order to understand malaria prevention and management in Dodoma region in particular and treatment seeking behaviour in general, it is important first to understand the region itself. For that reason, the burden of malaria in Dodoma region relative to other regions in Mainland Tanzania is provided first. This is given in terms of morbidity and mortality. In addition, a summary of the RBM initiative is presented.

2.2 Burden of Malaria in Dodoma Region

In Dodoma region, as in many regions in Mainland Tanzania, malaria accounts for most cases of morbidity and mortality among children under the age of five. It is the leading disease in both the outpatient department (OPD) and in the inpatient department (IPD) as Figure 2.1 illustrates. However, relative to other regions, statistics from MoHSW (2006) show that Dodoma region was ranked second in terms of admission due to malaria as a proportion of total admission in health facilities. However, in the same year, the region was ranked first in terms of deaths due to the disease as a proportion of total deaths in the health facilities (Figure 2.2). Moreover, Statistics from MoHSW (2006) show that between 2003 and 2004 deaths due to malaria increased from 34.3 percent in 2003 to 36.4 percent in 2004. While many factors may influence hospital admission decision, the disease state of the patient is fundamental to the outcome of the decision (Mason *et al.*, 1980). This observation has a long appearance in the health care services utilization literature. Rubenstein *et al.* (1969) argue that higher admission rate among children signifies that those who are hospitalized are brought to the health facilities when they are more seriously ill. Early medical care helps to reduce the chance of progression of the

illness to severe stages (Espino and Manderson, 2000). Moreover, timely health care has a positive effect on the management of the disease, which in turn decreases the likelihood of occurrence of adverse health events such as death (ibid). High admission coupled with high death rates due to malaria in health facilities motivated the choice of the study area.

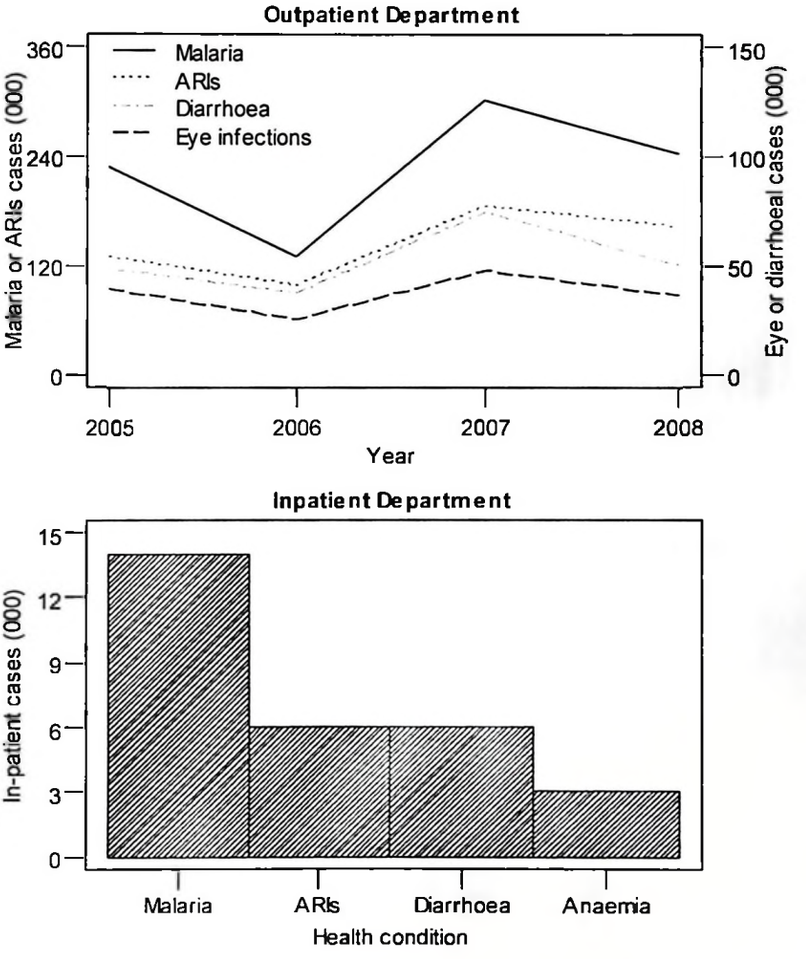


Figure 2.1: OPD and IPD cases for top four illnesses for under-five children in Dodoma, 2010

Source: Own drawing based on data from Dodoma Regional Hospital Annual Report (2010)

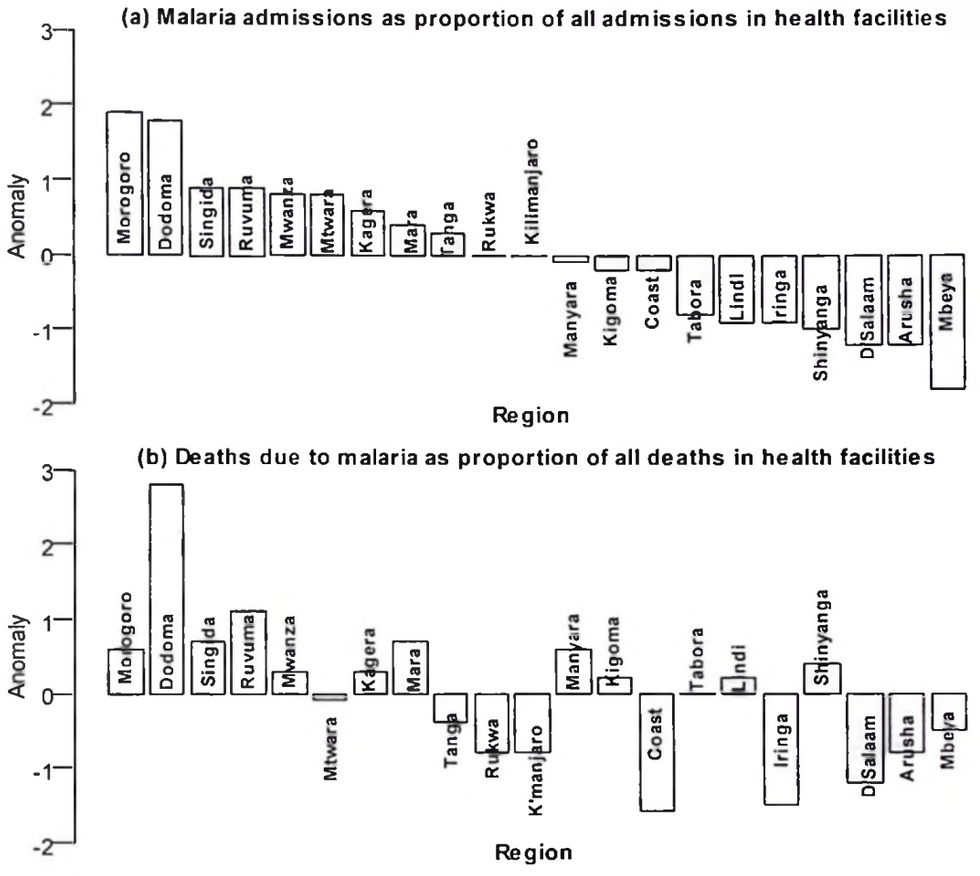


Figure 2.2: Proportion of admissions and deaths due to malaria in health facilities, 2004

Source: Own drawing based on data from MoHSW (2006)

The most common malaria infection is *Plasmodium falciparum* (Mboera *et al.*, 2006). This is equally the case in most positive cases of malaria (Ngasala *et al.*, 2011; Mazigo *et al.*, 2011). *P. falciparum* is one of the four species of the genus *Plasmodium* that causes malaria to humans. Other species are *P. vivax, P. malariae,* and *P. ovale* (Crawley and Nahlen, 2004). *Plasmodium falciparum*, which causes the most severe form of malaria and which can lead to death if not properly dealt with has been growing relative to the other species (Anyanwu, 2007). Availability of each specific vector

species in an area is dependent on certain environmental conditions that make possible for both the mosquito and parasite to survive (Stresman, 2010).

Figure 2.3 gives the distribution of malaria cases (disaggregated into uncomplicated-first y-axis and severe-second y-axis) among under-five children and five years and above population in the OPD in 2009 in Dodoma region. As evident in the figure, among under-five children, uncomplicated malaria cases were higher in April and less in July, August, and September. On the other hand, severe malaria cases among this group were much high in May and June and comparatively less in July and August. A comparable trend for both uncomplicated and severe malaria is also observed for the five years and above population.

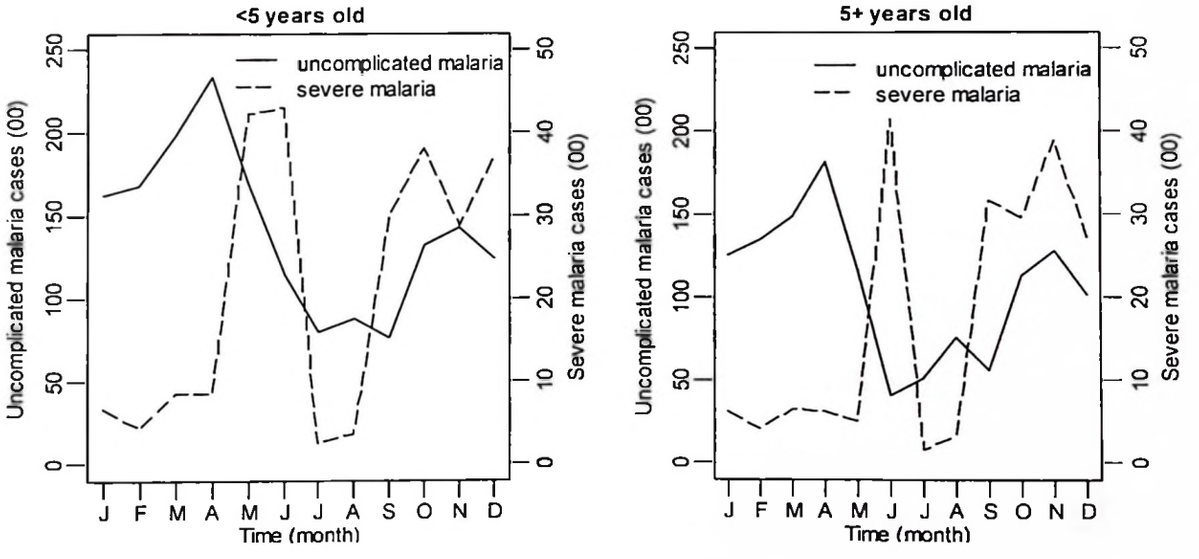


Figure 2.3: Monthly distribution of outpatient malaria cases in Dodoma, 2009

Source: Own drawing based on data from Dodoma Regional Hospital Annual Report (2010)

In terms of health facility utilization in situations of illnesses, statistics from MoHSW (2010) show that Dodoma region was ranked fifth among the regions with low OPD attendances per capita in Mainland Tanzania in 2009. Its OPD per capita value was 0.52 versus 0.74 that of Mainland Tanzania. The first four ranked regions (value) with lowest OPD per capita were Kagera (0.23), Mbeya (0.44), Manyara (0.46), and Rukwa (0.47) (MoHSW, 2010).

2.3 Child Mortality

Infant mortality rate (IMR) and under-five mortality rate (U5MR) are outcomes that are frequently used to measure the distribution and use of resources in a society (Haines, 1995; Jhamba, 1996). Therefore, differential rates in these (IMR and U5MR) aspects across communities are an indication of inequality in socioeconomic well-being in the respective societies. Figure 2.4 plots IMR and U5MR per 1,000 live births in Dodoma. It is revealed from the figure that the regional rates are generally above the national (overall) rates for both infant and under-five and that, the rates seem to vary across administrative units within the region. For example, while infant and under-five mortality rates in 2002 were 70 and 110, and 94 and 153 deaths per 1,000 live births in Kondoa and Dodoma urban districts respectively, the corresponding figures in Mpwapwa and Dodoma Rural districts were 128 and 217 and 142, and 239 respectively.

The observed differential rates in infant and under-five mortality between districts (Figure 2.4) in the region could be due to inequality in access to health care services,

both within and between administrative units. Mboera *et al.* (2006) examine the relationship between malaria parasitaemia and availability of healthcare facilities among school children aged between 5.9 to 12.3 years in Mpwapwa district in Dodoma. The authors (ibid) found that children in areas in which there was a health facility were about one-third less likely to acquire malaria than those living in areas without a health facility.

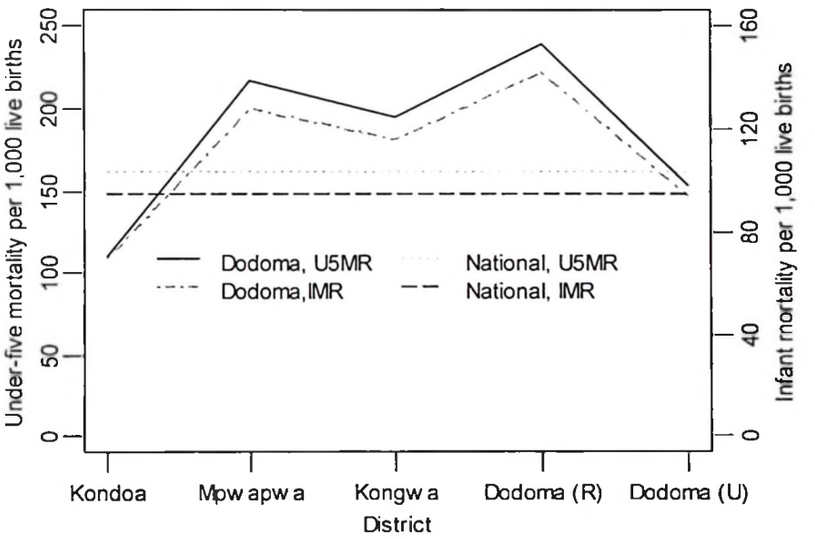


Figure 2.4: Spatial distribution of infant and under-five death rates in Dodoma, 2002

Source: Own drawing based on data from Research and Analysis Working Group (2005) and (TDHS, 2011)

2.4 Incidence of Poverty

As observed chapter 1, SES of individuals in a given context is one of the commonly reported factors that affect the utilization of health care services. In this regard, it was

considered important to understand how Dodoma region ranks relative to other regions in terms of incidence of incidence of poverty[4]. As Figure 2.5 shows, Dodoma region has the highest level (83.0 percent) of incidence of poverty, followed by Lindi region with an incidence of poverty level of 81.9 percent. Dar es Salaam, Kilimanjaro, and Arusha have the lowest three levels of incidence of poverty (Figure 2.5).

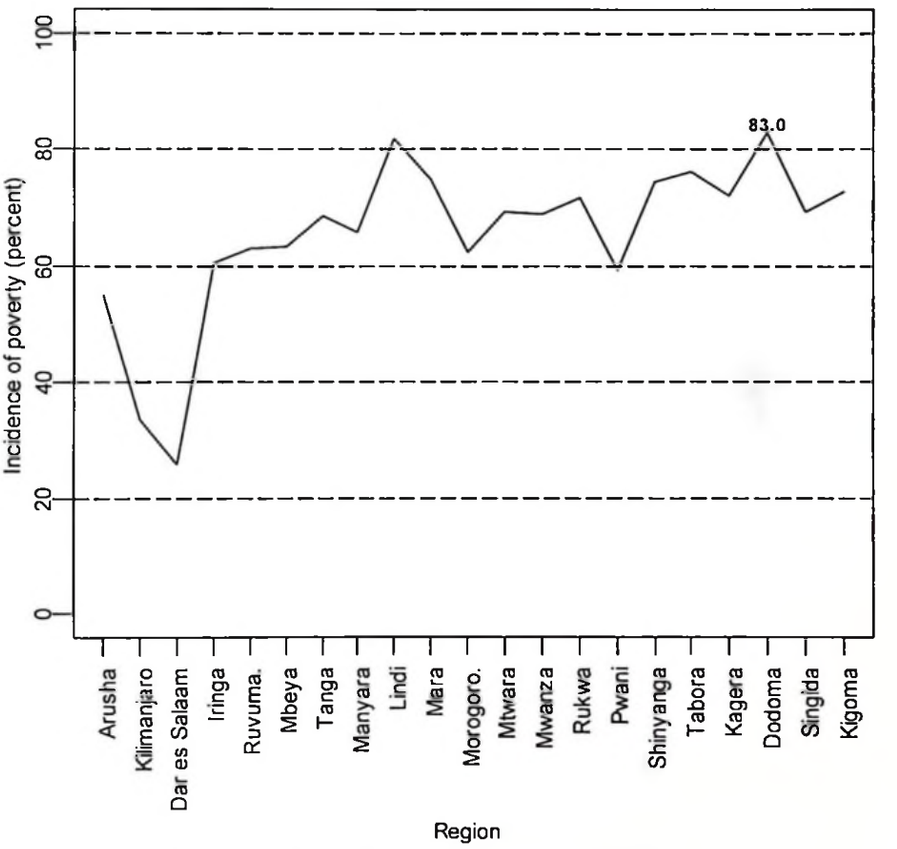


Figure 2.5: Incidence of poverty in Mainland Tanzania, 2010

Source: Own drawing based on data from Tanzania Human Development Report (THDR, 2014)

[4] According to THDR (2014), incidence of poverty (H) is defined as "percentage of the population with a weighted deprivation score of at least 33.3 percent. The measure is known as multidimensional poverty headcount."

2.5 The Roll Back Malaria Initiative

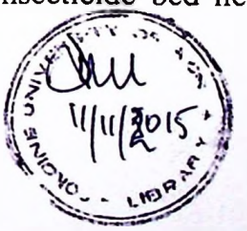
In an attempt to address the huge global public health problem represented by malaria in malaria-endemic countries of the world particularly in Africa, in 1998, WHO launched the RBM partnership. In this linkage, millions of dollars from international donor agencies have been donated for research and malaria control activities. In order to rapidly reduce malaria-related mortality in Africa, several strategies have been approved by the RBM initiative including prompt appropriate treatment of fever (Holtz *et al.*, 2003). This global focus of attention to fight against the disease has evolved at the era when the notions of decentralized health care and community participation have turned out to be integral components of disease prevention and management strategies worldwide (Williams and Jones, 2004).

Commitment of African leaders to fight against malaria in countries affected with the disease is reflected in the Abuja Declaration, following the African Summit on Roll Back Malaria held in Abuja, Nigeria in 2000. In this declaration, African heads of state and delegates dedicated themselves to ensuring that malaria mortality for Africa's people is halved by the year 2010 by implementing strategies and actions for RBM. Among the elements (indicators for monitoring) of the plan of action of the Abuja Declaration to RBM, include[5]: disease prevention- percentage of children under the age of five sleeping under ITNs; and disease management-percentage of high-risk people

[5] Roll Back Malaria/World Health Organization WHO/CDS/RBM/2003.46, *The Abuja Declaration and the Plan of Action,* www.rbm.who.int/docs/abuja_declaration.pdf retrieved on Monday, 2nd January, 2012

with malaria attack getting appropriate treatment, primarily with artemisinin-based combination therapy (ACT) in eight hours.

While awaiting a major scientific breakthrough to achieve success in eradicating malaria, it is widely acknowledged that use of ITNs is an indispensable strategy for preventing malaria among people most at risk of infection with the disease (Yakob *et al.*, 2010; Killeen *et al.*, 2007; Diallo *et al.*, 1999). Use of ITNs has been adopted by the RBM initiative as a key instrument for the achievement of its malaria control objectives (Ehiri *et al.*, 2004). This is particularly the case because it has been convincingly established that ITNs reduce a considerable proportion of malaria-related morbidity and mortality (Trigg and Wernsdorfer, 1999). The preventive efficacy of ITNs has been reported in a number of settings. Gosoniu *et al.* (2008) provide a critical examination of literature, showing that proper use of ITNs can result in a 17 percent reduction in child mortality and approximately halve clinical cases of malaria in endemic areas in Africa. For example, in Gambia, Greenwood (1999) notes that individual differences in the use of bed nets was observed to be a major cause of variations in the incidence of malaria within and between communities. Thus, this notable variation triggered the introduction of bed nets as a malaria-control intervention in other communities. In Zanzibar, scaling-up of malaria control activities especially ITNs, indoor-residual spraying (IRS), and ACT has led to reduction of malaria transmission (Aregawi *et al.*, 2011; WHO, 2010). Otten *et al.* (2009) examine the impact of scale-up of malaria prevention and treatment with reference to mass distribution of long-lasting insecticide bed nets (LLIN) to all



under-five children or all households and countrywide distribution of ACT in the public sector. Reductions of 55 and 67 percent in in-patient malaria cases and deaths respectively in under-five children were observed in Rwanda. The corresponding statistics in Ethiopia were 73 and 62 percent respectively (ibid).

Significant financial resources from various sources including the Global Fund to Fight AIDS, Tuberculosis and Malaria, the World Bank, the US President's Malaria Initiative, and bilateral donors have become available in recent years than before (O'Meara *et al.*, 2010). One area, which has received significant financial resources is concerned with attaining high coverage of critical malaria control interventions in malaria-endemic countries, particularly in SSA, where the burden of malaria is enormous. ITNs, IRS, ACT, and intermittent preventive treatment of malaria during pregnancy are WHO recommended promotion, management and control interventions for malaria (WHO, 2008). ITNs and IRS prevent malaria infection by reducing the possibility of an individual to be bitten by a malaria-carrying mosquito (Eisele *et al.*, 2010). ACT on the other hand, provides long lasting clinical treatment thus preventing progression of uncomplicated malaria to severe disease and death (Koram *et al.*, 2005). As part of its global strategic plan, in 2005 the RBM initiative set a goal of achieving 80 percent coverage of locally suitable malaria control measures such as ITNs by the year 2010 (Dunn *et al.*, 2011). Beginning 2005 through 2009, numerous countries made a significant progress in scaling-up of prevention intervention programmes (Steketee and Campbell, 2010).

Use of effective malaria control measures has been reported to reduce malaria-related burden in several parts of SSA in recent years (Moss *et al.*, 2012). In Tanzania, reductions in the burden of malaria have been achieved in several parts of the country including Zanzibar (Aregawi *et al.*, 2011), Tanga region (Mmbando *et al.*, 2010), and Pemba (Jaenisch *et al.*, 2010). However, Moss *et al.* (2012) note further that reductions in the burden of malaria in some African regions have not been achieved uniformly.

The MoHSW in Mainland Tanzania, in response to regional and global commitments to reduce the burden of malaria, has set the 2008-2013 National Malaria Medium-Term Strategic Plan (NMMTSP). The NMMTSP puts emphasis on five strategic approaches. These are namely: malaria diagnosis and treatment; malaria prevention supportive strategies; surveillance, monitoring, and evaluation; behavioural change communication and community-based malaria control; and regional/district support and capacity building (MoHSW, 2009).

According to the Tanzania Service Provision Assessment Survey 2006 (TSPA, 2007) scaling-up of malaria control interventions has been one of the priority areas in recent years. In this respect, as an attempt to prevent new cases of malaria in the population, an ITN's policy was adopted in Tanzania in November 2000 (ibid). In order to rapidly scale-up ownership and use of ITNs across communities especially in the lowest income categories, several strategies were adopted. These include social marketing of ITNs, commercial sector, private sector participation, and voucher scheme, targeting mainly

pregnant women and infants, and beginning late in 2008, a free net distribution (under-five coverage campaign) for all under-five children across all regions in the country (TSPA, 2007; Magesa *et al.*, 2005). Also, as in other countries in Africa, and because of resistance of *P. falciparum* to chloroquine and some sulfadoxine-pyrimethamine (Fansidar) first-line drug has been changed to currently ACT (Mubyazi and Gonzalez-Block, 2005).

However, with ITNs, Rhee *et al.* (2005) caution that increasing access to ITNs does not necessarily increase their utilization. Several factors have been found to predict utilization of ITNs. In Nigeria, Oresanya *et al.* (2008) found that the presence of a health facility within the community, religion and wealth index by caregiver's education were among the predictors of use of ITN among under-five children. A cross-country study evaluating bed net use and non-use in five countries found that in all five countries studied, levels of ownership or possession of ITNs were higher than use among children under the age of five (Eng *et al.*, 2010). Mboera *et al.* (2008) examined the relationship between malaria and mosquito net utilisation among schoolchildren in villages with or without health care facilities at different altitudes in Iringa District, Tanzania. The authors found that mosquito net coverage was associated with availability of healthcare services (ibid). Maslove *et al.* (2009) provide a systematic review of qualitative studies on obstacles to the effective treatment and prevention of malaria in Africa. Insufficient understanding of the cause and transmission of malaria, the belief that malaria cannot be prevented, and the use of inefficient prevention practices were the most reported barriers

to the effective prevention of malaria especially in children in Africa. Maslove and colleagues hence concluded that large-scale malaria control programmes must take into account the social and contextual factors of the places in which the intervention programmes are being implemented. As regards to use of antimalarials for fever presumed to be malaria, a study by Glik *et al.* (1989) in Guinea found that socio-cultural, individual, and structural factors were important determinants of use of antimalarials by mothers and their young children.

2.6 Data source

In order to achieve the objective in this chapter, statistics from technical reports of nationally representative household-based surveys were used. Specifically, data from the 2004-2005 and 2010 Tanzania Demographic and Health Surveys (TDHS) and 2007-2008 and 2011-2012 Tanzania HIV/AIDS and Malaria Indicator Surveys (THMIS) that were undertaken between 2002 and 2012, and which included a component on malaria or ownership and use of ITNs were used. A restriction to these surveys was made in acknowledging the fact that surveys such as TDHS and THMIS are nationally representative, and as observed by Okiro and Snow (2010) are generally powered to give sufficient precision in malaria control intervention coverage such as ITNs at regional level. In addition, data collections for these studies were executed in comparable periods (or seasons) in the respective years. That is, October 2004-February 2005 (TDHS, 2005), October 2007-February 2008 (THMIS, 2008), December 2009-May 2010 (TDHS, 2011), and December 2011-April 2012 (THMIS, 2013) and adopted same

sample design. With this restriction, the analysis of the data aimed at reducing variations in the estimates that could be attributed to differences in methodology and timing of data collection between surveys. On the other hand, the period between 2002 and 2011 was considered since this period overlay closely to the National Malaria Medium Term Strategic Plans, 2002-2007, and 2008-2013 (MoHSW, 2009).

2.7 Malaria Prevention and Case Management

Malaria prevention involves use of drugs (*prophylaxis*) and other prevention tools for example, ITNs, and IRS, among others (Mwenesi, 2005). Case management reflects individuals' response in situations of a suspected malaria infection. Malaria case management prevents the progression of the disease from mild to severe disease, which may lead to death if not properly dealt with (Lalchhuanawma and Murhekar, 2012). It also shortens the durations of symptoms and limits the spread of the disease to other people (ibid). Factors related to ITN availability, acceptability, affordability, and determinants of utilization at household and at community levels have been widely explored in the social sciences research as for example documented by Mwenesi (2005).

2.7.1 Levels and Trends in Ownership and Use of ITNs

Figure 2.6 gives the levels and trends in ownership and use of ITNs in Dodoma region contrasted with national estimates. As seen in the figure, between the 2004/05 and the 2007/08 surveys, the proportion of households with at least one ITN in the region increased by about 15 percent. That is, increased from 13.4 percent in the 2004/05

survey to 28.2 percent in the 2007/08 survey. The percentage of households with at least one ITN reported in the 2010 survey is about 72 percent, resulting into a shortfall of 8 percent between the 2010 coverage to the RBM 2010 target of 80 percent. However, the proportion of households with at least one ITN increased to about 93 percent in the 2011/12 survey. Overall, there was a gain in coverage of 79.4 percent between the 2004/05 and the 2011/12 surveys or 21 percent between the 2010 and the 2011/12 surveys.

In terms of use of ITNs by under-five children in Dodoma region, the findings revealed that between the 2004/05 and 2007/08 surveys, there was a gain in coverage of 7.3 percent. That is, increasing from 5.6 percent in the 2004/05 survey to 12.9 percent in the 2007/08 survey. The resulting percentage gain in use of ITN among under-five children in the study area between the 2007/08 and the 2010 surveys is 66.2 percent. Between the 2010 and the 2011/12 surveys, the proportion of under-five children who slept under an ITN the preceeding night decreased by 4.5 percent. That is, it dropped from 79.1 percent that was reported in the 2010 TDHS to 74.6 percent found in the 2011/12 THMIS.

Overall, as evidenced in Figure 2.6, both ownership and use of ITNs among under-five children display increasing trends, but at different rates. The magnitude of the gap between households' ownership and use of ITNs among under-five children in Dodoma region especially after the 2007/08 survey appears to be constant. The observed steep increase in households' ownership of ITNs between the 2007/08 and the 2011/12

surveys could be attributed partly to the under-five coverage campaign mentioned previously.

A comparison between the regional (Dodoma) and national (Mainland Tanzania) trends in both households' ownership of at least one ITN and use among under-five children show that the Dodoma region has, on average, high coverage rates than the overall (Mainland Tanzania), suggesting existence of differential rates in the two aspects between regions in Mainland Tanzania. The implication of the observed percentage gain particularly in use of ITNs on cases of malaria (indicated by fever) among under-five children in Dodoma region is discussed in the next section.

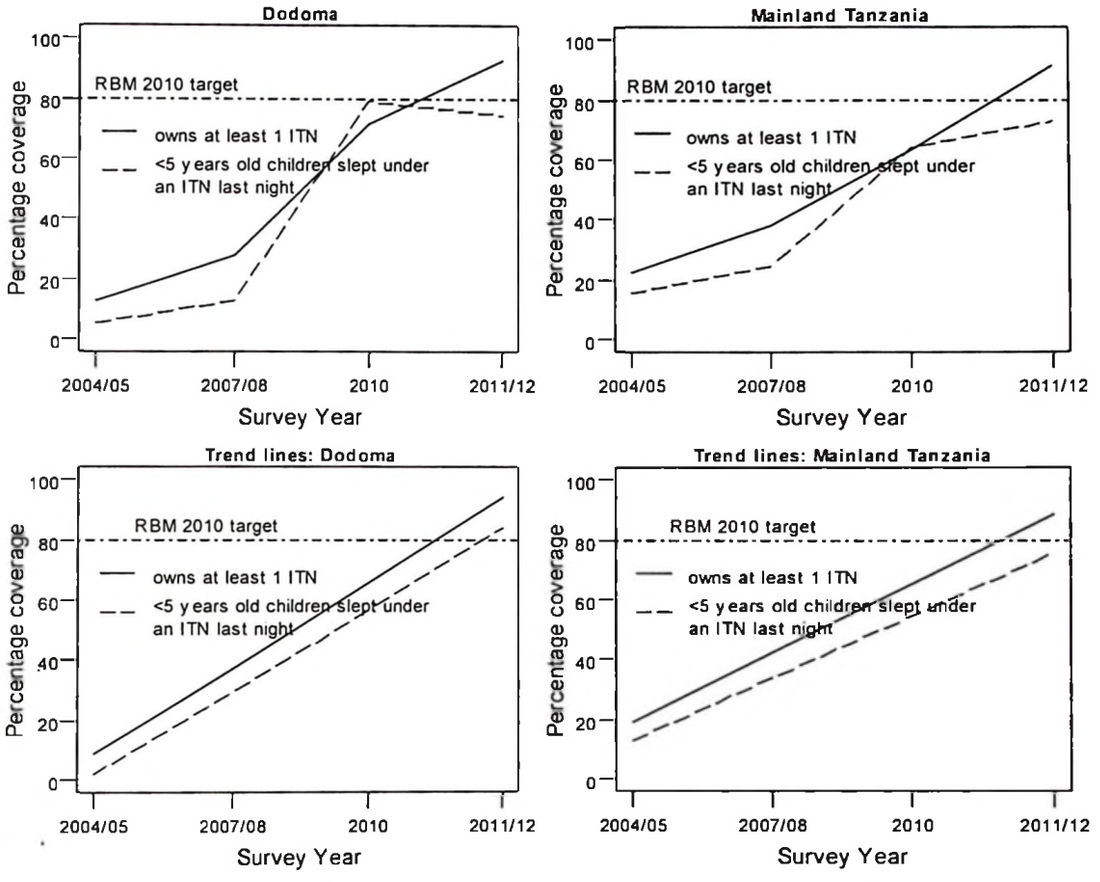


Figure 2.6: Levels and trends in ownership and use of ITNs, 2004/05, 2007/08, 2010, and 2011/12

Source: Own drawing based on data from TDHS (2005; 2011) and THMIS (2008; 2013)

2.7.2 Levels and Trends in Malaria Case Management

More than half (51 percent) of under-five children who were suspected of having malaria (had fever) in Dodoma region took an antimalarial drug in 2010[6]. The equivalent figures in the 2004/05 and the 2007/08 surveys were 45.9 percent and 26.5 percent, respectively. That is, 19.4 percent decrease between the 2004/05 and the 2010 surveys (Figure 2.7). In terms of timing of drugs, it is observed that only 32.4 percent of under-five children, who took an antimalarial drug in 2010, took it the same or next day after the onset of fever. The corresponding percentages in the 2004/05 and 2007/08 surveys were 36.2 and 24.6 respectively, which results into 11.6 percent decrease between the 2004/05 and 2007/08 surveys, but an increase of 7.8 percent between the 2007/08 and 2010 surveys. However, the figure (32.4 percent) reported in the 2010 survey is lower than that (45.9 percent) reported in the 2004/05 survey.

Overall, the gap between the numbers of under-five children with fever who took an antimalarial drug and those who took the drug the same or next day after the onset of fever in Dodoma region appears to be widening in recent years. That is, while the proportion of under-five children with fever who took an antimalarial drug is increasing, the number of under-five children who took the drug the same or next day after the onset of fever shows a decreasing trend. In contrast, the national (Mainland Tanzania) estimates for both number of under-five children who took an antimalarial drug and

[6] Estimates for the number of under-five children with fever who took an antimalarial drug and those who took the drug the same or next day after the onset of fever during the 2011-2012 THMIS for Dodoma region were suppressed because they were based on less than 25 unweighted cases.

those who the drug the same or next day after the onset of fever demonstrate decreasing trends. However, as it can be seen from the figure, the magnitude of the gap between the two statistics under reference is to some extent wider in recent years (especially beginning the 2007/08 survey), suggesting that they are declining at varying rates.

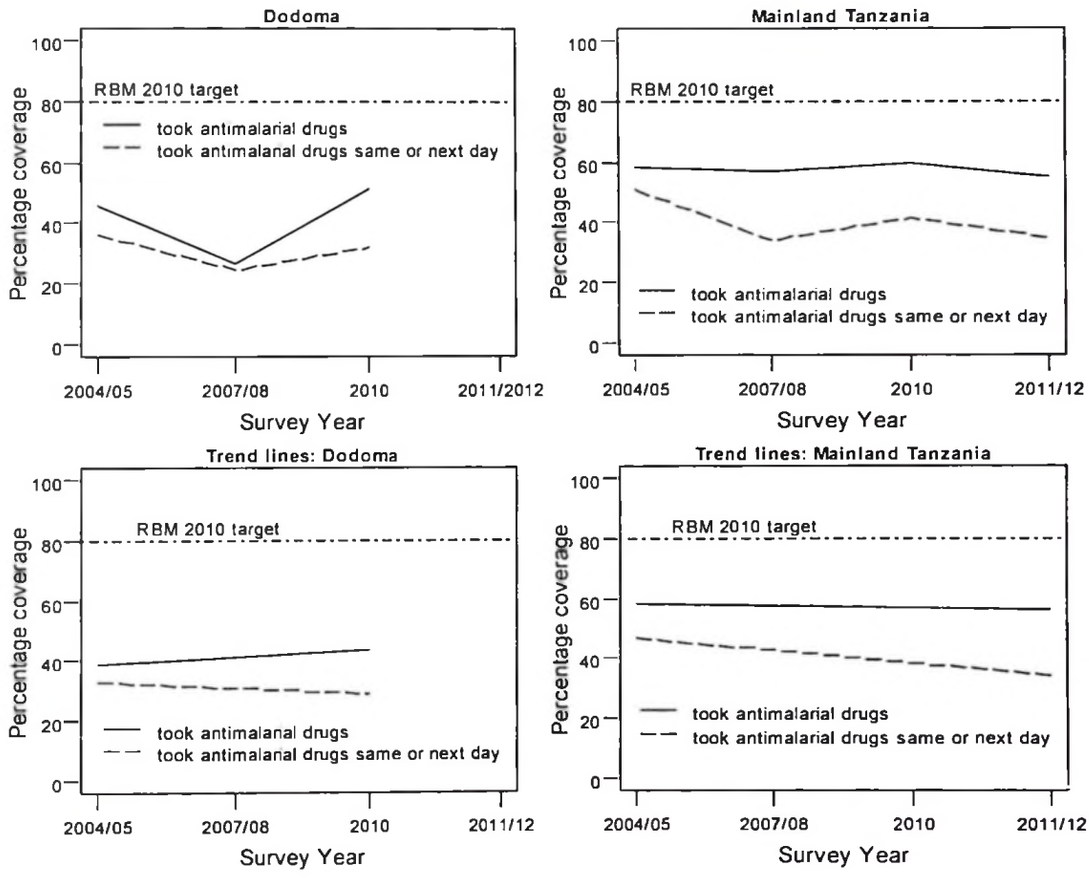


Figure 2.7: Under-five children who took antimalarial medicines, 2004/05, 2007/08, 2010, and 2011/12

Source: Own drawing based on data from TDHS (2005; 2011) and THMIS (2008; 2013)

2.8 Conclusion and a Way Forward

This chapter has provided a brief review of the context of Dodoma region primarily in terms of the levels and trends in the prevalence of fever, malaria prevention, and case management among under-five children. With reference to the three previously mentioned aspects of particular interest that have been explored in this chapter, the following conclusion can be drawn:

(i) There is an overall diminishing trend in the proportion of under-five children with fever in the past two weeks preceeding the date of the survey in Dodoma region as opposed to the national (Mainland Tanzania) trend.

(ii) Households' ownership and use of ITNs among under-five children in Dodoma region are increasing much faster than it is the case at the national (Mainland Tanzania) level. The increase in ownership of ITNs is particularly manifest in recent years beginning the 2007/08 survey. Accordingly, the magnitude of the gap between households' ownership and use of ITNs among under-five children appears to be much wider between the 2004/05 and 2007/08 surveys, but diminishes between the 2007/08 and 2010 surveys. A number of strategies including the voucher scheme and the introduction of the free net distribution campaign for all under-five children towards the end of 2008 may have contributed to the observed progress.

(iii) A declining trend in the proportion of under-five children with fever who took an antimalarial drug the same or next day after the onset of fever was also observed.

In the context of the RBM framework, in 2010, about 48 percent of under-five children with fever in Dodoma region received an antimalarial drug late. This finding reveals that even within the same context (e.g., region), caretakers are not all responding equally to childhood fever.

The findings in this chapter suggest that interventions (such as the RBM) aiming at improving childhood outcomes should be context specific. That is, should consider contextual differences within and between regions. As observed previously through several studies (e.g., Aregawi *et al.*, 2011; Mmbando *et al.*, 2010; Jaenisch *et al.*, 2010), reductions in the burden of malaria has been observed in many parts of Tanzania. However, Amorosa *et al.* (2005), citing Italy noted that differences in economic levels, public health infrastructures and other health care resources between geographical areas within Italy was one of the reasons for tardy eradication of the disease in some parts of the country.

The differences in both infant and under-five mortality rates across administrative units (districts) within Dodoma region observed in this chapter is most likely an indication of existence of likely effect of inequality in the distribution and use of health care resources between sub-units even within the same region. Therefore, failure to acknowledge existence of seemingly intense contextual differences represented by differences in progress on key malaria indicators between administrative units within the region can prompt untimely conclusions about success in reducing the burden of malaria in

Dodoma region in particular and Mainland Tanzania in general. Indeed, Mboera *et al.* (2015) found existence of significant variations in the risk of acquiring malaria infection between different ecosystems and livelihoods. The authors concluded that programmes that aim at malaria control have to take into account ecosystems and livelihoods of the target population through an integrated management of malaria and nutrition approach.

Each of the next three separate empirical chapters address one of the three specific objectives of the study outlined in chapter one. Each chapter covers an introduction; literature review; methodology, results, and discussion, among others.

CHAPTER THREE

SOCIOECONOMIC DIFFERENCES IN BELIEFS ABOUT THE HARMFUL OUTCOMES OF FEVER AMONG UNDER-FIVE CHILDREN

3.1 Introduction

Caretakers often regard fever as harmful (Crocetti *et al.*, 2001) and a disease in itself (Singhi *et al.*, 1991). Brain damage is one of the harmful effects of fever that is commonly reported by caretakers (Zyoud *et al.*, 2013; Walsh and Edwards, 2006). Others are febrile convulsions and death (Walsh and Edwards, 2006). In this perspective, effective information strategies, which address knowledge and beliefs about malaria, are considered essential inputs in the devising of intervention programmes that promote prompt access to early diagnosis and treatment with an effective antimalarial drug (Agu and Nwojiji, 2005).

The relationship between SES of individuals, households, or community and health has been widely examined (Cavalini and de Leon, 2008). At the micro-level, the SES of households in which children grow up has been identified as a key determining factor to health in infancy as well as achievements later in life. This linkage has been established in a number of studies including Ermisch *et al.* (2004), Power *et al.* (1990), and Cohen *et al.* (2004). These studies, however, require data, which is often not available in many developing countries.

Another line of research, especially in developing countries in which factors distributed along the SES hierarchy may interrupt investment decision in children's human capital is that of examining how gender differences in human capital investments vary across families with different levels of resources (for example, Alderman and Gertler, 1997; Pitt, 1997). One of the areas of interest in these studies has been to examine why households choose to invest more in one gender than in the other (for example, Alderman and Gertler, 1997). Although the evidence is mixed especially in the context of Africa, some studies reveal evidence of discrimination in intrahousehold allocation of resources with the bias often towards male children. In this line of research, two key hypotheses (the market incentives, and the parental preferences), have been generated to explain the observed level of discrimination in intrahousehold decisions to invest in children's human capital development such as health care in an episode of illness. Such explorations have however, been carried out more often in the South Asia and infrequently in SSA and in the Latin America (Alderman and Gertler, 1997).

Despite many years of empirical research as noted by Case *et al.* (2007), SES-health relationship particularly in childhood continue to be among the pertinent areas of research that can enhance our knowledge of the mechanisms by which the intergenerational transmission of poverty takes place. Oakes and Rossi (2003) noted that the focus of attention to socioeconomic factors in health-related research is in part due to their appropriateness to social policy about public health. However, the SES-health relationship is intricate in that there are many different pathways through which SES can

affect health in childhood and that not all SES-related inequalities in health favour individuals of the higher SES strata (Victora, 2007).

Personal determinants of behaviour include knowledge, beliefs, and attitude (Meyer-Weitz *et al.*, 2000). Beliefs and attitudes are in turn, determined by one's perceptions of risk and the perceived severity of a disease (Meyer-Weitz, 2000). In the same light Subedi (1989) observes that perceptions and beliefs are influenced and defined by the social environment in which the individual lives. To the best of my knowledge, perception of caretakers with different socio-economic status on the harmful outcome of fever in under-five children has not been examined. Therefore, this chapter examined the impact of caretakers' characteristics that are distributed along the socioeconomic hierarchy on perception about the likelihood of occurrence of harmful outcomes of fever among under-five children.

3.2 Literature Review

3.2.1 Theoretical Literature Review

The chapter draws on the theoretical literature on the health belief model (HBM) with reference to the Children's Health Belief Model (CHBM). The HBM is one of the most prominent theories, which have been considered to understand how people perceive and react to health-related events. Bush and Iannotti (1990) examine the standard HBM in which they reveal that an individual's willingness to take an action in response to a health-related event is dependent on the following three key factors.

(i) The level of threat posed by the health problem as determined by the individual's evaluation of severity and susceptibility to the problem;

(ii) The individual's appraisal of the benefits (or utility) to be derived from engaging in a particular course of action determined against his or her perception of barriers (socio-economic, physical, psychologic, among others) to performing the selected action; and

(iii) Some type of external or internal trigger or prompt to action. Factors such as socio-demographic and psychological have the potential of modifying health beliefs (Bowling, 2009; Bush and Iannotti, 1990).

In the HBM structure, as further evaluated by Langlie (1977), in preventive health behaviour (PHB) settings, achieving good health is the aspiration of virtually everyone in a given community. Steele and McBroom (1972) describe preventive health behaviours as behaviours that seek to use professional health services for the purposes of avoiding illnesses and their likely associated effects. Variations in PHB are due to differences in perceptions, which interrupt one's motivation to engage in action and decision of what cause of action to take in order for the objective of attaining good health to be realized. Consistent with Grossman's (1972) model of the demand for health and the CHBM, in the presence of a disease, the primary caretaker has to take an action.

An important distinction between the CHBM and the HBM as pointed out by Bush and Iannotti (1990), include the fact that in the CHBM the influence of the principal

caretaker of the child in response to a health problem is important. However, many psychological concepts such as motivation to take an action, health beliefs, attitudes, expectations, and anxiety are not directly observed thus their measurement has become a subject of major concern in the social sciences (Chen and Land, 1986). Nevertheless, the present study adapted the CHBM primarily because the study focused on under-five children hence the influence of their primary caretakers (mothers or guardians) on the course of action to take in response to an incidence of a suspected malaria problem was considered essential.

3.2.2 Empirical Literature Review

Health care decision-making is an intricate process (Tolhurst *et al.*, 2008)[7]. This process assumes that health care seeking decisions follow a sequence of stages (Pokhrel and Sauerborn, 2004; Mwabu, 1986). Different authors describe this sequence differently. Suchman (1965) for example, considers five stages. The first and basic decision-making is the decision that there is something wrong. According to Akin *et al.* (1981), no medical care would be sought without this stage. Jones *et al.* (1981) observed that many people disregard or self-medicate symptoms that persuade others to seek medical care.

The second stage is the decision that one is sick and needs formal medical care while the third stage in the process entails the choice of type of medical care provider (Suchman,

[7] Appendix B provides descriptions of some key terms related to the concept of health care decision-making in an event of illness.

1965). In some cases, multiple health care providers are consulted for same health condition before the illness fully disappears (Mwabu, 1986). This happens mostly when the individual patient or his /her caretaker fails to acknowledge the initial analysis of the symptoms or the treatment fails to meet the individual's treatment expectations (Suchman, 1965). Instead of trying multiple sources of medical care, the latter author argues that, one may be treated by a selection of medical practitioners at the same health care facility. In the context of Nepal for example, Subedi (1989) observes that individuals consult different health care providers depending on their perceptions and beliefs, which are in turn influenced and defined by the individual's social environment and network relationship. The last two decisions are the decision to comply with treatment directives or prescribed medications and the recovery or rehabilitation stage respectively (Suchman, 1965). Other researchers like Pokhrel *et al.* (2005) and Pokhrel and Sauerborn (2004) consider only four decision stages including the decision to choose the level of expenditure to treat the child.

In practice, infrequently all primary caretakers of children perceive the signs and symptoms of illnesses afflicting their children or themselves in the same way. For example, socioeconomic differences in perception of illness among a sample of pre-school children in the Philippines found that children who were perceived as ill were mostly from the highest socioeconomic hierarchy (Akin *et al.*, 1981).

The three key components of SES are economic status (measured by income); social status (measured by education); and work status (measured by occupation) (Adler *et al.*, 1993, 1994). These indicators of SES are interrelated; however, they do not totally coincide (Adler *et al.*, 1994) and thus have different implications as Chen *et al.* (2006) note. Economic condition for example, can be used to establish whether an individual can use health care resources to improve his/her health status (Vella and Ndiku, 1993) or the health status of others such under-five children.

Attitudinal and social factors play a significant role in individual's perception of illness, which in turn may affect her chance to take an action such as seeking specialized care and subsequently adherence to prescribed medical therapies (Greenwald *et al.*, 1978). In Nepal, for example, Pokhrel *et al.* (2005) noted that differential rates in child mortality could occur as a consequence of access to health care resulting largely from perception of illness, not necessarily from caretaker's decision to seek care or willingness to spend resources (time and money) on the sick children. Focusing on recognition of childhood illnesses and their traditional explanations, Hill *et al.* (2003) found that caretakers interpret some illnesses as not for professional treatment. Kinung'hi *et al.* (2010) compare knowledge, attitudes and practices about malaria among epidemic and non-epidemic communities of Muleba district in northwestern Tanzania. Using logistic regression model the authors found that level of knowledge of cause of malaria was among the significant determining factors of a household being affected by malaria epidemic in the district.

Using DHS data from five African countries, Fotso and Kuate-Defo (2005) construct and test a set of measures of SES indicators on the health of children. Health care services utilization (represented by incidences of antenatal care and immunization), anthropometric indicators (stunting and underweight), and infant and child mortality were used as dependent variables. The authors found that children from the highest SES strata performed better compared to their lowest SES counterparts in all proxies of health services utilization. In addition, children from the highest SES group had better anthropometric outcomes and were more likely to survive than those from the lowest SES counterparts were. Fosu (1994) compare user-related factors that influenced the utilization of health care facilities for childhood illnesses in SSA. Using DHS data for six countries, the author found (in a logistic regression framework) that family resource, mother's education, age of the mother, and number of reported diseases significantly influenced utilization of health care resources. Kofoed *et al.* (2004) compare the characteristics of children who go to health facilities for treatment of malaria episodes and those who do not. Several indicators of SES were measured and their significance in influencing health care seeking behaviour was examined. Of all proxies of SES examined in a multivariate analysis, only availability of electricity was found to be a significant predictor of care seeking (ibid).

Shehzad (2006) employs multiple indicators-multiple models to explore the determinants of child health in Pakistan. Also using DHS data, the author found significant impact of socio-economic conditions (e.g., possession of durables

goods/assets, housing characteristics, etc.), parental education, and health care variables. Buor (2003) focus on mother's education and how it influences the use of child and maternal medical care services in Ghana. The author used childhood mortality and prevalence of childhood diseases (respiratory tract infection, fever, diarrhoea) as outcome variables. A statistically significant positive relationship between mother's education and child survivorship was observed in the study. Kengeya-Kayondo *et al.* (1994) examined how rural Ugandan women aged 13 years and above recognized malaria in themselves and their children, treatment-seeking behaviour, and how the perception of the cause of the disease influenced treatment-seeking behaviour. Mothers in the study recognized raised body temperature, failing to suck or eat for old children, crying all the time, and vomiting as among the most common symptoms of malaria among children. Treatment seeking varied depending on the perceived severity of illness symptoms, beliefs about the type of malaria, and availability of money to cover treatment costs. Treatment was sought less often for mildly perceived illness symptoms.

Overall, it is unclear whether differences in parental reports of children's health status between the poor and the rich really indicate differences in the illness itself or differences in sensitive to illness between the two groups (Frederickx, 1998; Lindelow, 2003; Murasko, 2008). That is, the rich may report more sickness than the poor may, not because they are generally in more ill health than their poor counterparts are, but simply because they have the understanding about the symptoms of the disease. For example, a review by Kalichman *et al.* (2000) revealed that poor health literacy was associated with

less knowledge and understanding of chronic illnesses and negative treatment outcomes among people with such health conditions. In their study, Kalichman and colleagues concluded that, "poor health literacy creates barriers to fully understand one's health, illness, and treatment" (Kalichman *et al.*, 2000:325). This deficiency may proportionately or disproportionately affect their children. There is no definite evidence on what determines mother's health literacy in developing countries. As noted above, studies, which have examined the impact of maternal education on child health outcomes, have come with varying conclusions. Evidence of maternal education on judgement of severity of illness is also mixed. A review by Williams and Jones (2004) show that in some studies individuals' ability to characterize illness severity for specific symptoms was significantly associated with higher levels of education whilst in other studies, level of education was not a significant predictor of the degree of severity of illness episodes. Frederickx (1998) and Alaba and Koch (2008) found sex of head of household and his/her education level especially for the rich, and relationship of the child to the head of household to be associated with reporting of child illness episodes.

A distinction is often made between paternal and maternal education in the contribution to overall household SES hence their impacts on child health. Ross and Wu (1995) noted that because of much higher participation of men than women in the wage-labour market, paternal education is frequently associated with household wealth or economic status through higher wages. This is because well educated individuals are more likely to be employed in rewarding jobs hence earn higher incomes to meet essential goods

(including living in hood houses) and services for improving health status (ibid). The impact of housing on health is well documented in the literature. For example, Navarro *et al.* (2009) analyze the extent to which living in poor housing conditions can affect individuals' health status showing that housing deprivation has a negative effect on individuals' health. Greenwood (1999) noted that the incidence of malaria in a rural area in southern Sri Lanka was much higher among those who resided in poor quality houses than those who lived in good quality houses. Mmbando *et al.* (2011) found that individuals living in thatched roof houses or built of mud walls were at higher risk of *P. falciparum* infection in northeastern Tanzania than those who lived in houses roofed by iron sheets or built by bricks. On the other hand, maternal education has been consistently observed to have a strong effect on child health often associated with positive child health outcomes (Buor, 2003; Heaton *et al.*, 2005; Mwabu, 2008). Birdsall *et al.* (1995) observed that educated mothers are more effective users of health care services not only for themselves but also for their children.

Connected to the benefits of investment in education especially of women is the realization of women's autonomy (Sujatha and Reddy, 2009; Moursund and Kravdal, 2003). It has long been observed that in the context of developing countries especially in rural African societies, women are directly involved in the production of nonmarket goods such as health, nutrition and education. Nevertheless, have a less active role in the household's decision-making (Khandker, 1987; Meeker and Meekers, 1997). Central perhaps, to this issue of women's autonomy is the question of what must women's

autonomy encompass within a developing economy's context? Several strategies have been proposed to measure women's autonomy. Jejeebhoy and Sathar (2001) for example, describe women's autonomy as the degree to which women have equal say with their husbands in issues concerning themselves and their families; have power over resources; have access to knowledge; and have the right to make independent decisions on matters about themselves or their families. They must also have the liberty to visit relatives or friends and ability to discuss sharing of power within the families. Allendorf (2007) on the other hand, explains women's autonomy as the ability to make independent choices concerning their lives. In this viewpoint, the author (ibid) notes that women with greater autonomy or decision-making power and control over resources are better positioned to make resources allocation decisions that are beneficial to their children. They can also make better use of health care services and observe healthier lifestyle than their counterparts less autonomous women observe. Ghuman (2003) notes that women's autonomy include right to move, control over family resources, decision regarding health care for sick children, and respect by husbands.

Of particular interest, however, in this discussion are economic decisions, which are household decisions concerning investment especially in human. In the context of child health care seeking decisions, Ross (1998:1) writes, "in a liberal society, decisions about a child's health care should be made by his or her parents. In order for parents to make health care decisions for their child, they must balance the child's health needs, his or her needs for other primary goods, and the needs and interests of other members of the

family. To make these decisions in a way that reflects their values and beliefs, parents require wide latitude". Of particular interest, however, in this discussion are economic decisions, which are household decisions concerning investment especially in human. From the foregoing discussion, it is evident that efforts to improve child health must go hand in hand with investment in education.

3.3 Methodology

3.3.1 Descriptive Statistics

In order to explore the characteristics of the study population, both graphical and numerical summary measures were first estimated. For numerical descriptive measures, the arithmetic mean together with their corresponding standard deviation (SD) and frequencies together with their corresponding percentages (percent) were computed for continuous and discrete variables, respectively. Where appropriate, for skewed distributions, the median was used instead of the mean to describe the characteristics of the data. For graphical presentation of the data, scatter plots were used. To check whether significant differences in key variables existed between groups, separate tests for each variable depending on whether the variable was continuous or categorical were performed. For continuous and skewed or non-normally distributed variables, the Mann-Whitney U and Kruskal-Wallis (KW) nonparametric tests were used for $k = 2$ and $k > 2$ independent samples respectively (Zar, 1984).

The Mann-Whitney test statistic was calculated, following Zar (1984) as in equation (3.1):

$$U = n_1 n_2 + \frac{n_1(n_1+1)}{2} - R_1 \tag{3.1}$$

where, n_i is the number of observations in group $i(=1,2)$; R_1 is the sum of ranks in group 1. Under U, the null hypothesis (H_o) tested was that the groups had the same values of a variable. This was tested against the alternative hypothesis that the groups had different values of a variable. Likewise, following Zar (1984), H was calculated as in equation (3.2).

$$H = \frac{12}{N(N+1)} \sum_{i=1}^{k} \frac{R_i^2}{n_i} - 3(N+1) \tag{3.2}$$

Where, n_i is the number of observations in group i; $N = \sum_{i=1}^{k} n_i$ is the total number of observations in all K groups; and R_i is the sum of the ranks of the n_i observations in group i (=1, 2,…, K). Under H, the null hypothesis tested was that the median values of a variable, hence means were the same in all groups. H_o was tested against the alternative that the median, hence mean values of a avariable, were not the same in all groups.

To ascertain the normality of continuous variables, the Shapiro-Wilk test of normality (Shapiro and Wilk, 1965) was first performed. Under this test, the null, hypothesis tested was that the sample data were normally distributed. This was tested against the alternative hypothesis that the sample data were non-normally distributed.

On the other hand, for categorical variables, the Chi-square, χ^2 test- equation (3.3)- was employed to inspect the differences among groups. The χ^2 test statistic was computed (following Snedecor and Cochran, 1980; Zar, 1984) as in equation (3.3).

$$\chi^2 = \sum_{i=1}^{k} \frac{\left(f_i - \hat{f}_i\right)^2}{\hat{f}_i} \qquad (3.3)$$

Where, f_i is the number of observed counts in group i; $\hat{f}_i$ is the number of expected counts in group i if H_o is true. Under the χ^2 test, the null hypothesis was that there was indepedence of attributes, which was tested against the alternative that the attributes were dependent of one another.

3.3.2 Multilevel Modelling

This study adopted a multilevel modelling (MLM) approach. In this study, under-five children were nested within clusters (households) and households were nested within villages/communities. In this point of view, a household, as supported by Duncan *et al.*

(2002) was believed to define a reasonably homogeneous social environment, which was shared by all of its members. Therefore, under-five children within the same household or community were more likely to be similar with one another for example, in terms of living environment compared to children across households or community. Such data structure is subject to correlation often called the intra-class correlations (ICC) (Verbeke and Molenberghs, 2000; Stukel and Rao, 1997). Analysis of such data requires special treatment as most multivariate models assume that observations are independent and multilevel data violate this assumption (Guo, 2005). The most common statistical method for dealing with clustered data is the use of MLM (Warne *et al.*, 2012).

The advantages of MLM approach over the standard modelling strategies have been observed in several studies. Unlike any other analytical technique, MLM accounts for the unobserved contextual factors thus providing a framework that appropriately elucidates the extent to which specific differences between higher-level units are accountable for outcomes at the lower level (Srholecy, 2011). A number of researchers (for example, Rodríguez and Goldman, 2001; Subramanian *et al.*, 2004; Hedeker, 2003) have noted that analysis that ignores the ICC or suppose existence of independence of observations are inclined to underestimate the variance of the estimated regression coefficients. Underestimation of the variance of the estimated regression coefficients leads to overestimation of the significance of the effects of the explanatory variables (Hedeker, 2003). That is, such analyses as ordinary linear and binary regression yield biased parameter estimates hence misleading inferences and conclusions concerning

overall significance of the factors that influence the outcome variables of interest in the study. Consequently, the higher the correlation of the observations within clusters, the higher the likelihood that ignoring clustering would result in biases in parameter estimates (Warne *et al.*, 2012; Guo and Zhao, 2000).

Multilevel models provide the opportunity to simultaneously explain variation in the outcome variable at one level as a function of covariates measured at different levels and interactions within and between levels (Diez-Roux, 2000). In the context of the present study, the three levels of hierarchy considered were under-five children (level-1) nested within households (level 2), which in turn were nested within villages/streets (level 3). For data in this structure, MLM can account for fixed and random effects (Ettarh *et al.*, 2011). A notable practical analytical flexibility of multilevel models is that not all higher-level units are assumed to have the same number of level-1 units nested within (Hedeker and Gibbons, 1994). That is, for clustered data, the assumption of equal sample sizes within clusters is not important. Besides other advantages of MLM, this flexibility was considered essential in the present study since variable number of level-1 units (under-five children) were expected from the different districts.

3.3.2.1 Model Specification and Estimation

Model specification

Peugh (2010) provides key steps involved in a multilevel data analysis for both cross-sectional and longitudinal data. However, in terms of specification, following Guo and

Zhao (2000), Goldstein (1987), and Wang *et al.* (2012), the three-level multilevel model can be written as in equation (3.4).

$$g(\pi_{ijk}) = x_{ijk}^{T}\beta + z_{3,ijk}^{T}u_{k}^{(3)} + z_{2,ijk}^{T}u_{jk}^{(2)} + e_{ijk} \tag{3.4}$$

Where:

x_{ijk} represents a vector of covariates having fixed effects β; $z_{2,ijk}$ and $z_{3,ijk}$ represent vectors of covariates having random effects $u_{jk}^{(2)}$ and $u_{k}^{(3)}$ at the village or street and district levels, respectively; $\pi_{ijk} = P\left[y_{ijk} = 1 \mid u_{k}^{(3)}, u_{jk}^{(2)}\right]$ and $g(.)$ is a link function such as a logit or probit; and e_{ijk} is the error term. The subscripts i, j, and k indicate levels 1, 2, and 3 observation units. For the sample design in the present study, there were a total of K level-3 units; each level-3 unit had J_k level-2 units; and the jth level-2 unit in the kth level-3 unit had n_{ijk} level-1 units.

All random terms in equation (3.4) are assumed to be mutually independent and normally distributed (Guo and Zhao, 2000; Goldstein, 1987). That is,

$$u_{jk}^{(2)} \sim N\left(0, \Omega_{u}^{(2)}\right),\ u_{k}^{(3)} \sim N\left(0, \Omega_{u}^{(3)}\right), \text{ and } u_{jk}^{(2)} \sim N\left(0, \sigma_{e}^{2}\right)$$

The random effects $u_{jk}^{(2)}$ and $u_{k}^{(3)}$ accounted for variations in the data, which are attributed to clustering at the village or street and district levels respectively. In particular, $u_{jk}^{(2)}$ represents the effect of the jth village or street in the kth district on the covariates $z_{2,ijk}$ and describe between village or street variability whereas $u_{k}^{(3)}$ represents the effect of the k^{th} village on the covariates $z_{3,ijk}$ and is characteristic of between district variability (Guo and Zhao, 2000; Goldstein, 1987).

The model in equation (3.4) can alternatively be formulated as in equation (3.5), and this representation can be learned from for example, Rodríguez and Goldman (2001), Short and Zhang (2004); and Stephenson and Tsui (2002).

$$y_{ijk} = \beta_0 + x'_{ijk}\beta_1 + x'_{jk}\beta_2 + x'_{k}\beta_3 + u_{jk}^{(2)} + u_{k}^{(3)} \tag{3.5}$$

In the model in equation (3.5), y_{ijk} represent an outcome measure of interest concerning under-five children; $u_{jk}^{(2)}$ and $u_{k}^{(3)}$ represent unobserved level-2 and level-3 characteristics respectively; x_{ijk}, x_{jk}, and x_{k} represent observed characteristics at levels 1, 2, and 3 having fixed effects β_1, β_2, and β_3 respectively; and $u_{jk}^{(2)} \sim N\left(0, \sigma_u^{2(2)}\right)$, $u_{k}^{(3)} \sim N\left(0, \sigma_u^{2(3)}\right)$ (e.g., Rodríguez and Goldman, 2001).

The model in equation (3.4) falls under the generalized linear model family of regression models which include the standard linear models with normal errors, logistic and probit models for binary and multinomial data, log-linear models for count data, gamma, and exponential statistical models, among others (Wang *et al.*, 2012). Specifically, the model is in the Generalized Linear Mixed Models (GLMM) family of models, which is an extension of the multilevel linear models or linear mixed models (ibid).

The model in equation (3.4) can be written in GLMM short form following Fotouhi (2007) as in equation (3.6).

$$g(\pi) = X\beta + Zu \tag{3.6}$$

In many practical investigations, rarely there is a multilevel data set with adequate number of level-3 units to permit a three-level multilevel modelling. In situations of fewer level-3 units, one may disaggregate level-3 data to level-2 units and a level-2 multilevel model is applied to analyze the data (Wang *et al.*, 2012). Moreover, with three or higher-level multilevel models, interpretation of the results is very difficult, especially when more variables at different levels and more random coefficients are considered (ibid). Accordingly, the analysis in this study fitted two-level multilevel model of the form given in equation (3.7).

$$g(\pi_{ij}) = x_{ij}^T \beta + z_{ij}^T u_j \tag{3.7}$$

Where: $\pi_{ij} = P\left[y_{ij} = 1 \mid u_j\right]$, $(j = 1,...,n; i = 1,...N)$, and $u_j \sim N(0, \Omega_u)$.

To check for the suitability of the multilevel analysis in the present study, an empty or intercept-only model (Wang *et al.*, 2012) given as in equation (3.8) was first fitted. The model in equation (3.5) permits assessment of ICC defined as in equation (3.9), where for the logistic regression model, the residual variance $\hat{\sigma}_e^2$ is $\pi^2/3$.

$$y_{ij} = \kappa_{00} + u_{0j} + e_{ij} \tag{3.8}$$

By fitting the model in equation (3.8), within-and between-group variance in the outcome that can be explained by level-1 and level-2 explanatory variables included in the multilevel model was assessed. According to Wang *et al.* (2012), multilevel analysis is necessary only when statistically significant within group observation dependence or ICC is found; otherwise, standard techniques may be used in the analysis.

$$ICC = \frac{\hat{\sigma}_{u0}^2}{\hat{\sigma}_{u0}^2 + \hat{\sigma}_e^2} \tag{3.9}$$

Since the focus of the study in this chapter was on understanding perceptions of caretakers with different socio-economic status on the harmful outcome of fever in

under-five children, a two-level multilevel random effect logistic regression model presented in equation (3.10) was fitted.

$$g(\pi_{ij}) = SES'_{ij}\beta + x'_{ij}\lambda + u_i \tag{3.10}$$

Where i and j are household (individual) and cluster (village) indicators, respectively; is a vector of regressors distributed along the SES dimensions as described previously; x_{ij} is a vector of regressors different from caretakers' socioeconomic characteristics; $\pi_{ij} = P[y_{ij} = 1 \mid SES_{ij}, x_{ij}, u_i]$; and $g(.)$ is a logit link function, Moreover, β and λ represent vectors of fixed effects for socioeconomic characteristics and control variable respectively. The term u_i is a random effect variable assumed to have a mean of zero and constant variance (Novignon and Nonvignon, 2012). For the analysis in this study, u_i provides an estimate of the variance across all villages considered in the study. A larger value of u_i implies that the outcome is more dependent on the villages involved (ibid).

Model estimation

Estimation of the model parameters for GLMM can be done in several different ways. Guo and Zhao (2000) note that the standard way for estimating the model parameters in the literature is to assume that the random effects u are normally distributed thus integrate out the unobserved random effects u. Specifically, the maximum likelihood

(ML) estimation of GLMM maximizes the marginal or integrated likelihood function as described below.

Following Renard (2002); Gibbons and Hedeker (1997); Guo and Zhao (2000); Hedeker (2003); and Fotouhi (2007), assuming independence of the responses, the conditional likelihood function for the two-level multilevel model in equation (3.10) is given as equation (3.11).

$$\ell_j(\beta,\Omega_u) = \log \int \prod_{i=1}^{N} \pi_{ij}^{y_{ij}} \left(1-\pi_{ij}\right)^{1-y_{ij}} \phi\left(u_j;\Omega_u\right) du_j \tag{3.11}$$

Where $\phi(u;\Omega_u)$ is the normal density function $N(0;u)$. The log marginal likelihood is given as in equation (3.12).

$$\ell(\beta,\Omega_u) = \sum_{j=1}^{n} \ell_j(\beta,\Omega_u) \tag{3.12}$$

Parameter estimates (β and Ω_u) are those that are obtained by maximizing (through standard optimization techniques) the integrated (or log marginal) likelihood function in equation (3.12).

However, unlike in the case of linear model where the resulting unconditional density function has a closed form, in GLMM, or nonlinear multilevel models, the resulting density function does not have a closed form (Renard, 2002; Guo and Zhao, 2000). That is, it is not explicit (Chow, 1999) or is unknown and thus, the solution necessitates the use of approximation estimation techniques (Guo and Zhao, 2000).

Several approximation techniques for estimation of the parameters of interest in GLMM have been proposed. Frequently used ML-based estimators for MLM are full information maximum likelihood and Restricted or Residual Maximum Likelihood (REML) (Wang *et al.*, 2012). However, ML and REML estimation is constrained with large computational time and convergence problems. Significant reductions in computational time due to increases in computer speed and recent development of new built-in analytical features in many software packages such as SAS and STATA have overcome the computational limitations that hampered ML estimation in GLMM in the past (ibid).

According to Wang *et al.* (2012), the two fundamental approximation procedures are: (i) linearization, which approximates the marginal or integrated likelihood function by means of techniques such as Taylor series expansion and (ii) integral approximation using numerical methods. In the SAS system software, the linearization and integral approximation estimation methods are implemented through two procedures and macros namely, *PROC GLIMMIX* and *PROC NLMIXED*, and *%GLIMMIX* and *%NLMIXED*

respectively. Prior to version 9.2 of SAS (SAS 9.2) (SAS Institute Inc. 2008), *PROC GLIMMIX* was based on linearization method only. In SAS 9.2, linearization is the default estimation method. The restricted or residual psuudo-likelihood (REPL/RSPL) is among the numerous linearization methods. Maximization of the RSPL can be done with several optimization techniques in the SAS procedure GLMMIX. Newton-Raphson algorithm is the default optimization method. In addition to the linearization method, two numerical integration approximation methods namely, Laplace and adaptive Gauss-Hermite quadrature have been added as options for implementing GLMM estimation through the procedure *PROC GLIMMIX* in SAS 9.2 (ibid).

According to SAS Institute Inc. (2008), linearization-based approximation methods have several advantages. They can estimate models for which the joint distribution function is hard or not possible to determine. When contrasted with numerical integration approximation techniques, linearization methods allow a large number of random effects to be estimated in the model, and the variance/covariance structure of level-1 residual matrix can be easily accommodated in the model. Others are that the model is iteratively estimated based on the linear mixed model hence, both ML and REML can be implemented to estimate model parameters, and they are easy to implement (SAS Institute Inc., 2008).

As with many procedures, the linearization-based methods also have some drawbacks. One of these is that the deviance statistic or -2LL cannot be used for model comparison

since linearization-based methods use pseudo-data for model estimation (Wang *et al.*, 2012). As a result, they do not have a real likelihood. This is not the case with numerical integration methods where the likelihood function is from the original data used in the analysis. Therefore, comparisons of various nested models through the likelihood ratio (LR) test are possible with numerical integration approximation methods. Like, linearization-based methods, numerical integration methods also have some restrictions. One of these limitations is that it is often difficult to manage many random effects in a multilevel nonlinear model (ibid).

Guo and Zhao (2000) employ different estimation procedures to analyze binary multilevel models, showing that differences in parameter estimates across the various estimation procedures were much smaller. They conclude that in most analytical work especially in the social sciences research, the first and second orders penalized quasi-likelihood (PQL) and SAS *GLIMMIX* are sufficient. Short and Zhang (2004) note however, that PQL method could result into biased estimates of random effects when the random effect is large and the number of observations per unit is small. Moreover, Rodríguez and Goldman (2001) demonstrated that estimates derived by marginal quasi-likelihood (MQL) for binary responses might be subject to substantial bias when the amount of clustering is sufficiently large. Noortgate *et al.* (2003) use SAS *GLIMMIX* macro and MLwiN software and found similar estimates for MQL from both software packages. However, the author noted that MQL estimates were less significant than PQL estimates. As a result, they restricted their estimation to PQL approximation procedure.

However, PQL approximation in MLwiN occasionally crashed something, which necessitated them to use SAS to estimate the unknown parameters through the PQL approximation procedure.

In this study, estimation of the parameters of the model in equation (3.10) was carried out in the SAS system version 9.2 using the RSPL through the procedure *GLIMMIX*. To overcome convergence problems in the estimation, the Newton-Raphson Ridge Optimization method (SAS Institute Inc., 2008) was employed. According to SAS Institute Inc. (2008), the Newton-Raphson Ridge Optimization method performs much better for small-to medium-sized problems, and it does not need several function, gradient, and Hessian calls. Attempts were made to fit the models using the Laplace or the adaptive Gauss-Hermite quadrature methods in the SAS procedure *GLIMMIX*, but it resulted into serious problems of increased computational time and non-convergence of the models.

3.3.3 Variables

The variables for this study were grouped into three major categories namely, child specific factors, household specific factors, and community factors as discussed in details below.

(i) Child factor/characteristics

Child characteristics collected include age (in months), sex, biological relatedness to head of household, whether or not the child's biological father and mother were alive

and whether or not one or both of the biological parents lived at the household, and so on. As long noted by Barker (1973), age is one of the variables that are difficult to measure with accuracy in developing countries. This is particularly because of limited birth registration and illiteracy of a considerable part of the population in these countries. To verify the correctness of the stated ages particularly of under-five children, clinic cards were requested from the respondents. For under-five children, the dates of birth (day, month, and year) were recorded whereas for five years and above population, the ages were recorded as at last birthday. Whenever a clinic card or any other relevant document such as birth certificate was not available for checking the accuracy of the stated dates of birth, the interviewers asked the caretaker about the time of birth of the child in relation to seasons or remarkable national or local events.

Besides child's demographic characteristics, the study collected information on each child's illness and associated behaviour by the caretakers. Concerning illnesses, caretakers were asked about whether the child under the age of five in the household had experienced an episode of fever, or convulsion, diarrhoea, cough/flu, or vomiting at any time during the previous four weeks preceding the day of the interview[8]. Also, collected was information on number of days the child was ill with the symptom(s) and the course of action the caretaker took for the child.

[8] Different reference periods including within past two weeks (TDHS, 2011; THMIS, 2008; Pillai *et al.*, 2003; Taffa and Chepngeno, 2005), past 12 weeks (Andaleeb, 2008), and one month (Su *et al.*, 2006) have been used in household surveys to capture past events.

The study also collected information on caretakers' perception of the symptoms at first appearance. That is, whether or not they interpreted the symptoms as indicative/suggestive of any illness. The caretakers were also requested to retrospectively recall their perceived severity of the symptoms focusing on fever at first appearance at any time during the past four weeks preceding the date of the survey. In medical settings, severity of a symptom or disease is regularly measured on an ordinal scale (Qu *et al.*, 1995). Many authors including Wiseman *et al.* (2008), Teerawichitchainan and Phillips (2008), Sepehri *et al.* (2008), and Nacher *et al.* (2001) have assessed perception of severity of illnesses in both children and adults. Often a three-option (severe, moderate or mild/minor) item is used to capture the required responses. This is analogy to self-assessed or rated health measure of health status (excellent, very good, good, fair or poor). This is often measured using a single item "how would you describe the health status of your child, would you say it is excellent, very good, good, fair or poor? In the present study, severity of fever was assessed by asking caretakers "think back to the time of onset of the fever that (*name of child*) experienced at any time during the past four weeks. How would you describe the degree of severity? Would you say that it was severe, moderate, or mild?"

The information described in the above paragraph aimed to capture one essential aspect (recognition and importance attached to symptoms) of fundamental influences upon illness behaviour within the health belief framework (Ludwig and Gibson, 1969).

The caretakers who sought medical care for their sick under-five children were asked to report from which source(s) (starting with the first) the treatment was sought for each child. To capture the notion of delay to seek treatment, respondents were asked to report when after the onset of symptoms the treatment was sought. This information was measured through a single item "how many days after (e.g., fever) began did you first seek advice or treatment for (*name of child*)?"

(ii) Household context/characteristics

At the level of household, information collected includes socio-economic and demographic characteristics. These are age (years), sex, and level of education of the head of household, where appropriate, his/her spouse/partner, primary caretakers and their marital status as well as their religious affiliation. According to the framework by Jacobson (2000), other members of the household are likely to influence health care decisions within the household. There are different pathways through which other members of the household may affect health care decisions. David *et al.* (2004) argue, for instance, that large families are likely to have problems taking care of all children. In this relation, information on household size was also collected.

As mentioned previously, because of the intricacy in accurately measuring household expenditure as a proxy for income within a short period, an asset-based approach was employed to measure the SES of households. This is consistent with the observation by Stephenson and Tsui (2002) who argue that, in the absence of information on household

income, an asset index can be used to represent the SES of the household. Howe *et al.* (2008) note further that, data gathered based on household assets is more reliable than that collected based on income or consumption expenditure. This is the case because the former set of information is frequently collected using simple questions or direct observation by the interviewer thus suffers from less recall or social desirability bias (ibid). To create the wealth variable or index, the study employed the Principle Component Analysis (PCA) technique on a set of correlated household durable assets and living conditions (housing structure and materials) items. Table 3.1 provides a list of variables (durable assets and housing characteristics) used to construct the wealth index with PCA.

Construction of Wealth Index

The PCA technique is a variable reduction procedure that is used to identify groups of observed variables that tend to string up together empirically (Jolliffe, 1986; Chalasani, 2012). It combines a number of correlated variables into a smaller number of underlying sizes (Hamilton, 2003). Factor analysis technique is also a common variable reduction method (Johnson and Wichern, 1998; Stevens, 1996; Widaman, 1993; Kim and Mueller, 1978; Hatcher, 1994; Giri, 1996; Norman and Streiner, 1994). However, in construction of indices, the PCA has been widely used (Fotso and Kuate-Defo, 2005). In some settings, ad hoc methods have been used to classify individuals into different socioeconomic groups. For example, Ndyomugyenyi *et al.* (2007) classified respondents without a bicycle or livestock as being poorest while those with these assets regarded as

being least poor. Howe *et al.* (2008) note that weighing of categorical asset items through PCA is rather problematic. Multiple correspondence analysis (MCA) is an alternative method to PCA. However, wealth indices for seven countries in SSA constructed using MCA were similar to those from PCA (ibid). Accordingly, the present study adopted the PCA approach in the construction of the wealth index as described below.

Table 3.1: List of variables used to construct wealth index

Variable	Variable
Electricity	Bicycle
Paraffin	Motorcycle/scooter
Radio	Car/truck
Television	Watch
Mobile	**Main floor material**
Telephone	Earth/sand/mud/dung
Iron	Ceramic
Refrigerator	Cement
Main source of drinking water	**Main wall material**
Piped into dwelling	Grass
Piped into compound/plot	Poles and mud
Public tap	Sun-dried bricks
Neighbour's tap	Baked bricks
Open well in dwelling	Cement
Open public well	Stones
Neighbour's open well	Other
Protected well in yard/plot	**Main roof material**
Protected public well	Grass/thatch/mud
Borehole	Iron sheet
Spring/river/stream/pond/lake/dam	Tiles
Tanker truck	Asbestos
Lighting energy	
Electricity	
Solar	
Paraffin-hurricane-lamp	
Paraffin-pressure-lamp	
Paraffin-wick-lamp	
Candles	
Other	

Following Fotso and Kuate-Defo (2005), to account for the variance-covariance structure, instead of using the originally p correlated variables, k unrelated principal components, which were linear combinations of optimally weighted observed p variables were used. The k principal components are usually arranged in (descending) order of magnitude of the variances they account for as in equation (3.15) and they are constructed as follows.

Assume that $X=(x_1,x_2,...,x_p), \lambda_1 \geq \lambda_2 \geq ... \geq \lambda_p \geq 0$ and $e_i=(e_1,e_2,....,e_p)$ is the matrix pertaining to the original p correlated variables, the eigen values and eigen vectors corresponding to the correlated p variables respectively. Using the property that the eigen vectors of a symmetrical matrix ("A" say) are orthogonal to each other, that is, $(A-\lambda I)e=0$, the principal components can be obtained from equation (3.13).

$$u_i = e_{i1}x_1 + e_{i2}x_2 + ... + e_{ip}x_p \tag{3.13}$$

Equation (3.13) can be rewritten in general form as in equation (3.14).

$$u_i = \sum_{k=1}^{p} e_{ik}x_k = Xe_i \tag{3.14}$$

Following Fotso and Kuate-Defo (2005), the first principal component (u_1) entails determining a weight-vector e_1 such that the variance $\text{var}(u_1)$ corresponding to the original variables used in its construction is maximized subject to the constraint that e_1 is of unit length (that is, $\sum_{k=1}^{p} e_{1k}^2 = 1$). The variance, $\text{var}(u_1)$ is defined as in equation (3.15) (ibid).

$$\text{var}(u_1) = u_1'u_1 = e_1'X'Xe_1 = e_1'\Omega e_1 \tag{3.15}$$

Likewise, the second principal component involves determining a weight-vector e_2 that maximizes the variance $\text{var}(u_2)$ of the original variables, which was not accounted for by the first principal component subject to the constraint that e_2 is also of unit vector (or $\sum_{k=1}^{p} e_{2k}^2 = 1$). The remaining $p-2$ principal components are also constructed in a similar manner. In the PCA technique, the number of components extracted is usually equal to the number of observed variables (p) being analyzed. However, in most empirical analyses, only the first few components account for a maximal amount of total variance in the observed variables, consequently, only these first few principal components are kept, interpreted, and used in subsequent estimations. In the present study, only the first three principal components were used. The proportion of variance explained by the kth component was defined as shown in equation (3.16).

$$\lambda_k / \left(\lambda_1 + \lambda_2 + ... + \lambda_p\right) \qquad (3.16)$$

The procedure *PROC PRINCOMP* in the SAS System for Windows version 9.2 (SAS Institute Inc., Cary, NC, USA) was used to achieve the construction of factor scores/loadings, which were subsequently used in the calculation of wealth index (Cody and Smith, 1997). To assess the internal consistency (or interrelatedness) among the different indicators of wealth given in Table 3.1, the Cronbach's Alpha (α) coefficient (Cronbach, 1951) was used. As Tavakol and Dennick (2011) note, Cronbach's α is a widely used measure of internal consistency reliability. Studies which have employed the Cronbach's α coefficient to ascertain internal consistency of a set of test items include Lau *et al.* (2010); Lin *et al.* (2012); Nansel *et al.* (2009); Marcinowicz *et al.*, (2010); Northcott and Harvey (2012); Yu *et al.* (2010); and Heishman *et al.* (2008). Cronbach's $\alpha \geq 0.70$ is considered as acceptable internal consistency (Sherrill-Mittleman *et al.*, 2009). Consistent with studies such as Jombo *et al.*, 2011; TDHS, 2005; 2008) the households were divided into socioeconomic quintiles (poorest, second, middle, fourth, highest) based on the factor scores in the kth principal component as shown in Table 3.2.

Table 3.2: Ownership of assets and housing characteristics by wealth quintile

Variable	Wealth Quintile				
	Poorest	Second	Middle	Fourth	Highest
Electricity	0.000	0.005	0.005	0.026	0.964
Paraffin	0.190	0.198	0.216	0.232	0.165
Radio	0.033	0.129	0.243	0.266	0.329
Television	0.000	0.000	0.006	0.036	0.958
Mobile	0.010	0.052	0.209	0.319	0.410
Telephone	0.000	0.000	0.000	0.200	0.800
Iron	0.008	0.016	0.140	0.342	0.494
Refrigerator	0.000	0.000	0.000	0.022	0.978
Watch	0.021	0.098	0.187	0.258	0.436
Bicycle	0.103	0.147	0.284	0.274	0.193
Motorcycle/scooter	0.000	0.020	0.060	0.260	0.660
Car/truck	0.000	0.000	0.000	0.278	0.722
Main source of drinking water					
Piped into dwelling	0.000	0.000	0.033	0.067	0.900
Piped into compound/plot	0.000	0.000	0.000	0.077	0.923
Public tap	0.110	0.228	0.279	0.261	0.121
Neighbour's tap	0.000	0.000	0.000	0.469	0.531
Open well in dwelling	0.000	0.000	0.000	0.500	0.500
Open public well	0.407	0.268	0.191	0.125	0.009
Neighbour's open well	0.000	0.200	0.200	0.600	0.000
Protected well in yard/plot	0.000	0.000	0.000	1.000	0.000
Protected public well	0.000	0.188	0.188	0.500	0.125
Borehole	0.000	0.000	1.000	0.000	0.000
Spring/river/stream/pond/lake/dam	0.135	0.243	0.365	0.230	0.027
Tanker truck	0.000	0.000	0.000	1.000	0.000
Sanitation facility					
Flush toilet	0.000	0.000	0.000	0.091	0.909
Ventilated improved pit latrine	0.000	0.000	0.000	0.146	0.854
Traditional pit latrine	0.196	0.219	0.225	0.228	0.132
No latrine/bush/field	0.561	0.146	0.220	0.049	0.024
Cooking energy					
Electricity	0.000	0.000	0.000	0.000	1.000
Bottled gas	0.000	0.000	0.500	0.000	0.500
Paraffin/Kerosene	0.000	0.000	0.000	0.000	1.000
Charcoal	0.000	0.007	0.037	0.271	0.686
Firewood	0.521	0.146	0.271	0.063	0.000
Lighting energy					
Electricity	0.000	0.000	0.000	0.022	0.978
Solar	0.000	0.000	0.250	0.500	0.250
Paraffin-hurricane-lamp	0.004	0.057	0.172	0.608	0.159
Paraffin-pressure-lamp	0.000	0.600	0.000	0.400	0.000
Paraffin-wick-lamp	0.325	0.304	0.262	0.105	0.004
Candles	0.000	0.000	0.000	0.667	0.333
Other	0.113	0.371	0.355	0.161	0.000
Main floor material					
Earth/sand/mud/dung	0.275	0.280	0.290	0.150	0.006
Ceramic	0.000	0.000	0.000	0.000	1.000
Cement	0.000	0.000	0.003	0.336	0.660
Carpet	0.000	0.000	0.000	0.000	1.000
Main wall material					
Grass	1.000	0.000	0.000	0.000	0.000
Poles and mud	0.512	0.274	0.149	0.065	0.000
Sun-dried bricks	0.212	0.278	0.206	0.266	0.037

Variable	Wealth Quintile				
	Poorest	Second	Middle	Fourth	Highest
Baked bricks	0.034	0.168	0.412	0.336	0.050
Cement	0.000	0.000	0.005	0.113	0.882
Stones	0.000	0.000	0.000	0.000	1.000
Other	0.000	0.000	0.500	0.500	0.000
Main roof material					
Grass/thatch/mud	0.599	0.304	0.093	0.003	0.000
Iron sheet	0.000	0.138	0.248	0.301	0.313
Tiles	0.000	0.000	0.000	0.500	0.500
Asbestos	0.000	1.000	0.000	0.000	0.000

(iii) Community context/characteristics

The study also collected information on a proxy of access to health care resources for treatment and allied advantages such as health-related information across communities. Community-level information collected to account for community effects includes distance (in kilometre) to the nearest health facility and market place. To capture for community variability in monetary resources, which could influence the prices of key consumable and non-consumable items, occupation of the heads of households and caretakers was categorized as employed, farm-related and non-farm activity. Also included was place of residence (rural/urban). Design-related variables: village sizes (measured by number of households) and number of households with under-five children in the sampled villages within the selected districts were also included as contextual or community-level variables to account for both demand of health care services in the community and complex sample design adopted. Table 3.3 gives a complete list of variables used in the present chapter and their description.

Table 3.3: Description of variables in the study

Variable	Description	Nature
Level-1 variables		
Belief	Outcome variable- caretakers' belief of likelihood of occurrence of health effects of fever	Dichotomous measure (1=Some chances; 0=No chance)
Agechild	Age group (in months) of child	Categorical (0=0-11; 1=12-23; 2=24-35; 3=36-47; 4=49-59)
Sexchild	Sex of child	Dummy (1=Male, 0=Female)
Convul	If child experienced convulsion during the past 4 weeks	Dummy (1=Yes; 0=No)
Diarrh	If child experienced diarrhoea during the past 4 weeks	Dummy (1=Yes; 0=No)
Coughf	If child experienced cough/flu during the past 4 weeks	Dummy (1=Yes; 0=No)
Vomit	If child experienced vomiting during the past 4 weeks	Dummy (1=Yes; 0=No)
Bothpar	If both biological parents of child stay at home	Dummy (1=Yes; 0=No)
Relhead	Relationship of child to head of household	Dummy (1=non-biological son/daughter; 0=biological son/daughter)
Under5	Number of under-five children in household	Dummy (0=one; 1=2-3)
Homemch	If biological mother of child stays at home	Dummy (1=Yes; 0=No)
Agecare	Age of main caretaker of children in the household	Count data (years at last birthday)
Educhead	Education of head of household	Categorical (0=No education; 1=Primary; 2=Secondary and above)
Educare	Education of main caretaker of children in the household	Categorical (0=No education; 1=Primary; 2=Secondary and above)
Mstatus	Caretaker's marital status	Dummy (1=Currently married/living with a man as if married; 0=Otherwise)
Careocc	Current occupation of caretaker	Categorical (0=unemployed;1=1 =Working in agricultural activities; 2=Employed in non-agricultural activities)
Sexhead	Sex of head of household	Dummy (1=Male, 0=Female)
Yearsplc	Years caretaker has been in the current place of residence	Dummy (1=Always; 0=Otherwise)
Sourceinf	Caretaker's main source of information in matters of child health	Dummy (1=Health Worker; 0=Otherwise)
Indicfev	Perception of fever-whether fever was indicative of certain disease	Dummy (1=Yes; 0=No)
Severefev	Perceived severity of fever	Categorical (0=Mild; 1=Moderate; 2=Severe)
Agehead	Age of head of household	Count data (years at last birthday)
Headocc	Current occupation of head of household	Categorical (0=unemployed;1=1 =Working in agricultural activities; 2=Employed in non-agricultural activities)
Household *size*	Number of household members	Count data
Wealthq	Wealth index	Categorical (0=Poorest; 1=Second; 2=Middle; 3=Fourth; 4=Highest)
Level-2 contextual variables		
Location	Place of residence	Dummy (1= Rural; 0= Urban)
Populv	Village population size	Count data
Elighh	Number of households with under-five children in village	Count data

Variable	Description	Nature
NearHF	Distance from household to nearest health facility	Dummy (1=≥ 5 km ; 0=< 5 km)
Nearmkt	Distance from household to nearest market	Dummy (1=≥ 5 km ; 0=< 5 km)
District	District of residence	Categorical (1=Kondoa; 2=Bahi; 3=Dodoma Urban; 4=Mpwapwa)
Passable	Main road passable throughout the year	Dummy (1=Yes, 0=No)
Qualityroad	Perceived quality of main road	Dummy (1=Fair or good; 0=Poor)

Dependent variable

Caretakers whose under-five children experienced an episode of fever were asked to indicate their perception about the likelihood of occurrence of possible harmful effects of fever to their under-five children with possible responses: high chance, low chance, or no chance at all. Therefore, the outcome variable was polycotomous and ordered in nature representing caretaker's perceived or self-assessed chance of occurrence of potential health effects of fever for her under-five children. Prior to the question on likelihood of occurrence of harmful effects of fever, caretakers were asked to report any adverse outcomes, which could occur because of fever to a child.

There are many factors, which frequently guide the choice of a suitable analytical strategy for estimating the strength of relationship between one or sets of explanatory variables and dependent variables. Nature of the outcome variable to be used in the analysis is often regarded as an important determining factor of which analytical strategy to employ (Maddala, 1983). Since the values that the outcome variable takes on have a particular order attached to it, the most relevant strategy to describe the relationship between the outcome measure and the explanatory variables is to estimate an ordered *probit* model (Maddala, 1983). In the context of the present study, this entails fitting a

multilevel model on an ordinal outcome. However, even in situations where the outcome measure is multinomial in nature, collapsing of the categories to form a binary outcome is frequently done in empirical studies (Navarro *et al.*, 2009; Power *et al.*, 1990; Contoyannis and Jones, 2004). This is done for many reasons including achieving simplicity in both implementation and interpretation of analysis results (Navarro *et al.*, 2009). Moreover, critics of surveys argue that constructing a scale with ordinal or interval properties from social data requires underlying form of explicit mathematical systems, which are not found in the social sciences (Seale, 2004). Accordingly, in the present study, for easy of interpretation of analysis results, the three categories of the outcome variable were collapsed into a dichotomous dependent variable distinguishing between some chance (1) and no chance (0) of occurrence of potential adverse effects of fever.

Explanatory variables

The primary explanatory variables or covariates of interest in this chapter were socioeconomic characteristics. Five different groups of variables represented the SES characteristics of focus in this chapter. These are household economic status, education, and occupation of caretaker. Assuming a collective decision-making process within the household, household economic status was used as a proxy of caretaker's income. As observed earlier (Subedi, 1989) that perceptions and beliefs are influenced by the social environment in which individuals live, contextual variables/factors: place of residence (rural/urban) were included. Place of residence is often considered as a relevant marker

of SES especially in less developed economies (Msisha *et al.*, 2008). District of residence, distance (km) to the nearest health facility and marketplace, and perceived quality of main road, and whether the main road was passable throughout the year were also included. Educational attainment was categorised into three major groups relevant for Tanzania: no education, primary education, secondary education and above (Msisha *et al.*, 2008). Likewise, occupational status was categorized as unemployed, working in agricultural activities, or in non-agricultural activities.

All the remaining variables shown in Table 3.3 were considered as important to moderate (control) the SES-health beliefs relationship. These include age (years) and sex of head of household, age of caretaker, age (months) and sex of child. As already observed and stressed further by Barker (1973), the number of cases of a disease in each age group could be influenced by differential use of medical services at different ages. In recognition of this fact, in all model estimations carried out under the present study, under-five children's ages were categorized into several age groups. In studies about malaria, WHO recommends grouping children under 5 years of age into three distinct groups: 0-11 months; 12-23 months; and 2-4 years (Barker, 1973). The THMIS (2008) classifies under-five children aged between 6-59 months into five groups: 6-11 months; 12-23 months, 24-35 months, 36-47 months, and 48-59 months. The present study classified under-five children consistent with the THMIS (2008), the age group 0-11 months inclusive. This grouping permits to understand the influence of each age group on the outcome variables of interest. For example, intuitively, for child level predictors,

it was expected that in matters of health care seeking, younger children or infants were likely to receive more attention than their counterpart older children would. In addition, a non-bio-mother is likely to reduce positive parenting thus was expected to have a negative effect on outcomes such as timing of the decision to seek treatment or advice. Consequently, biological relationship of child to head of household was also included as a control variable. Other variables included were household size, number of under-five children in the household, marital status of caretaker, etc.

Considering that lone parenting may have a negative effect on the management of an illness, a dummy variable representing presence or absence at home of both biological parents of the child was included in the analytical model. In addition, the analysis controlled for other important covariates that were anticipated to increase the propensity of likely health effects of fever in the environment in which the child lived. These include whether or not the child experienced convulsion, diarrhoea, cough/flu, and vomiting during the previous four weeks preceeding the survey. Other variables were number of years that the caretaker had been in the current place of residence, caretaker's main source of information in matters of child health, perception of fever (whether fever was considered as indicative of an illness), and perceived severity of fever. In order to adjust for the effect of the sampling design, design-related information/variables were included in the model instead of sampling weights. Specifically, size variables: number of households in the sampled villages and number of households with under-five children in the sampled villages within the selected districts were included.

3.3.4 Data Source

3.3.4.1 Study Design and Target Population

The data for analysis in the present chapter and the rest of the empirical chapters in this dissertation was based on a cross-sectional survey of households, which was carried out in Dodoma region. The desired target population for the study were all under-five children in the sampled administrative units. Accordingly, only households in which at least one child under the age five was present in the household were eligible for sampling to constitute the sample for the study. This restriction was made in acknowledging the fact already mentioned. That is, treatment seeking for under-five children depends on their caretakers, under-five children is the group most susceptible to malaria (Dillip *et al.*, 2009), and which can quickly lead to death if not appropriately dealt with (WHO, 2006; Chibwana *et al.*, 2009). In this study, the standard definition used in many surveys (e.g., DHS) in which a household is defined as a person or group of persons (whether related or not) who live together and share the same food bowl (TDHS, 2005) was adopted. A household member was thus defined consistent with other studies as any person (including domestic helpers, long-term guest, etc.) living in the same house and sharing meals and information (Mashreky, 2010). Accordingly, eligible under-five children were children of permanent members of the household as per the adopted definition of a household in the study.

It is acknowledged that in situations whereby individuals that are not selected to constitute the sample differ considerably from those selected in terms of the variables of

interest, in that situation there is a high likelihood of selection bias problem (Vosti, 1990). Therefore, in order to avoid running into selection bias problem, all under-five children of members of household in the selected households were equally selected for the study.

3.3.4.2 Sampling Procedure

The study utilized a probability sampling procedure in which each population unit was given a non-zero chance of inclusion in the sample. A random sample was necessary as it ensures statistical validity of the results (Cabrera and McDougall, 2002). The reporting unit was the household with children under the age of five years. In order to arrive at the household level and to choose the households efficiently, a three-stage cluster sampling procedure was employed (Whittemore, 1997). The primary sampling unit (PSU) was the district in Dodoma region[9]. The secondary sampling unit (SSU) was the village (in rural settings) or street (in urban areas) while the tertiary sampling unit (TSU) was the household in a village or a street. At each stage of the sample selection process, a probability sampling procedure was employed as described in the next paragraph.

In many practical situations the PSUs of interest often contain different number of units or there are of unequal size units (Bowling, 2009). Snedecor and Cochran (1980) have noted that when the PSUs are of unequal sizes, selection with probabilities proportional to size (PPS) is often recommended. The measure of size (MoS) used to select the ith

[9] See Kish (1965) for details of notion of PSU in sampling problems

PSU in the study was the number of villages/streets in the district. This was achieved by cumulative total method sampling technique (Cochran, 1977). The villages or streets within the selected districts were also selected with PPS using the number of households in the village or street at 2009 based on the 2002 Population and Housing Census (PHC) projections of the National Bureau of Statistics (NBS, 2006) as the MoS.

In each sampled village or street, a complete listing of eligible households was made prior to selection of the households for interviews. Community or sub-units (hamlet or street) leaders with the assistance of ten cell leaders carried out the listing of eligible households in their respective sub-units within the villages or streets. Total number of households registered in each village or street was compared with previous lists obtained for other activities targeting under-five children such as distribution of free mosquito nets (under-five coverage campaign). Information collected during the listing of eligible households was names of heads of households and age (in approximate years) of any child under the age of five within the household. In the majority of sample survey schemes, simple random sampling (SRS) is used within selected subgroups in the population (Cabrera and McDougall, 2002). Therefore, in this study, to select the representative households from the lists of selected villages or streets, Simple Random Sampling Without Replacement (SRSWR) scheme was used. A random numbers table was used to achieve this.

3.3.4.3 Sample Size

The intention of the study was to have a representative sample taking into account existing geographically-defined administrative units in the study region as well as both costs and precision for informative analysis. It was hoped that inclusion of several geographic domains would provide a reasonable representation of the target population. Because of financial constraint, four out of the six districts (67 percent), which were officially recognized in the region at the time of designing of the study, were selected. These were Bahi, Dodoma Urban, Kondoa, and Mpwapwa districts.

There are numerous formulas in the literature as Aday and Cornelius (2006) provide some examples, for determining sample sizes. However, to estimate the size of the sample (n) or households for interviews, the study adapted the formula defined as shown in equation (3.17) below (Department of Economic and Social Affairs of the United Nations Secretariat, 2005). Calculation of the sample size was based on several variables including the key indicator of the study, the desired precision, the target population, and non-response rate, among others as equation (3.17) demonstrates.

$$n = \frac{(z^2)(r)(1-r)(f)(k)}{(p)(\bar{n})(e^2)} \tag{3.17}$$

Where n was the required sample size, z represented the desired level of confidence, r was an estimate of the key indicator, which was measured from the target population of

the study, and f was the sample design effect. The quantity k was a factor to account for non-response units, p was an estimate of the percentage of the total population accounted for by the target population and for which the parameter r was based, $\bar{n}$ was the average household size and e was the margin of the error, which the study aimed to attain in the estimates.

The key indicator that the study aimed to estimate was the likelihood that a case of malaria (represented by fever) for under-five children was expected to be reported by the primary caretakers in the sampled households. According to THMIS (2008), about 19.5 percent of children under the age of five in Dodoma were reported having experienced an illness with a fever in the past two weeks preceding the survey. Based on the 2002 PHC data, the projected population of under-five children in Dodoma at the end of 2009 was about 18 percent of the region's total population (NBS, 2006). Accordingly, to calculate the sample size, the values of r and p were taken to be 0.195 and 0.18 respectively. The probability of reporting a case of malaria in the study was estimated with a 5 percent margin of relative error at the 95 percent level of confidence (z=1.96). In this case $e = 0.195r$ =0.00975. Non-response rate may vary considerably between geographic areas and even between rural and urban areas within the same region or district. For simplicity and in order to ensure that both costs and precision were optimally balanced, a value of k (=9.9 percent) close to the default value (10 percent) was used in the calculation of the size of the sample for the study. Based on statistics from THMIS (2008), the design effect (f) for the key indicator variable in the study

area was 1.385, thus, f was taken to be 1.385. The value of $\tilde{n}$ =4.5 from the 2002 PHC was used in the calculation in equation (3.17). Substitution of these summary statistics in equation (3.13) resulted into an estimated sample size, n of about 1073 households. The calculated sample size was rounded up to 1080 households with at least one child under the age of five.

Because of resources constraint, in each selected PSU, 18 villages/streets were sampled resulting into 72 villages/streets for the study. In each selected SSU, 15 households with children under the age of five were sampled. A small number of households and of constant size were taken from each sampled village or street for the purpose of lowering the sampling design effect in the study. This was done assuming that individuals from within the same cluster were more likely to be in a way similar to one another, but heterogeneous across clusters. Kerry and Bland (2001) demonstrated in particular that when a large number of study subjects per cluster and cluster size weights are used, the power of the study decreases. Therefore, small size clusters result into better overall reliability of sample estimates.

Of the total 1080 sampled households, 1027 households were successfully interviewed leading to a response rate of approximately 95 percent. The response rate was almost equally distributed among the study districts. That is, 25.1 percent (n=258), 25.5 percent (n=262), 24.3 percent (n=250), and 25.0 percent (n= 257) of the studied households were from Kondoa, Bahi, Dodoma Urban, and Mpwapwa respectively. The 5 percent

(n=53) non-response rate was due to various reasons including respondents declining to be interviewed (n=22, 2.1 percent), the entire household being absent for an extended period (n=11, 1.1 percent) and sampled household not being separate from another household (n=7, 0.7 percent). Other factors, which contributed to non-response were dwelling not found (n=5, 0.5 percent), absence of a knowledgeable person to be interviewed in the household after three visits (n=1, 0.1 percent) and age of youngest child in the sampled household being above five years at the time of first visit of the household (n=7, 0.7 percent).

3.3.4.4 Questionnaire

The data were collected through face-to-face interviews using a structured questionnaire (Appendix C). The questionnaire consisted of items adapted from validated questionnaires (including DHS, Living Standards Measurement Study, THMIS and so on) already being used in similar settings within and outside of the country, besides author-generated items. The study restricted the interviews to structured-interview format since it is the most commonly used data collection strategy in health behaviour studies especially those oriented to quantifications (Di Iorio, 2005). The questionnaire was designed in English, but was later translated into Kiswahili to facilitate the interviews. In order to ensure that the original meanings of the various items of the questionnaire were maintained, the Kiswahili version was sent to an independent university staff who was conversant in both English and Kiswahili to help translate it back into English (back translation). The two versions were scrutinized systematically

question-by-question to identify any discrepancies available in wording or sentence formulation. Inconsistencies were checked and synchronized accordingly.

The final version of the questionnaire was subjected for pre-testing to a sample of 30 households from a ward, which consisted of both rural and urban characteristics in Dodoma Municipality. The ward used for pre-testing was not selected for interviews in the main data collection session. While many aspects were checked during the pre-testing of the questionnaire, in order to ensure that the questions produced reliable answers and valid measures of the estimates of interest, close attention in the pre-testing was placed on checking whether or not the following aspects were suitable: (i) wording of the questions. That is, whether or not the questions were understood and conceptualized by all the respondents equally, (ii) the length of time required to complete one household interview thus optimal duration of data collection for the entire study, (iii) plausible response categories of questions, and (iv) sequence of questions in the questionnaire[10]. As mentioned, some measure items such as household expenditure were found to be not feasible to yield reliable responses, thus were dropped in the final version of the questionnaire.

Respondents on socio-economic and demographic characteristics of household were heads (males or females) of households or their spouses. Where the head of the

[10] The effect of questions and their order in a questionnaire on survey responses is well documented. Kalton and Schuman (1982), McFarland (1981) and Bradburn and Mason (1964) provide a succinct exposition of the effect that questions and the order have on survey responses respectively.

household or his/her spouse was not available, a representative respondent from among the members of the household was chosen. On the other hand, respondents on matters of child health were the primary caretakers (women) of children under the age of five at the household. The study restricted to women respondents in matters of child health because they are often the primary caretakers of children under the age of five in the household. For that matter, they stand a better chance of providing health-related information including assessment of illnesses, their severity and information on treatment for their children (Tolhurst *et al.*, 2008). McCauley *et al.* (1992) also support that fact in which they found that mothers of children in Dodoma were responsible for health practices. Moreover, on the grounds that not all children under the age of five stay with their biological mothers at home, the study considered as a primary respondent any adult woman who stayed with the child and one who was responsible for most of his/her care decisions including medical care at the household. Such a person was referred to as the "primary caretaker" or simply "caretaker". Therefore, the primary caretakers were either biological mothers or adult women guardians of the child in the sampled households.

Administration of questionnaire

Data collection took place for about four months (October 2010-January 2011). Sampled households were identified with the help of village executive officers or his/her representative in the respective villages/streets. In some villages, especially those located in remote areas, information (including names of heads of randomly selected households and key respondents) regarding the study, and the date the research team was

expected to visit the area for interviews was sent to the local leaders well in advance. This was done in order to ensure a smooth and timely completion of data collection and to increase the response rate.

Trained research assistants with background in various fields including medical conducted the interviews. Prior to beginning of data collection process, the research assistants had four-day training on various aspects of the study including the objectives of the study and data collection method. The interviews were conducted in Kiswahili (the language that is widely spoken in Tanzania), thus the interview technique adopted in the study was to read the questions as orally as possible. In exceptionally few cases (wherever the respondents was not fluent enough in Kiswahili) a translator fluent in the interviewer's language was used. However, in order to ensure reliability of the responses, care was taken not to alter the meaning of the questions. In matters related to child health, whenever the respondent was provisionally unavailable to be interviewed at the first visit of the household, up to two additional visits (preferably at a time when there was a good chance to meet the respondent for interview) were made. Equally, where appropriate, attempts were made to convince the respondents who, for various reasons, were unwilling to be interviewed. Key messages that were given to the respondents who declined to participate in the study include re-assuring their anonymity and confidentiality of information. No substitution of either unavailable or loath respondents was made.

Data quality

In order to ensure that the data were of good quality to meet the expected goal of the study, the principal investigator supervised the data collection. Several mechanisms were used to check the quality of the collected data. These included scrutiny of a randomly selected sample of questionnaires for each interviewer on daily basis beginning the first day of commencement of data collection. In addition, the principle investigator randomly visited each interviewer while conducting the interview at the sampled household to ascertain the accuracy of the corrected information. In order to avoid repetition of any detected error in future interviews, debriefing sessions involving the supervisor and all interviewers were conducted on every evening of data collection. Problems that emerged from the field were made known, discussed and consensus obtained in order to improve the data collection process.

Data Management

The collected data were entered in the Statistical Package for the Social Sciences (SPSS for Windows version 12.0) programme. Because of time constraint, the data were single-entered. However, to verify the precision of data entry in SPSS, after the data entry of all questionnaires, two data verification strategies were employed. First, 10% of randomly selected questionnaires were thoroughly checked. Second, descriptive statistics and frequency distributions of each variable were examined. Cross-tabulations to search for any additional problems were also carried out.

3.4 Results

3.4.1 Descriptive Statistics

Table 3.4 presents descriptive statistics for selected variables in the study as a whole while Table A1 of Appendix "A" gives descriptive statistics of variables for the sub-sample of data analyzed in this chapter. That is, a sample distinguishing between children whose caretakers believed that the harmful effects of fever could occur and those whose caretakers did not.

The findings in Table 3.4 reveal that more than three-quarters (n=826, 80.4 percent) of the 1027 successfully interviewed households were headed by males and 19.6 percent (n=201) by females. The mean age (SD) of heads of households was 37.4 (10.6) years with a range of 17-80 years and was evenly distributed between wealth quintiles (p=0.163). Most heads of households (n=77, 7.5 percent) were at the age of 30 years than any other age value. Male heads of households were on average (SD) older than female heads of households: 38.1 (10.4) versus 34.0 (10.7) years respectively (p<0.001).

The mean (SD) number of household members was 4.9 (1.9) people with a range of 2-15 people. Most of the households (n=234; 22.8 percent) had four members and there was a statistically significant difference (p<0.001) in household size between households in urban and rural areas: 4.3 (1.7) versus 5.2 (1.9) people respectively. Household size also differed between districts (p<0.001) with Kondoa and Dodoma Urban districts having

the highest and lowest mean (SD) household sizes of 5.7 (2.1) and 4.3 (1.6) people respectively.

A total of 1390 eligible under-five children were studied from the successfully interviewed (n=1027) households in the study. Of the total children, 27.8 percent (n=387) were from Kondoa district, 26.4 percent (n=367) from Bahi district, 22.5 percent (n=313) from Dodoma Urban district, and 23.2 percent (n=323) from Mpwapwa district (p=0.000). More than two-third (n=692, 67.4 percent) of the households, 29.9 percent (n=307) and 2.7 percent (n=28) had one, two, and three eligible under-five children respectively. Of the households with 3 eligible under-five children, approximately 61, 21, 7, and 11 percent were from Kondoa, Bahi, Dodoma Urban, and Mpwapwa districts respectively (p<0.001). There was a statistically significant association between number of under-five children and household wealth status (p=0.002). More than three-quarter (n=166, 75.1 percent), 24.0 percent (n=53), and 0.9 percent (n=2) of the households in the highest wealth category had one, two, and three eligible children respectively. The corresponding proportions in the poorest wealth group were 58.8 percent (n=114), 38.7 percent (n=75), and 2.6 percent (n=5) respectively.

The findings reveal that most of the heads of households (n=666, 64.8 percent) had completed primary education while others: had never attended school (n=163, 15.9 percent), had some primary education (n=92, 9.0 percent), had secondary school

education (n=90, 8.8 percent), and had higher (college/university) education (n=16, 1.6 percent). Female heads of households were more than double likely to have never attended school at all than their male heads of households counterparts: 27.9 percent (n=56) females against 13.0 percent (n=107) males (p<0.001). There was a highly significant association (p<0.001) between education level of heads of households and wealth status. Of the heads of households with no education, 44.8, 26.4, and 20.2 percent were in the poorest, second, and middle wealth categories respectively. Some 5.5 and 3.1 percent were in the fourth and highest wealth quintiles respectively. In contrast, of those with higher education, approximately 81, 13, and 6 percent were in the highest, fourth, and middle wealth groups respectively. Between sexes, the majority (n=180, 88.7 percent) of the male-headed households were in the middle wealth quintile while the majority (n=50, 25.9 percent) of the female-headed households were in the poorest wealth category as Table 3.4 shows.

The most frequently reported occupation (n=717, 69.8 percent) of heads of household was agriculture and/or livestock keeping. Self-employment (both with and without employees) constituted the second (n=191, 18.6 percent) most common type of occupation by heads of households. There was a statistically significant association (p<0.001) between occupation of head of household and education. Of the heads of households with higher education (n=16), three-quarter (n=12, 75.0 percent) were employed in the government or parastatal sector while of those who had never attended school at all (n=163), 90.8 percent (n=148) were farmers and/or livestock keepers. In

this study, none of the heads of household who had higher education was engaged in agricultural activities.

Table 3.4: Descriptive statistics for selected variables by wealth quintile

Variable	Wealth Quintile					Total	*P* value
	Poorest	Second	Middle	Fourth	Highest		
Socio-Demographic Characteristics							
Sex of HH head, *n* (percent)							
Male	143 (74.1)	153 (77.7)	180 (88.7)	177 (83.1)	173 (78.3)	826 (80.4)	0.003§**
Female	50 (25.9)	44 (22.3)	23 (11.3)	36 (16.9)	48 (21.7)	201 (19.6)	
Age (years) of head of HH, mean (SD)	39.0 (11.6)	36.9 (10.0)	37.6 (10.9)	37.6 (10.6)	36.0 (9.6)	37.4 (10.6)	0.163‡
Household size, mean (SD)	5.0 (1.7)	5.1 (1.7)	5.3 (1.9)	5.0 (2.2)	4.4 (1.7)	4.9 (1.9)	<0.001‡***
Eligible <5 children in HH, *n* (percent)							
One	114 (58.8)	120 (61.2)	138 (68.0)	154 (72.3)	166 (75.1)	692 (67.4)	
Two	75 (38.7)	71 (36.2)	55 (27.1)	53 (24.9)	53 (24.0)	307 (29.9)	0.002§**
Three	5 (2.6)	5 (2.6)	10 (4.9)	6 (2.8)	2 (0.9)	28 (2.7)	
Socioeconomic Characteristics							
Education of head of HH, *n* (percent)							
No education	73 (37.8)	43 (21.8)	33 (16.3)	9 (4.2)	5 (2.3)	163 (15.9)	
Some primary	24 (12.4)	17 (8.6)	23 (11.3)	20 (9.4)	8 (3.6)	92 (9.0)	
Primary finished	96 (49.7)	133 (67.5)	144 (70.9)	151 (70.9)	142 (64.3)	666 (64.8)	<0.001§***
Secondary	0 (0.0)	4 (2.0)	2 (1.0)	31 (14.6)	53 (24.0)	90 (8.8)	
Higher	0 (0.0)	0 (0.0)	1 (0.5)	2 (0.9)	13 (5.9)	16 (1.6)	
Farming/livestock keeping	187 (96.9)	190 (96.4)	188 (92.6)	137 (64.3)	15 (6.8)	717 (69.8)	
Government and parastatal	0 (0.0)	1 (0.5)	1 (0.5)	15 (7.0)	28 (12.7)	45 (4.4)	
Private	0 (0.0)	0 (0.0)	2 (1.0)	9 (4.2)	34 (15.4)	45 (4.4)	<0.001§***
Self-employed with employees	0 (0.0)	1 (0.5)	4 (2.0)	11 (5.2)	10 (4.5)	26 (2.5)	
Self-employed without employees	1 (0.5)	2 (1.0)	3 (1.5)	36 (16.9)	123 (55.7)	165 (16.1)	
Unable to work (old, sick, disabled)	5 (2.6)	3 (1.5)	5 (2.5)	5 (2.3)	11 (5.0)	29 (2.8)	
Caretakers' Characteristics							
Age (yrs), mean (SD)	32.0 (8.4)	30.4 (7.6)	29.9 (7.4)	30.7 (8.2)	29.9 (8.0)	30.5 (7.9)	0.080‡*
Marital status, *n* (percent)							
Currently married	113 (58.5)	131 (66.5)	169 (83.3)	152 (71.4)	156 (70.6)	721 (70.2)	
Living as if married	24 (12.4)	19 (9.6)	7 (3.4)	22 (10.3)	16 (7.2)	88 (8.6)	
Widowed	18 (9.3)	11 (5.6)	6 (3.0)	8 (3.8)	5 (2.3)	48 (4.7)	<0.001§***
Divorced	11 (5.7)	7 (3.6)	4 (2.0)	6 (2.8)	7 (3.2)	35 (3.4)	
Separated	13 (6.7)	10 (5.1)	10 (4.9)	5 (2.3)	9 (4.1)	47 (4.6)	
Never married	14 (7.3)	19 (9.6)	7 (3.4)	20 (9.4)	28 (12.7)	88 (8.6)	
Education, *n* (percent)							
No education	92 (47.7)	54 (27.4)	30 (14.8)	21 (9.9)	6 (2.7)	203 (19.8)	<0.001§***
Primary not finished	8 (4.1)	15 (7.6)	22 (10.8)	11 (5.2)	8 (3.6)	64 (6.2)	
Primary finished	93 (48.2)	123 (62.4)	146 (71.9)	159 (74.6)	161 (72.9)	682 (66.4)	

Variable	Wealth Quintile					Total	*P* value
	Poorest	Second	Middle	Fourth	Highest		
Secondary	0 (0.0)	5 (2.5)	5 (2.5)	22 (10.3)	38 (17.2)	70 (6.8)	
Higher	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	8 (3.6)	8 (0.8)	
Child Characteristics							
Age (months), *n* (percent)							
0-11						299 (21.5)	
12-23						287 (20.6)	
24-35						274 (19.7)	na
36-47						268 (19.3)	
48-59						262 (18.8)	
Sex, *n* (percent)							
Male	139 (50.0)	137 (49.3)	129 (46.4)	141 (50.7)	146 (52.5)	692 (49.8)	0.592[¥]
Female	139 (50.0)	141 (50.7)	149 (53.6)	137 (49.3)	132 (47.5)	698 (50.2)	
Biological mother stays at home, *n* (percent)							
Yes	267 (96.0)	268 (96.4)	268 (96.4)	264 (95.0)	260 (93.5)	1327 (95.5)	0.416[§•]
No or not alive	11 (4.0)	10 (3.6)	10 (3.6)	14 (5.0)	18 (6.5)	63 (4.5)	
Biological father stays at home, *n* (percent)							
Yes	195 (70.1)	212 (76.3)	236 (84.9)	217 (78.1)	203 (73.0)	1063 (76.5)	0.001[§•••]
No or not alive	83 (29.9)	66 (23.7)	42 (15.1)	61 (21.9)	75 (27.0)	327 (23.5)	
Relationship to head of HH, *n* (percent)							
Son/daughter	254 (91.4)	258 (92.8)	258 (92.8)	254 (91.4)	248 (89.2)	1272 (91.5)	
Grand child	24 (8.6)	17 (6.1)	16 (5.8)	23 (8.3)	26 (9.4)	106 (7.6)	0.271[§]
Other relative	0 (0.0)	2 (0.7)	4 (1.4)	0 (0.0)	2 (0.7)	8 (0.6)	
Adopted/foster child	0 (0.0)	1 (0.4)	0 (0.0)	1 (0.4)	2 (0.7)	4 (0.3)	
Community Characteristics							
Place of residence, *n* (percent)							
Urban	1 (0.5)	7 (3.6)	4 (2.0)	55 (25.8)	200 (90.5)	267 (26.0)	<0.001[§•••]
Rural	192 (99.5)	190 (96.4)	199 (98.0)	158 (74.2)	21 (9.5)	760 (74.0)	
Distance (km) to nearest HF, mean (SD)	10.2 (8.6)	9.8 (8.2)	9.4 (7.5)	6.8 (6.5)	4.1 (2.7)	7. 9 (7.3)	<0.001[§•••]
Distance (km) to nearest market, mean (SD)	15.2 (10.5)	14.1 (10.9)	12.0 (11.4)	10.6 (11.4)	3.1 (2.9)	10.8 (10.8)	<0.001[¥•••]
Road passable the whole year, *n* (percent)							
Yes	123 (63.7)	134 (68.0)	144 (70.9)	167 (78.4)	215 (97.3)	783 (76.2)	n.a
No	70 (36.3)	63 (32.0)	59 (29.1)	46 (21.6)	6 (2.7)	244 (23.8)	

[¥]KW test, [§] Chi-square test; [¥] Mann-Whitney *U* test; * significant at < 0.1 level; **significant at < 0.05 level; *** significant at < 0.01 level; n.a=not appropriate; HH=household; HF=health facility. **Source:** Field Data (October 2010-January 2011)

The findings reveal that the mean (SD) age of caretakers was 30.5 (7.9) years with a range of 16-69 years. About two-thirds (n=682, 66.4 percent) of the caretakers had completed primary education; 19.8 percent (n=203) had no education at all, 6.8 percent (n=70) had secondary education, 6.2 percent (n=64) had some primary education and a small proportion (n=8, 0.8 percent) had higher education. Of those who had never attended school, the majority (n=92, 47.7 percent) were in the poorest wealth category while all of those with higher education were in the highest wealth category. There was a statistically significant association between education attainment of caretakers and district of residence (p<0.001). More than half (n=38, 54.3 percent) and three-quarter (n=6, 75.0 percent) of those with secondary and with higher education respectively were from Dodoma Urban district. The findings reveal further that education attainment of the caretakers varied (p<0.001) between rural and urban areas with caretakers in the latter location (n=6, 75.0 percent) being more likely to attain higher education than those in the former areas (n=2, 25.0 percent). The number of years of stay in the study district of the caretaker was significantly associated with the district in which the caretaker was residing (p<0.001). Approximately 47.0 percent (n=479) of the caretakers were always resident in the respective district of residence, 1.8 percent (n=18) had lived for less than a year, 23.3 percent (n=239) for 1-4 years, 9.5 percent (n=98) for 5-9 years, and 18.8 percent (n=193) had lived for more than 10 years.

With regard to marital status, the findings show that, most of the caretakers (n=721, 70.2 percent) were married, 8.6 percent (n=88) were living with a man as if married, 8.6

percent (n=88) had never been married. Others had separated with their partners (n=47, 4.6 percent), a similar amount (n=48, 4.7 percent) was widowed, whereas a small proportion (n=35, 3.4 percent) were divorced. Less than 1 percent (n=2) of the caretakers in the study had never given birth, 37.3 percent (n=383) had had between 1-2 live births, 34.3 percent (n=352) between 3-4 live births, whilst the remaining 28.2 percent (n=290) had had at least five live births. There was a significant association between number of live births and education level of caretaker (p<0.001). Over half (n=5, 62.5 percent) of the caretakers with higher education had had between 1-2 live births compared to 30.0 percent (n=61) of those without education. The number of live births that an individual caretaker had had was independent of her religious affiliation (p=0.219).

Of the total under-five children in the study, the majority (n=698, 52.2 percent) were females. The mean (SD) ages was 28.6 (17.3) months. Most of the children (n=287, 20.6 percent) were aged between 12-23 months followed by the age groups 24-35, 36-47 and 48-59 months, which constituted 19.7 percent (n=274), 19.3 percent (n=268) and 18.8 percent (n=262) respectively. Children in the age groups 0-5 and 6-11 months respectively represented 10.0 percent (n=139) and 11.5 percent (n=160) of the total children.

More than nine in ten children (n=1310, 94.2 percent) had both of their biological parents alive and 80.5 percent (n=1054) of those children had their parents currently

living at home. The findings reveal further that the majority of the children lived at home together with their mothers (n=1327, 95.5 percent) than their fathers (n=1063, 76.5 percent). Age of the child was weakly or marginally (at the 0.1 level) significantly associated with availability at home for both of his/her biological parents (p=0.06). Whereas availability at home for both biological parents was not associated with the age of the child, availability at home of biological mothers was highly dependent on the age of the child (p<0.001). Children in the age groups 0-11 and 12-23 months old respectively had 100 and 98 percent of their biological mothers at home compared to 92.3, 92.9 and 93.1 percent for 24-35, 36-47 and 48-59 months olds. In terms of relationship of the children to the heads of households, the majority (n=1272, 91.5 percent) of the children were sons/daughters of the heads of households.

Of the 1027 successfully interviewed households, the majority (n=760, 74.0 percent) were from rural areas. The average (SD) distance to the nearest health facility was 7.94 (7.3) km. The majority (n=177, 17.2 percent) of the households in the study were 4 km away from the nearest health facility than any other reported value of distance. Proximity of households to health facilities in the study areas varied between districts of residence. Figure 3.1 illustrates the findings regarding district variability of distances to the nearest health facility. As evident in the figure, the mean (95 percent C.I) distances from the household to the nearest health facility was much higher among households in Mpwapwa district than was in Kondoa, Bahi, Dodoma Urban, and Mpwapwa districts: 7.0 (6.26, 7.76), 9.4 (8.42, 10.43), 4.4 (4.02, 4.78), and 10.8 (9.73, 11.85) km

respectively. As Figure 3.1 shows, Bahi and Mpwapwa districts had mean distances, which were above the overall point estimate of mean distance (7.94 km). Consistent with observation in previous studies such as Tanzania Service Availability Mapping 2005-2006 (TSAM, 2006), the distance to the nearest health facility was redefined to take on only two values, that is, less than five and five and above km.

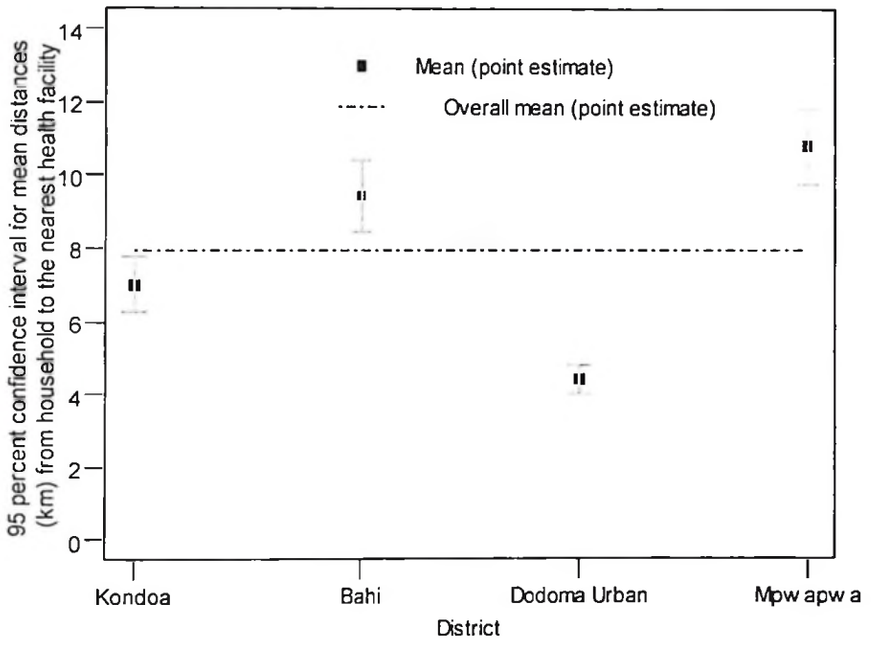


Figure 3.1: Between district comparison of distances to the nearest health facility

Source: Own drawing based on field data (October, 2010-January, 2011)

Concerning distance to the nearest market, the findings show that the majority of the households (n=657, 64.0 percent) were more than 5 kilometres away. Distance to the nearest market also varied between districts. Households in Dodoma Urban district

(n=184, 73.6 percent) were more likely to be within 4 kilometres from the nearest market than those in Kondoa (n=87, 33.7 percent), Mpwapwa (n=56, 21.8 percent) and Bahi (n=43, 16.4 percent) districts (p<0.001). About 96 percent (n=239), 82.9 percent (n=213), 65.3 percent (n=171), and 62.0 percent (n=160) of the households in Dodoma Urban, Mpwapwa, Bahi and Kondoa districts respectively were in areas in which the main road was passable all through the year.

More than half (n=760, 54.7 percent) of the total children in the study were reported having not experienced any of the five major symptoms (fever, convulsion, diarrhoea, cough/flu and vomiting) in the past four weeks preceding the date of the survey. The remaining 45.3 percent (n=630) experienced at least one of the symptoms. Of the total children who experienced at least one symptom, about 1.0 percent (n=6) experienced all the five symptoms and the other children experienced four (n=58, 9.2 percent), three (n=89, 14.1 percent), two (n=150, 23.8 percent) and one (n=327, 51.9 percent) of the five symptoms.

Figure 3.2 presents the distribution of number of symptoms experienced by children for selected characteristics. In particular, the figure provides a representation of the distribution of number of symptoms comparing children across wealth groups (plots i-v), and the district in which the children were from (plots vi-ix). In addition, the figure compares children by level of education of their caretakers (plots x-xiv), and age of child (plots xv-xx). There appears to be some explainable variations between the selected

individual, household, and community level factors in terms of distribution of number of symptoms, which the children experienced. For example, whereas 22.6 percent (n=74) and 25.7 percent (n=84) of the total children who experienced one symptom were from the poorest and second wealth quintiles, 18.0 percent (n=59), 20.2 percent (n=66), and 13.5 percent (n=44) were from the middle, fourth, and highest wealth groups respectively. A similar pattern was observed for the number of children who experienced two, three, four, and five symptoms and equally for the level of education of the caretakers.

The most commonly reported symptoms were cough/flu, fever, and diarrhoea, which were reported in 35.5 percent (n=494), 23.7 percent (n=329) and 14.8 percent (n=206) of the total children respectively. Vomiting constituted 8.3 percent (n=115) of the total children in the study while a small proportion (n=12, 0.9 percent) of the children experienced convulsion. The findings divulge that, of the total children with fever, 52.9 percent (n=174) were males. However, there was no association between recognition of fever and sex of child (p=0.198).

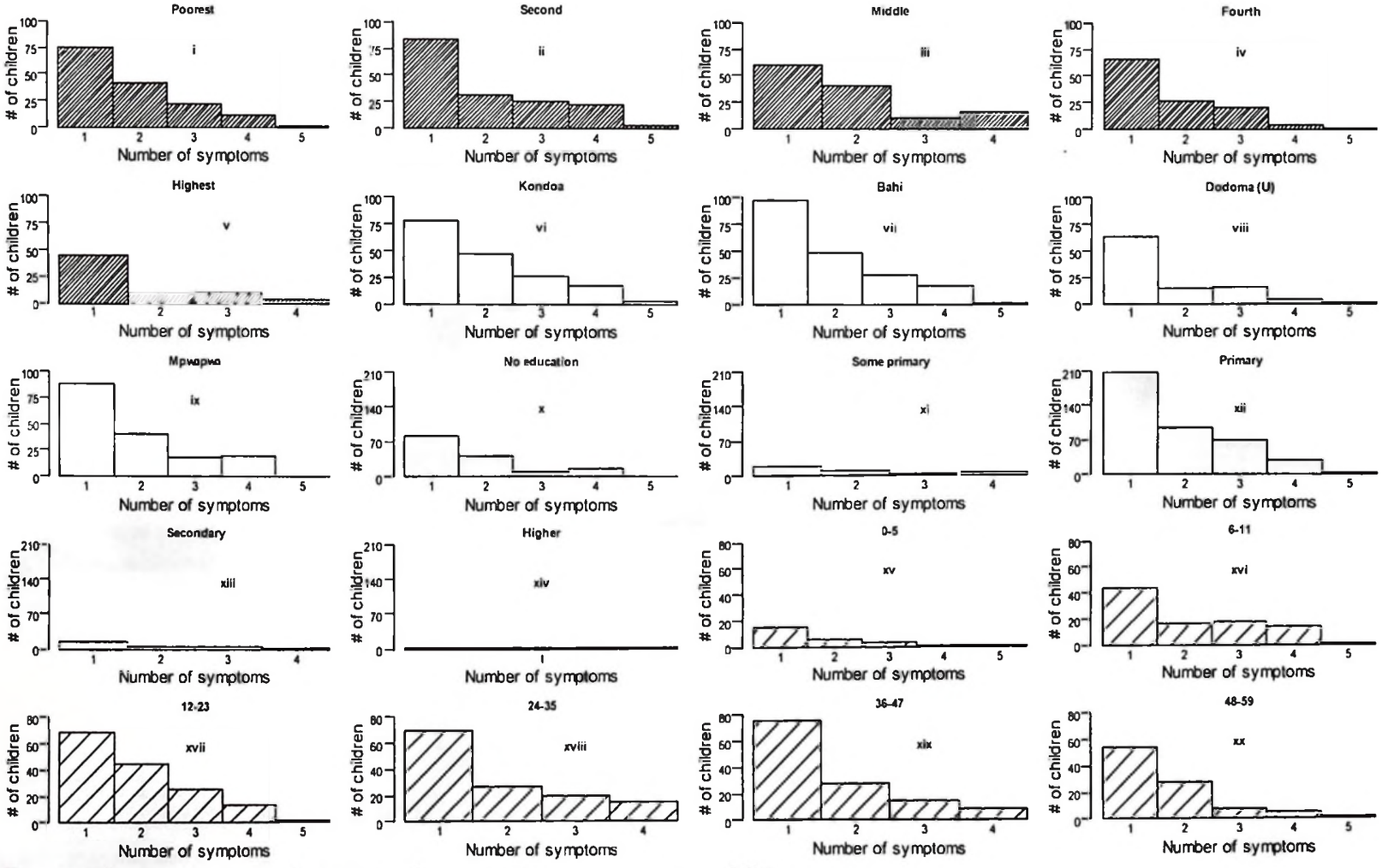


Figure 3.2: Distribution of number of symptoms experienced by children

Source: Own drawing based on field data (October, 2010-January, 2011)

The findings show that statistically, the rate of reporting of fever among under-five children was significantly highly dependent on the wealth group in which the children were from (p<0.001). Children from the lowest and second SES were frequently reported as having experienced an incidence of fever than children in the middle and fourth SES. The former two groups represented 24.6 percent (n=81) and 28.0 percent (n=92) while the latter groups represented 19.1 percent (n=63) and 18.5 percent (n=61) respectively. The highest wealth quintile group accounted for 9.7 percent (n=32) of the total children with fever in the study. District of residence and age of child were both statistically significantly associated with reporting of fever (p<0.001). Education of caretaker was not significantly associated with reporting of fever (p=0.587). Moreover, children from rural areas (n=275, 16.1 percent) were more likely to be reported having experienced an episode of fever than their counterparts in the urban areas (n=54, 16.1 percent) and the association was significant (p<0.001).

Figure 3.3 plots the number of children in the study who experienced the primary symptom (fever) and any of the other symptoms at any time during the past four weeks preceding the day of the survey. As the figure illustrates, the highest proportion (n=230, 16.5 percent) of the total children in the study experienced both fever and cough/flu. Fever and diarrhoea represented the second highest proportion (n=142, 10.2 percent) followed by fever and vomiting (n=100, 7.2 percent) while fever and convulsion represented 0.9 percent (n=12) of the total children in the study.

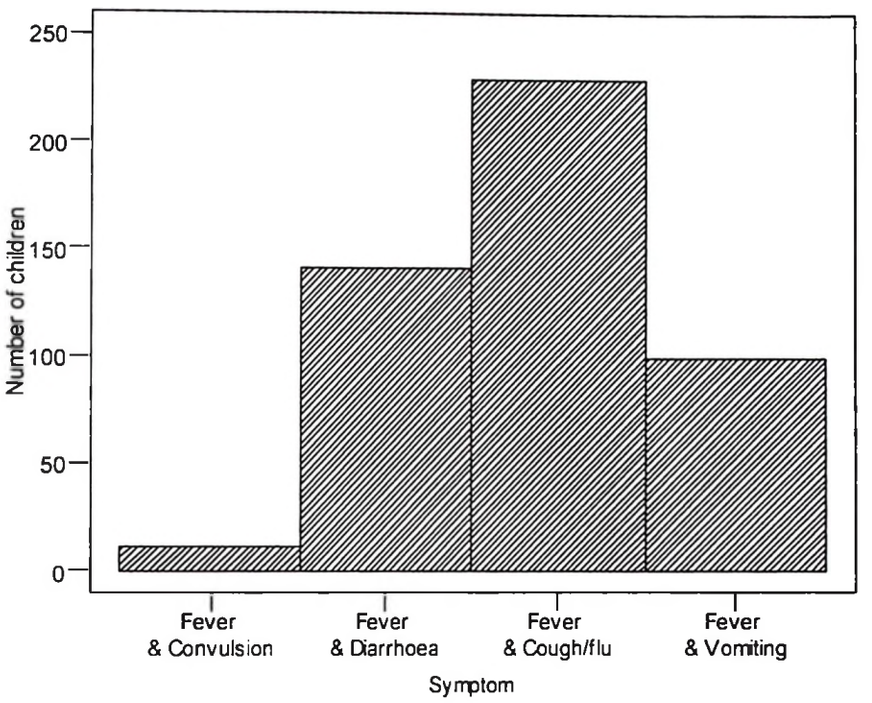


Figure 3.3: Distribution of children who suffered comorbidities

Source: Own drawing based on field data (October, 2010-January, 2011)

Table 3.5 summarizes caretakers' perceptions of symptoms at their first appearance among children in the study. It can be seen that, fever in more than two third (*n*=227, 69.0 percent) of the total children in whom this symptom appeared was perceived by their caretakers as suggestive of an illness. That is, not perceived as being a "normal" condition (*hali ya kawaida tu* Kiswahili translation) as was described by some of the caretakers. Caretakers perceived fever in most of the children (*n*=223, 98.2 percent) as being a sign of malaria, 1.2 percent (*n*=3), and 0.4 percent (*n*=1) as indicative of pneumonia or *kichomi* (Kiswahili translation) and urinary tract infection respectively. Convulsion in all the children (*n*=12, 100.0 percent) who experienced it was perceived

as being a sign of a malaria illness. Furthermore, the findings reveal that more than three quarters (n=155, 75.2 percent) of the total children who experienced diarrhoea were perceived as not being ill with any potential childhood diseases. Only about one quarters (n=51, 24.8 percent) of the children with the symptom were considered as being ill with a certain ailment. However, caretakers of most of the children (n=41, 80.4 percent) did not know which disease was associated with the symptom, which the child experienced. Only about 20 percent (n=41) of the children were perceived as being ill with malaria. Cough/flu and vomiting were perceived as indicative of an illness among 45.1 percent (n=223) and 69.6 percent (n=80) of the total children with the symptoms respectively. For most of the children (n=144, 66.8 percent) cough/flu was perceived as pneumonia, 19.7 percent (n=44) as malaria, and caretakers of 13.3 percent (n=30) of the children did not know which illness could be. On the other hand, vomiting was perceived as a sign of malaria in more than one-quarter (n=21, 26.3 percent) of the children while in most of the children (n=59, 78.8 percent), caretakers did not know which illness could be (Table 3.5).

The findings reveal that with the exception of fever, which was found to be marginally significant at < 0.1 level (p=0.095), caretakers' perceptions of all the other symptoms as to whether or not they were suggestive of certain illnesses at their first appearance among the children were not significantly associated with caretakers' level of education (p>0.1). Also, with the exception of diarrhoea (p=0.043), perceptions of all the other symptoms were independent of distance to the nearest health facility. In contrast,

perceptions of whether the symptoms were indicative of certain illnesses were found to be significantly associated with the district in which the children resided ($p<0.1$). The corresponding p-values of associations between district and perceptions for fever, diarrhoea, cough/flu, and vomiting were 0.014, 0.006, 0.002, and 0.060 respectively. Moreover, perceptions of children as to whether or not a particular symptom was indicative of an illness were independent of the wealth group in which an individual child was found in ($p>0.01$).

Table 3.5: Caretakers' perceptions of symptoms at onset among children

Symptom	Children with the symptom perceived as suggestive of a disease, yes, *n* (percent)	Perceived illness, *n* (percent)	
Fever	227 (69.0)	Malaria Pneumonia (*kichomi*) urinary tract infection	223 (98.2) 3 (1.3) 1 (0.4)
Convulsion	12 (100)	Malaria	12 (100)
Diarrhoea	51 (24.8)	Malaria Don't know	10 (19.6) 41 (80.4)
Cough/flu	223 (45.1)	Malaria Pneumonia (*kichomi*) Don't know	44 (19.7) 149 (66.8) 30 (13.5)
Vomiting	80 (69.6)	Malaria Don't know	21 (26.3) 59 (78.8)

Source: Field data (October, 2010-January, 2011)

As mentioned, caretakers were asked to indicate their perceived beliefs on the occurrence of harmful effects of fever when it first appeared on their under-five children at any time during the course of the past four weeks preceding the study. The findings

reveal that of the total children with fever (n=329) in the study, 46.2 percent (n=152) were perceived by their caretakers as having a high chance of experiencing any adverse health effect because of the fever that the child experienced. Others were perceived as having a low (n=94, 28.6 percent) or no chance at all (n=83, 25.2 percent). There were significant associations between perception of likely effects of fever and each of the variables wealth status (p=0.084), caretakers' level of education (p=0.010), and district of residence (p=0.007). For example, across wealth quintiles, caretakers were less likely to perceive their children as having no chance at all compared to low or high chances. Moreover, children of highly educated caretakers were less likely to be perceived as having a low chance of experiencing any of the potential health effects of fever. With the exception of Kondoa district, the majority of children in all the other districts were generally perceived as having a high chance for the adverse effects of fever to occur.

3.4.2 Estimation Results

Table 3.6 provides results of fitting the model in equation (3.10) with a logit link function. Model 1 in Table 3.6 is the empty or unconditional model (equation (3.8)) for the probability of reporting some chances (low or high) of occurrence of the harmful effects of fever (that is, the event="1"). From the table, the ICC is about 0.17, which shows existence of a moderately large within-group homogeneity or between-group heterogeneity. The estimated variance of the random term ($\hat{\sigma}_u^2$) on the logit scale is 0.6571 and is statistically significant (χ^2=5.97, p=0.0073). As observed previous, this could be interpreted to mean that caretakers' belief about the occurrence of harmful

effects of fever in under-five children was more dependent on the villages involved in the study. Therefore, the multilevel modelling approach was necessary to the data on the outcome measure in the present chapter.

The estimate of the fixed-effect for model 1 is 1.2307 ($p<0.001$), suggesting that the overall mean log-odds of having some chances for harmful effects of fever to occur was 1.2307. The corresponding probability of reporting some chance of occurrence of harmful effects of fever on average in the study population is estimated as $\hat{p} = \exp(1.2307)/1+\exp(1.2307)=0.774$. This is largely consistent with the reported proportion of children with fever who were perceived by their caretakers to have some chance (73.8 percent) of occurrence of the harmful effects of fever in the study.

Model 2 was fitted using all the variables shown in Table 3.6. As seen in the table, there seems to be a statistically significant difference (at 0.1 level) in reporting of some chances for harmful effects of fever to occur between caretakers with secondary and above education and those without education. The estimated coefficient for the variable secondary and above education of caretakers is -2.0375 (p=0.0681). That is, the log-odds of reporting some chances for harmful effects of fever to occur among under-five children is -2.0375 times higher in caretakers with secondary and above education as compared to uneducated caretakers, adjusting for the other variables in the model. Moreover, there seems to be a statistically significant difference in beliefs about the occurrence of harmful effects of fever between children of heads of households who had

secondary education and above and those of uneducated heads of households, adjusting for the other variables in the model. The estimated coefficient is 2.8957 (p=0.0430), suggesting an increased probability of reporting of occurrence of some chances for harmful effects of fever among children from households in which the heads of households had secondary education and above than those without education. Occupation of heads of households also appears to be statistically significant at < 0.1 level, with children of heads of households in non-agricultural activities more likely to be perceived to have some chances for harmful effects of fever to occur, adjusted for all other variables in the model. The corresponding estimated coefficient is -3.2708 (p=0. 0.0756).

With regard to contextual variables, the variable *eligHH* (that is, number of households with under-five children in the sampled village) was statistically significant at < 0.1 level. The corresponding estimated coefficient is -0.0077 (p=0. 0.0724), suggesting decreased probability of perception of occurrence of harmful effects of fever among children from villages with large under-five children, adjusted for all other variables in the model. The estimated effect of the variable perceived quality of road is 1.1097 (p=0.0325), indicating an increased probability of perception of some chances for harmful effects of fever to occur in areas where the quality of main roads were perceived to be fair or good than in areas with poor main roads, adjusted for all other variables in the model.

There appears also to be statistically significant differences (at 0.1 level) in beliefs about the occurrence of harmful effects of fever between children whose both biological parents stay at home and those whose both parents are not at home (p=0.0717). The variable perception that fever was a sign of an illness is statistically significant (p=0.0467). The log-odds of reporting some chances for harmful effects of fever to occur is 0.8165 times higher among children whose fever was perceived as a sign of an illness against those whose fever was not considered as a sign of an illness, adjusting for all the other variables. The log-odds of reporting some chances for harmful effects of fever to occur is --1.1856 (p=0.0159) times higher among children whose fever was perceived as being severe as compared to those whose fever was perceived as mild, adjusting for all the other variables. There is also a statistically significant difference in beliefs about the occurrence of harmful effects of fever between children from male-headed households and those of female-headed households (p=0. 0574). The log-odds of reporting some chances for harmful effects of fever to occur is -3.4094 times higher among children from male-headed households as compared to children from female-headed households, adjusting for all the other variables in the model.

Table 3.6: Multilevel logit model on perceived harmful effects of fever, n=329

	Model 1		Model 2	
Parameter	**Estimate (S.E)**	**P-value**	**Estimate (S.E)**	**P-value**
β intercept	1.2307 (0.1865)	<.0001	2.4972 (2.8261)	0.3803
Age of child:				
0-11			Ref.	Ref.
12-23			-0.0126 (0.5506)	0.9817
24-35			-0.8421 (0.5702)	0.1419
36-47			0.1097 (0.5878)	0.8523
48-59			-0.6786 (0.5834)	0.2467

Parameter	Model 1		Model 2	
	Estimate (S.E)	P-value	Estimate (S.E)	P-value
Sex of child (male)			0.3017 (0.3531)	0.3968
Convulsion (yes)			0.3276 (0.9479)	0.7375
Diarrhoea (yes)			0.5748 (0.4224)	0.1794
Cough/flu (yes)			0.0017 (0.4274)	0.9968
Vomiting (yes)			0.0032 (0.4509)	0.9943
Both parents (yes)			2.3335 (1.2655)	0.0717*
Relhead (non-son/dau.)			1.5317 (1.2826)	0.2337
Number of <5 (2-3)			-0.0457 (0.4004)	0.9097
Homemch (yes)			0.3633 (1.4805)	0.8123
Age (caretaker)			-0.0280 (0.0443)	0.5278
Education (caret.):				
No education			Ref.	Ref.
Primary			0.2445 (0.4937)	0.6226
Secondary+			-2.0375 (1.0915)	0.0681*
Occupation (caret.)				
Unemployed			Ref.	Ref.
Agricul. activities			-1.4007 (1.2556)	0.2710
Non-agric. activities			-1.0447 (1.2278)	0.3996
Yearspl (always)			0.3021 (0.3945)	0.4477
Mstatus (married)			1.1433 (1.7217)	0.5102
Sourceinf (HW)			-0.2361 (0.4416)	0.5957
Indicfev (yes)			0.8165 (0.3998)	0.0467**
Percsev. of fever:				
Mild			Ref.	Ref.
Moderate			-0.3123 (0.4197)	0.4588
Severe			-1.1856 (0.4820)	0.0159**
Age (head)			0.0326 (0.0359)	0.3642
Sex-head (male)			-3.4094 (1.7428)	0.0574*
Education (head):				
No education			Ref.	Ref.
Primary			0.5330 (0.5061)	0.2980
Secondary+			2.8957 (1.3896)	0.0430**
Occupation (head):				
Unemployed			Ref.	Ref.
Agricul. activities			-1.3015 (1.4175)	0.3722
Non-agric. activities			-3.2708 (1.7211)	0.0756*
HHsize			-0.0154(0.1247)	0.9020
Economic status:				
Poorest			Ref.	Ref.
Second			-0.0458 (0.4919)	0.9261
Middle			0.5542 (0.5666)	0.3306
Fourth			0.0629 (0.6576)	0.9241
Highest			2.1039 (1.4843)	0.1597
Location (rural)			0.5823 (1.2509)	0.6432
Populv			0.0017 (0.0013)	0.2012
EligHH			-0.0077 0.0042)	0.0724*
NearHF (≥5 km)			0.3738 (0.4973)	0.4576
Nearmkt (≥5 km)			-0.3658 (0.5633)	0.5223
District of residence				
Dodoma Urban			Ref.	Ref.

Parameter	Model 1		Model 2	
	Estimate (S.E)	P-value	Estimate (S.E)	P-value
Bahi			1.2765 (1.2974)	0.3289
Kondoa			0.0535 (1.3003)	0.9673
Mpwapwa			1.3979 (1.2880)	0.2819
Passable (yes)			-0.3417 (0.5084)	0.5072
Qualityroad (good)			1.1097 (0.5001)	0.0325**
σ_u^2	0.6571	0.0073***		

* significant at < 0.1 level; ** significant at < 0.05 level; *** significant at < 0.01 level

3.5 Discussion

In this chapter, 329 under-five children with fever in the past four weeks preceding the date of the survey were studied and the majority (74.8 percent) were perceived by their caretakers to have some chances for the harmful effects of fever to occur. The findings of this study concur with those of Alex-Hart and Frank-Briggs (2011) who found that 84.1 percent of mothers believed that fever had complications and that mostly (67.7 percent) believed that fever could cause convulsion while 6 percent believed that fever could lead to death. In the same light, Walsh and Edwards (2006) reviewed literature on the management of childhood fever by parents and realized that many parents considered fever to be harmful and were exceptionally concerned about the perceived harmful outcomes of fever.

It has also been revealed in this study that secondary and above education of caretakers was associated with decreased beliefs that the harmful effects of fever could occur. Children of caretakers with no education were more likely to be perceived to have some chances for the harmful effects of fever to occur than children whose caretakers had

secondary and above education. This implies that differences exist in the ability to manage childhood fever between the educated and uneducated caretakers. This may be partly attributed to increase in knowledge among the educated caretakers on how to efficiently deal with childhood fever when it occurs and partly due to high level of autonomy among the educated caretakers. The observed phenomenon seems to agree with the findings from other studies about the role of maternal education in health-related matters in children. For example, Buor (2003), Heaton *et al.* (2005), and Zottarelli *et al.* (2007) observed that maternal education had a strong effect on child health, often resulting into better health outcomes. In Ghana, a statistically significant positive relationship between mother's education and child survivorship was observed (Buor, 2003). Zottarelli *et al.* (2007) on the other hand, observed that children of highly educated mothers and who were above 150 cm had a lower risk of stunting compared to children of no education mothers and were less than 150 cm height. Semba *et al.* (2008) found that high level of maternal education was strongly associated with protective childcare practices including use of a local health post and receipt of childhood immunisations. In the same vein, Birdsall *et al.* (1995) observed that educated mothers were more effective in using health care services not only for themselves, but also for their children. In a study on mothers' perception of fever management in children, Alex-Hart and Frank-Briggs (2011) note that most of the educated mothers knew the causes of fever and the symptoms associated with fever.

When the findings in the present study are carefully evaluated one could conclude that highly educated mothers are more likely to act appropriately when fever appears in their children than their counterpart uneducated caretakers. Moreover, women's education has a strong association with their autonomy (for example, Sujatha and Reddy, 2009; Moursund and Kravdal, 2003) as supported empirically by the present study's findings. Women's autonomy, which includes control over resources and decision regarding health care for sick children (Ghuman, 2003), may persuade them to report that their under-five children have less possibility for the harmful effects of fever to occur.

In this chapter, it was also found that secondary education and above of heads of households, was significantly associated with increased log-odds of belief about the occurrence of harmful effects of fever among children. This finding appears to be counterintuitive in view of a strong linkage between education and household wealth, which has long been established in literature. Studies have observed that well educated individuals earn higher incomes to meet necessary goods and services for improving health status (Semba *et al.*, 2008; Ross and Wu, 1995). In this perspective, as observed earlier in the literature review, paternal level of education is often associated with household income.

Walsh and Edwards (2006) provide a review of literature on management of childhood fever by parents, showing that when fever occurs, parents often take children's febrile temperature constantly, mostly hourly in order to monitor its severity. The authors note

further that not all parents were able to accurately check their children's febrile temperature. The inability to accurately measure the temperature was associated with SES, including lack of thermometers. However, in the present study, the economic status of households measured by possession of durable goods was not significant. That is, there were not statistically significant differences in beliefs about the occurrence of harmful effects of fever between children from the poorest wealth category and all the other wealth categories. This finding appears to be counterintuitive, based on the observation above by Walsh and Edwards (2006) that there is a strong association between the wealth status of households and acquisition of essential resources to manage childhood fever. This might be the case because the wealthier people may be too hard to believe in medical advices especially if they pretend to know much as compared to the seemingly poor but ready to adhere to medical advice regarding care seeking and caretaking.

Lack of a statistically significant effect of wealth status of households on beliefs about the occurrence of harmful effects of fever could be due to many factors. It could be due to existence of strong relationships among most of the socioeconomic variables considered in the analysis. For example, with respect to the outcome measure of interest in the present chapter, education of caretaker and that of head of household could be highly linked. Semba *et al.* (2008) noted that highly educated fathers often earn more money and marry women of similar levels of education. In the present study, sex of head of household appears to have a negative effect on the outcome measure, indicating that

relative to male-headed households, children in female-headed households were associated with high probability for harmful effects of fever to occur. This is not surprising as headship is often associated with household income control including decisions guiding income expenditure, often male-headed households being more affluent than female-headed households are.

The somewhat counterintuitive finding about the role of education of the head of household on beliefs about the occurrence of the harmful effects of fever could be due to differences in perceptions of severity of illness between the uneducated and the educated ones hence, between the poor and the rich. This is likely to be so because the rich people are expected to be mostly the highly educated ones than the poor and mostly the lowly educated ones. As a result, the highly educated ones may be well acquainted with signs and symptoms of illnesses than the lowly educated individuals. That is, the latter individuals are more experienced or knowledgeable of facts about illnesses than the former ones. Akin *et al.* (1981) for example, explored factors determining the decision to choose a health care provider among a sample of preschool children who experienced an episode of illness in the Philippines. In this study, it was found that children who were perceived to be ill were mostly from the highest SES hierarchy. On this matter, the authors wrote, "it is likely that lower income families often do not consider their children sick even though they are displaying symptoms which would lead higher income families to define the child as ill" (Akin *et al.*, 1981: 253).

Regarding perceived quality of the road, the findings from the present study showed that children in places where the quality of the main road was perceived as being fair or good were associated with increased probability of beliefs about the occurrence of harmful effects of fever. This finding is also unexpected. Although it cannot be surmised accurately why fair or good quality of road is associated with increased log-odds of beliefs for the occurrence of the harmful effects of fever, this finding suggests that child health is a multi-faceted issue. That is, even in areas where the physical environment can be considered good, limitation in aspects that are of significant importance in matters of child health could persuade caretakers to perceive that their under-five children are at risk of experiencing the harmful effects of fever.

3.6 Conclusion

Beliefs about the occurrence of harmful effects of fever in under-five children differ significantly by caretakers' level of education and type of occupation. Both education and occupation of caretakers are associated with decreased beliefs about the occurrence of harmful effects of fever in under-five children. Promoting enrolment in higher education and participation in the labour market particularly in non-farm activities of women would be valuable to the health of under-five children especially in resource-constrained areas and where fever is a common childhood problem afflicting a significant proportion of these children.

CHAPTER FOUR

THE EXTENT OF DELAY IN TREATMENT SEEKING FOR FEVER AMONG UNDER-FIVE CHILDREN

4.1 Introduction

The Wold Health Organization recognizes that early diagnosis and prompt treatment, within 24 hours of onset of symptoms, is an essential element of malaria control (WHO, 2000). In spite of this, Wiseman *et al.* (2008) observed that a considerable proportion of deaths among under-five children in SSA occur in part because of delays in seeking medical care. The present chapter explored the extent of delay to seek treatment for fever for under-five children in relation to the Abuja recommendation of treating malaria within 24 hours of the onset of symptoms among under-five children.

4.2 Literature Review

4.2.1 Theoretical Literature Review

The chapter draws on the theoretical model by Safer *et al.* (1979). Safer and colleagues (ibid) proposed a three-stage framework to account for the total time from first appearance of illness symptoms to the time treatment is first sought. Figure 4.1 presents a schematic representation of the three phases of delay to seek medical care in which the letters "*Y*" and "*N*" stands for "yes" and for "no", respectively. 'Appraisal delay' describes the time that the individual with the symptoms takes to judge whether the symptoms are indicative of an illness, the outcome of which may trigger further action

(whether or not to seek treatment). For under-five children, as it is the case in the present study, appraisal delay describes the time that the primary caretaker takes to evaluate a symptom as an indication of an illness. On the other hand, 'illness delay' describes the time from judging that the symptoms are indicative of an illness to the time the individual decides to take professional medical care from a health facility. 'Utilization delay' describes the time from the decision to seek medical care to the time the patient or his/her caretaker goes to the health facility and uses the services of the facility (Safer *et al.*, 1979).

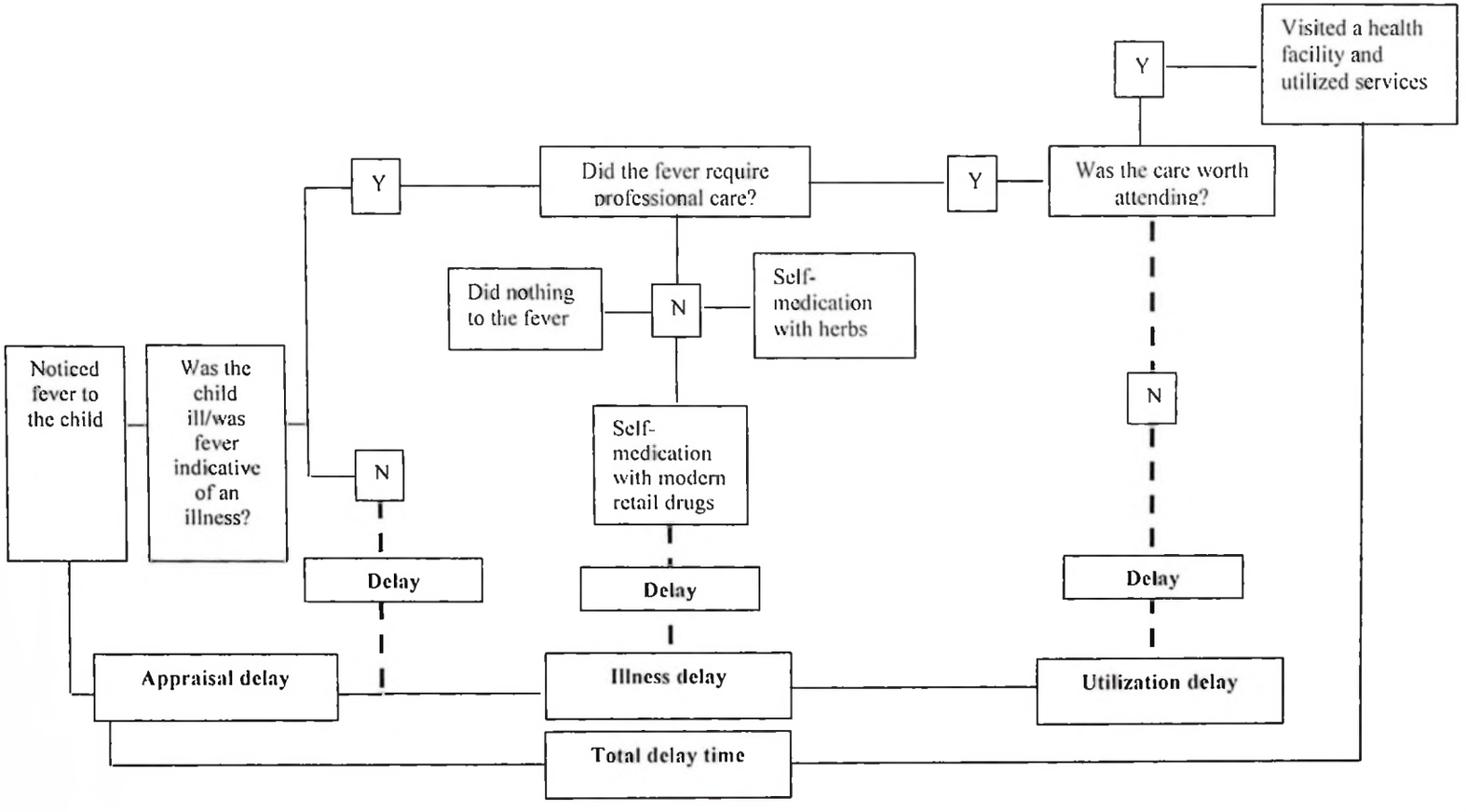


Figure 4.1: Schematic representation of total delay time to seek treatment

Source: Adapted from Safer *et al.* (1979)

4.2.2 Empirical Literature Review

In spite of its use in many health services research over decades, there is still no explicit and widespread definition of the concept of delays to seek treatment or advice. Variable threshold points characterizing delays for presentation at a health facility even for the same illness exist in the literature. For example, Williams and Jones (2004) examined the literature on behavioural issues related to malaria control in SSA. While referring to McCombie (1996)'s study, Williams and Jones (2004) observed that in some studies researchers considered delays not as the time to any treatment but as the time prior to presentation to a health facility. Kutner and Gordon (1961) establish from the review of the literature that delay was defined as the time that elapsed between recognition of illness symptoms and first contact with a physician. On the other hand, Thongsuksai *et al.* (2000) categorized delays in breast cancer care study into two groups: patient delay (defined as the time from onset of symptom to first care), and system delay (defined as the time from first care of the patient to treatment).

Conigliaro *et al.* (2002) considered delay to seek care as the time between first appearance of symptoms to presentation to a health facility. The extent of delay to seek medical care may be influenced by where one wants to seek care from given her social and economic context. The decision where to seek care from given illness is perhaps, the most illness decision stage, which has received relatively more attention in the literature on the demand for health care in developing countries. The focus has been to understand factors that influence the choice of type of health care provider (for example,

government or private dispensaries, health centres, traditional healer, and the like) when an individual experience an illness.

A number of individual, household, and community-related factors have been identified to influence the choice of health care provider options in a given society. However, significant variations in the quantity exist across countries or even between regions within a country (Williams and Jones, 2004). While some studies have indicated that SES of parents especially income and education are important factors for reducing the levels of morbidity and mortality in both children and adults, studies on health care provider choice have shown mixed results. For example, Alderman and Gertler (1997) examined the provision of medical care to a sample of pre-school children in rural Pakistan. The authors found that maternal education had no impact on the choice of health care provider. While using the nested multinomial logit (NMNL) model, they found instead that the price elasticity of demand for female care especially at low income levels was more elastic than that of males. That is, among low income individuals, the sex of child was an important factor and that males were often taken to private doctors than females were. This finding is attributed mainly by perceived gender (sons against daughters) differential earnings and thus support to parents at old ages (Yueh, 2001).

Focusing on malaria patients and using the multinomial logit (MNL) model Asenso-Okyere *et al.* (1996) found self-medication to be the first treatment option for malaria in

Ghana. Age and sex of patient, treatment costs, availability of drugs, and education significantly influenced the choice of provider. Frederickx (1998) examines the determinants of health status, health care and health care choice in rural Mainland Tanzania. The author found that in matters of health, women's autonomy (proxied by headship) was more pronounced than education except for the well-off individuals. Using logistic regression, the author found that the probability of seeking treatment especially from private health facilities, was more significant in a female-headed household than it was in a male-headed household. These findings were influenced primarily by decision-making power of head of household as revealed previously.

Findings by Sahn *et al.* (2003) reveal that an increase in the education level of the head of household was associated with an increase in the demand for health care from either government or private health facilities than the no/self-care option. Age of patient also influenced the choice of health care provider. Using data from the 1993 Human Development Report Survey and employing the NMNL framework, Sahn and colleagues (ibid) found that adult patients were more likely to receive health care from both public and private health facilities (instead of public and private clinics) than under-five children. Studies by Lawson (2004) and Ssewanyana *et al.* (2004) in Uganda also contradict the finding that education does not influence the choice of health care provider. In these studies, education, especially of the head of household was associated with high probability of private care among children. Lawson (2004) found significant gender effect in the choice of health care provider. Among school-aged children, an

increase in income increased the likelihood of seeking care for boys only and that among pre-school children, an increase in income was associated with high likelihood of seeking care from private providers for boys only.

In the study on the distributional impact of public spending in Cameroon, focusing on health care, Kamgnia (2008) examines also using the NMNL model, the determinants of medical care provider choice. Cost of treatment, distances to health facilities, and gender were among the factors, which affected the choice of type of health care provider both in rural and urban areas. An increase in income among individuals was found to be associated with a shift from public to private providers. The shift from public to private care in an event of increase in income was meant to receive quality medical care since users perceived the latter facilities to be of relatively high quality than the former facilities (ibid). A study by Canaviri (2007) for Bolivia also supports the above finding. Using the random parameter logit or the Mixed Multinomial Logit (MMNL) model and focusing on a sample of outpatients, Canaviri (2007) notes that price and income were the key determining factors of the decision to choose a health care provider. An increase in user fees also shifted the demand from government to private facilities. Also using the MMNL framework, Borah (2006) found that treatment costs, education level, duration of illness, and household size, among others, influenced the choice of health care provider in rural India. Whilst Kamgnia, Canaviri, and Borah showed that household income was an important determinant of the decision to choose a health care provider in the respective countries, Lindelow (2003) showed that income (proxied by per capita

household consumption) was not an important determinant in Mozambique. Using data from the National Household Survey on Living Conditions and employing the MNL model, Lindelow (ibid) found instead, that education and distance to health facility to be important determinants. The study conducted by de Bartolome and Vosti (1995) to investigate the determinants of choosing between public and private health care for malaria treatment in Brazil showed that household size, and education influenced the choice of treatment provider. Persons from less populated and well-educated households were more likely to receive malaria treatment from private facilities. Age, gender, and number of previous infections did not influence the choice of care.

In an exploratory analysis to discern patterns of health care provider choice in circumstances of an illness in rural Kenya, Mwabu (1986) found that type of illness and its associated perceived severity, age, education, and household's income influenced the choice of type of health care provider. Other significant factors were sex, religion, previous contact with facility, and characteristics of facility. Furthermore, patients consulted at least one health care provider for the same illness episode. The reason for the observed pattern of subsequent visits to health care providers was unmet expectation. Studies on the doctor-patient relationship have revealed that the likelihood of patients to perform certain acts including compliance with treatment instructions, depend among other things, on their relationship with the doctor. Using only a sample of adults (15 years and above), consistent with Vosti (1985); Mwabu *et al.* (1993) found also gender to have no impact on the choice of medical care in rural Kenya. Instead, quality of care

(proxied by availability of essential drugs, medical doctors, among others as previously noted), treatment costs were the most important factors.

Sauerborn *et al.* (1996) examine whether or not allocation of household resources for health care was done based on individual's age group and gender in Burkina Faso. Sick children between 0 to 9 years received less medical attention than it was for their adult counterparts. The authors (ibid) argue that the disparity in the allocation of household resources for medical care between the two groups was because the adults were responsible for daily upkeep of the rest members of the household. Thus, when any member in the adult group fell sick, he/she was given particular attention that would ensure him/her early recovery to permit resumption of his/her daily activities.

Dong *et al.* (2008) compare the characteristics of users and non-users of health care services in Burkina Faso. Using data from a survey of households in which a two-stage cluster sampling technique was employed, the authors found through a multinomial logistic regression approach that severely perceived illnesses, high income and acute health conditions raised the probability of seeking care from modern medical care.

4.3 Methodology

4.3.1 Extent of Delay

The analysis in this chapter was mainly descriptive for which graphical and numerical summary measures were estimated. In particular, in order to understand the extent of

delay (time from the onset of the symptom to the time when care was first sought) to seek treatment or advice for fever, the mean (SD) and frequencies (percent) were computed. As mentioned in chapter three, where appropriate, the median was computed instead of the mean.

4.3.2 Testing for Differences in Duration to Seek Treatment between Symptoms

While the focus of the study was on fever, comparisons between fever and other symptoms in terms of delays were also made. In order to establish whether differences existed among the symptoms in terms of days, which elapsed between the onset of the symptom and the action to seek treatment or advice, the KW test was employed. Moreover, simultaneous multiple pairwise comparisons were carried out in order to ascertain which pairs of symptoms were significantly different in terms of mean delay times (days). In total, $k(k-1)/2 = 10$ (where $k = 5$ represents the number of symptoms under consideration) pairwise comparisons were made. The Bonferroni approach was employed in controlling the Type I comparisonwise error rate (Neter *et al.*, 1996). The Bonferroni procedure modifies the level of significance α to $2\alpha / k(k-1)$ for each of $k(k-1)/2$ differences. Therefore, under this procedure the level of significance used is $\alpha / k(k-1)$ rather than of $\alpha / 2$ (ibid).

4.3.3 Variable and Data Source

The variable of interest in this chapter was the number of days elapsed from first appearance of fever to the time before an action to seek treatment or advice was made.

This was captured using the item "how many days after fever began did you first seek advice or treatment?" The same question was asked for other febrile illnesses. Accordingly, the analysis in this chapter used a sub-sample of the data in which caretakers reported to seek medical care for fever and other febrile illnesses. The data for analysis in this chapter come from the survey described in details in chapter three. That is, a cross-sectional survey of households that was undertaken in Dodoma region.

4.4 Results

4.4.1 Sources of Treatment or Advice Visited

Of the total 329 children who had fever within the previous four weeks preceding the date of the survey, 87.2 percent (n=287) had medical care sought for the symptom. Likewise, of the total children who had cough/flu, diarrhoea, vomiting, and convulsion, 71.9 percent (n=355), 85.4 percent (n=176), 88.7 percent (n=102), and 100 percent (n=12), respectively had medical care sought for the symptom.

Various sources of treatment or advice were visited by the caretakers in response to the symptoms, which their under-five children experienced at any time during the past four weeks preceding the date of the survey. Caretakers sought treatment or advice from public/government and private sources as well as religious or Faith-Based Organizations (FBOs). Within the public category, the different sources of treatment or advice visited were regional and district hospitals, health centres, and dispensaries. Similarly, the various private sources of care consulted were hospital, health centres, and dispensaries.

For FBOs, only health centres and dispensaries were consulted. Other caretakers turned to pharmacies and non-modern or traditional sources. In some situations, multiple sources of treatment or advice were visited for the same illness symptom. Figure 4.2 presents the various sources consulted first by the caretakers and the frequency of children who received medical treatment from the sources for the different health conditions, which they experienced.

As seen in Figure 4.2, the first and most common source of treatment or advice was government dispensaries. Dispensaries were the sources of treatment or advice for 50.2 percent (n=144), 50.0 percent (n=6), 53.4 percent (n=94), 47.9 percent (n=170), and 46.1 percent (n=47) of all the children who were ill with and whose caretakers sought treatment or advice for fever, convulsion, diarrhoea, cough/flu, and vomiting respectively. The next frequently visited source of treatment or advice for the five symptoms was district hospital. This was the source of medical care for 15.0 percent (n=43), 16.7 percent (n=2), 13.1 percent (n=23), 14.1 percent (n=50), and 17.6 percent (n=18) of the children who were ill with and whose caretakers sought treatment or advice for fever, convulsion, diarrhoea, cough/flu, and vomiting respectively.

It can been seen from Figure 4.2 that caretakers sought medical treatment for cough/flu more frequently from pharmacies/shops or accredited drug dispensing outlets (ADDOs), called *duka la dawa baridi* (in Kiswahili) and non-modern (traditional) sources than it was the case for the other symptoms. The percentages of children with cough/flu whose

caretakers first consulted a pharmacy/shop/ADDO or a traditional source for treatment or advice were 7.0 percent (n=25) and 10.7 percent (n=38) respectively. None of the children with convulsion in the study received medical care from a pharmacy/shop/ADDO while one caretaker resorted to a traditional treatment. Children with fever were less likely (n=9, 3.1 percent) to receive treatment from pharmacies/shops or ADDOs than it was the case with diarrhoea (n=6, 3.4 percent) or vomiting (n=5, 4.9 percent).

In most cases, caretakers sustained the same first source of care for almost all the various symptoms, which their under-five children experienced. That is, if a child experienced multimorbidity during the past four weeks preceding the survey, then his/her caretakers sought treatment or advice for the various symptoms more often from the same source. This pattern of health care services utilization for the various symptoms is reflected in Figure 4.2. The pattern displaced in Figure 4.2 could also be due to incidences of simultaneous onset of the various symptoms among some children in the study.

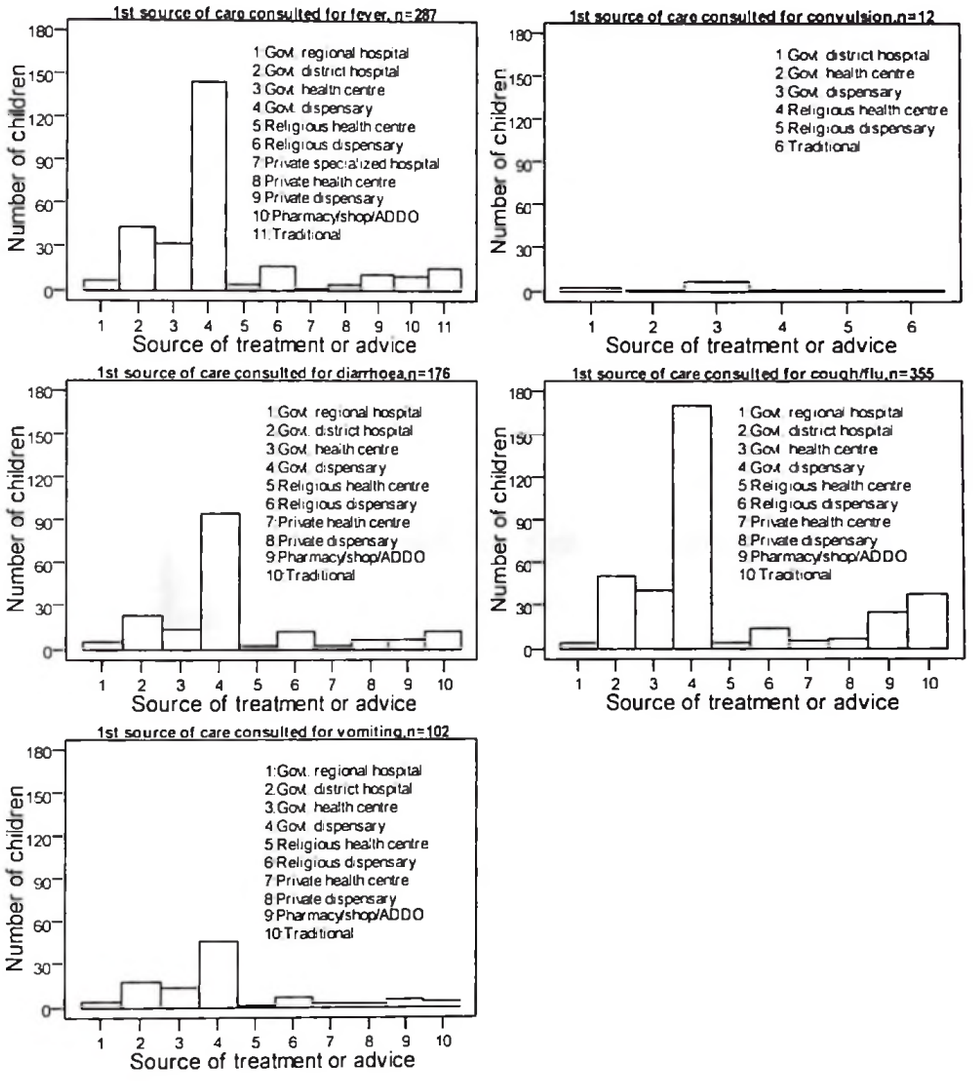


Figure 4.2: First sources of treatment or advice consulted by caretakers

Source: Own drawing based on field data (October, 2010-January, 2011)

Rarely in practice, when a child falls ill with multiple symptoms of a disease such as malaria and which occur concurrently, his/her caretaker would first seek treatment or advice from multiple sources for the different symptoms. Indeed, as the data for the present study verify, some caretakers sought treatment or advice from more than one

source for the same symptoms, which their under-five children experienced. However, in general, caretakers made visits to mainly two separate sources of treatment or advice.

Figure 4.3 presents a list of second sources of treatment or advice, which were consulted by the caretakers for the various symptoms. As seen from the figure, caretakers sought treatment or advice from more than one source more often for fever (n=24, 12.8 percent) than was the case with diarrhoea (n=14, 8.0 percent) or cough/flu (n=31, 8.7 percent) or vomiting (n=6, 5.9 percent). Furthermore, as Figure 4.3 shows, across symptoms, the most frequently consulted second source of treatment or advice in the study was pharmacy/shop or ADDO. This pattern of health care seeking could be interpreted to mean that the first visited sources of treatment were perhaps, not stocked with the prescribed medications. In particular, caretakers received treatment services for their children from pharmacies/shops or ADDO more frequently for fever (n=12, 50.0 percent) and vomiting (n=3, 50.0 percent) than was the case for diarrhoea (n=5, 35.7 percent) or cough/flu (n=10, 32.3 percent). Furthermore, caretakers who first consulted public/government sources resorted to pharmacies/shops or ADDOs more often than those who first sought treatment or advice from non-government sources. For example, of the 50 percent children whose caretakers sought medical care for fever at a pharmacy/shop or ADDO, first sought treatment or advice from a public/government health facility.

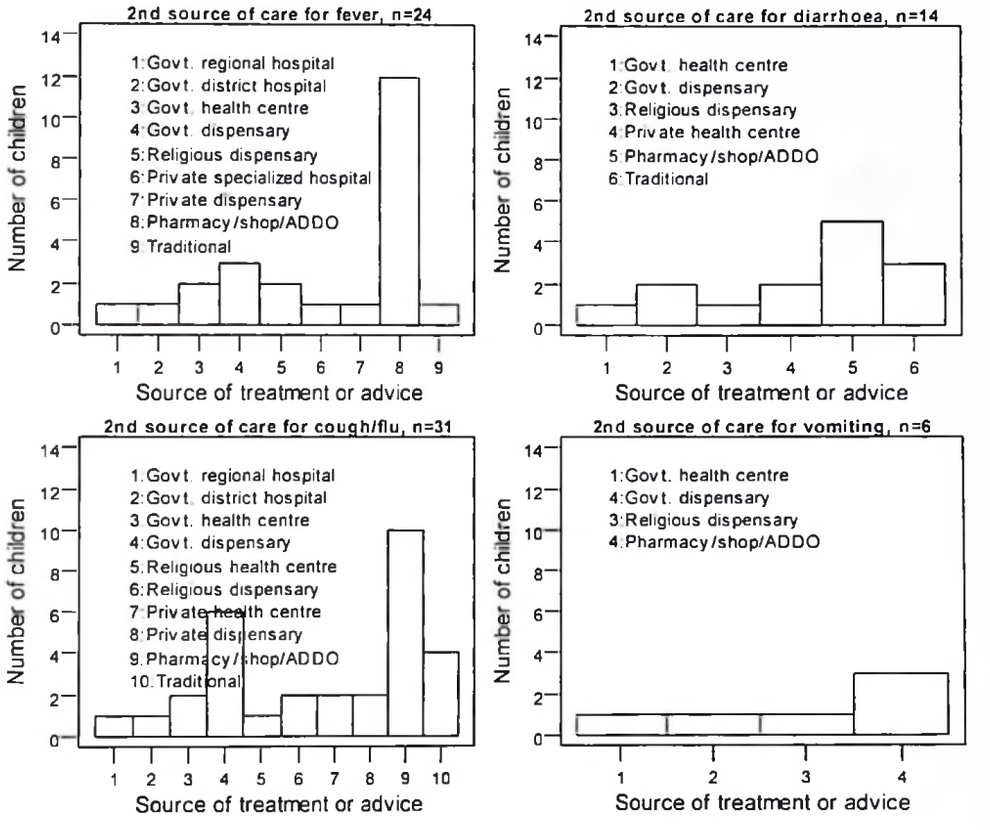


Figure 4.3: Second sources of treatment or advice consulted by caretakers

Source: Own drawing based on field data (October, 2010-January, 2011)

4.4.2 Distribution of Duration of Symptoms

Figure 4.4 presents distributions of total time (days) children were ill with each of the five symptoms considered in the study. As seen from the figure, the time children were ill with the symptoms varied between symptoms with convulsion exhibiting a short duration than all the other symptoms. The median durations of the symptoms were 7.0, 1.0, 3.0, 7.0, and 2.0 days for fever, convulsion, diarrhoea, cough/flu, and vomiting respectively. The modal durations for fever, convulsion, diarrhoea, cough/flu, and vomiting were 7.0, 1.0, 2.0, 7.0, and 2.0 days, respectively.

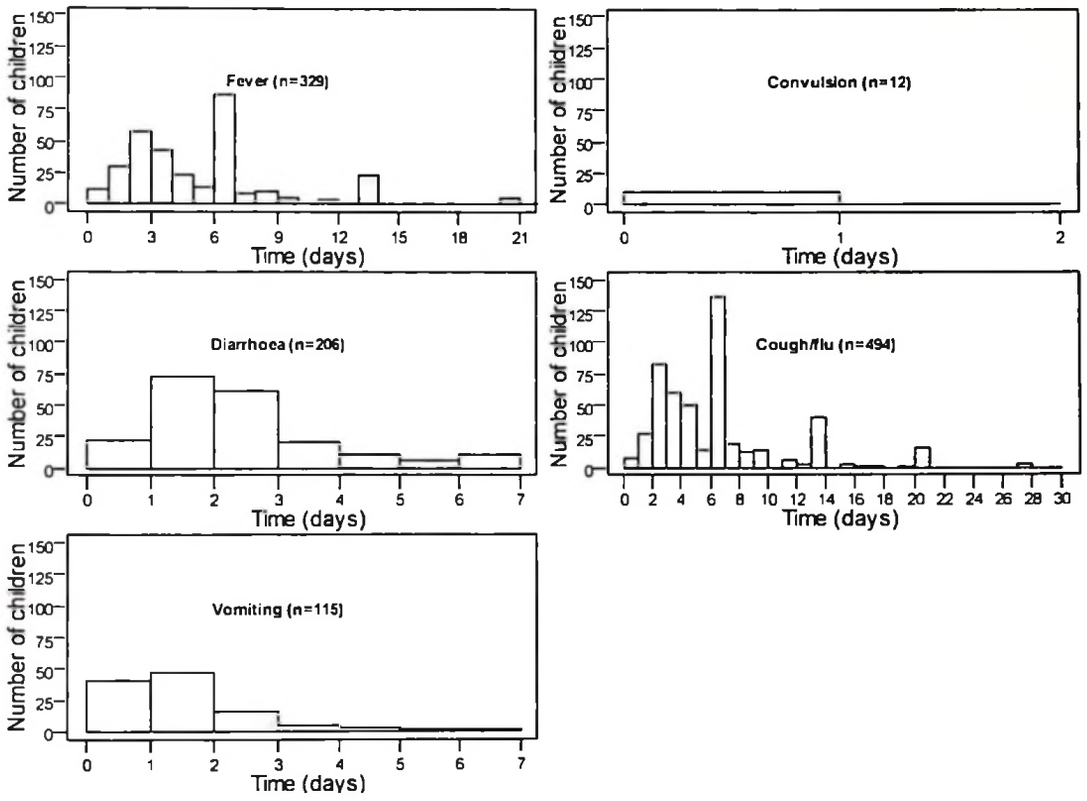


Figure 4.4: Distribution of days children were ill with the symptom

Source: Own drawing based on field data (October, 2010-January, 2011)

4.4.3 Extent of Delay to Seek Treatment

Figure 4.5 displays the distribution of days that elapsed before the caretaker sought medical care for various febrile illnesses. As it can be seen in Figure 4.5, the number of days, which elapsed before treatment or advice was sought are in some way dependent on the symptom. With reference to fever, fifty-two children (18.1 percent) were taken for medical care on the same day of the symptom onset. The number of children increased, reaching 80 (27.9 percent) and 84 (29.3 percent) after one day and two days of the symptom, respectively, but declined afterwards, reaching 57 (19.9 percent) and 13

(4.5 percent) after three and four days of the symptom, respectively. Only one child (0.3 percent) was taken for medical care after five days of recognizing the symptom (Figure 4.5). On the other hand, the median time of delay in fever care seeking was two days.

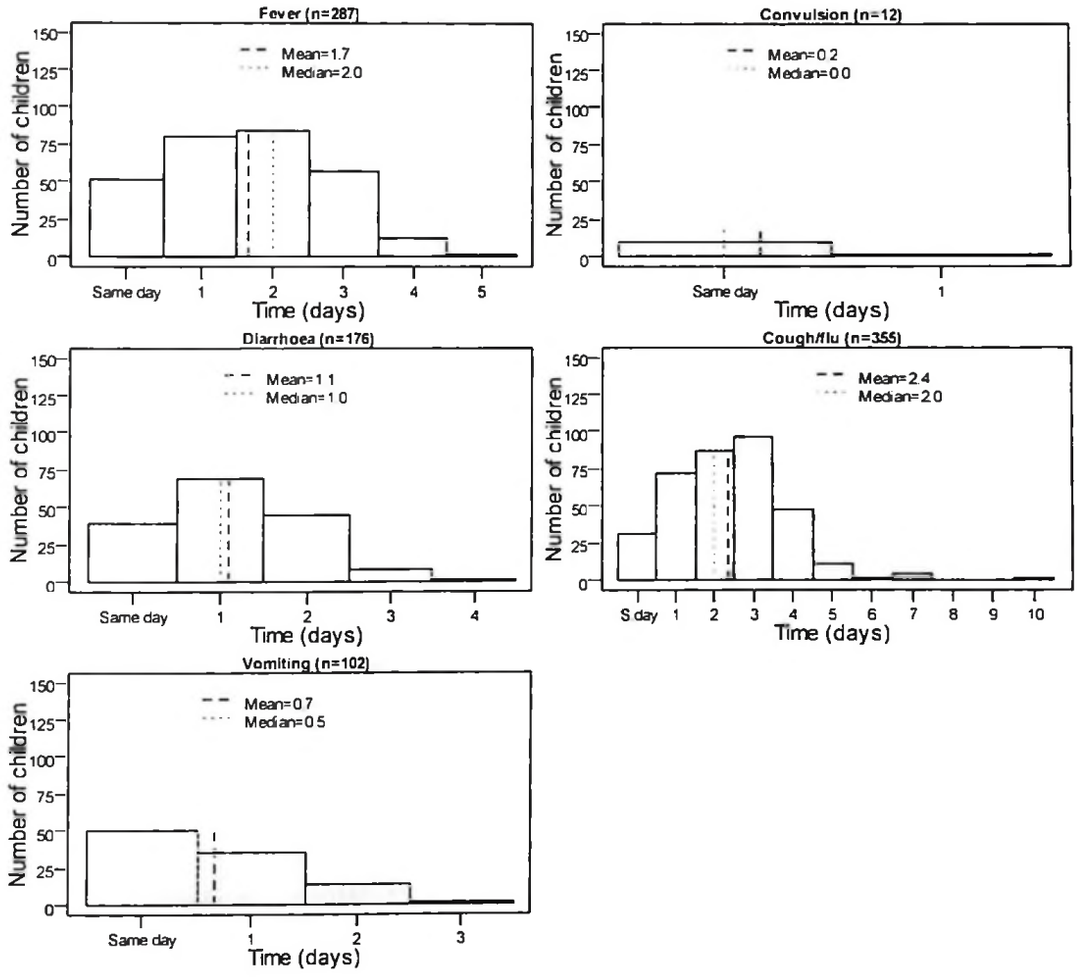


Figure 4.5: Distribution of days after symptom sought treatment or advice

Source: Own drawing based on field data (October, 2010-January, 2011)

Likewise, number of children (percent) with convulsion, diarrhoea, cough/flu, and vomiting who received medical care within the same day of onset of the symptom were

10 (83.3 percent), 40 (22.7 percent), 32 (9.0 percent), and 51 (50.0 percent), respectively. The median times of delay for convulsion, diarrhoea, cough/flu, and vomiting were 0.0, 1.0, 2.0, and 0.5 days, respectively.

In order to get a clear graphical representation of the distribution of days after symptom sought treatment or advice, Figure 4.5 was re-sketched yielding the graphical display given as Figure 4.6. From the figure, it can be seen that the profile of days after symptom treatment or advice was sought is shorter for convulsion than for all the other symptoms. Vomiting represented the next shortest profile of days followed by diarrhoea, fever, and finally cough/flu in that order. This implies that if each of the symptoms under study was considered independently, then children with cough/flu were less likely to be taken for treatment or advice earlier than it was for children who experienced any of the remaining symptoms. As seen in Figure 4.6, the profile for cough/flu spans from 0 to 10 days while that of fever, diarrhoea, vomiting, and convulsion span from 0-5 days, 0-4 days, 0-3 days, and 0-1 days respectively. However, the profile for cough/flu exhibits characteristics similar to those of fever and diarrhoea. That is, first increasing then decreasing. Likewise, the profiles for convulsion and vomiting demonstrate a similar pattern, that is, a decreasing trend. This implies that caretakers were more likely to tolerate seeing their under-five children with cough/flu without treatment or advice than they were for other symptoms. As for the case of perception of symptoms discussed previously, caution have to be exercised also here in interpreting the profiles since they do not take into consideration multimorbidity, which some of the children experienced

simultaneously.

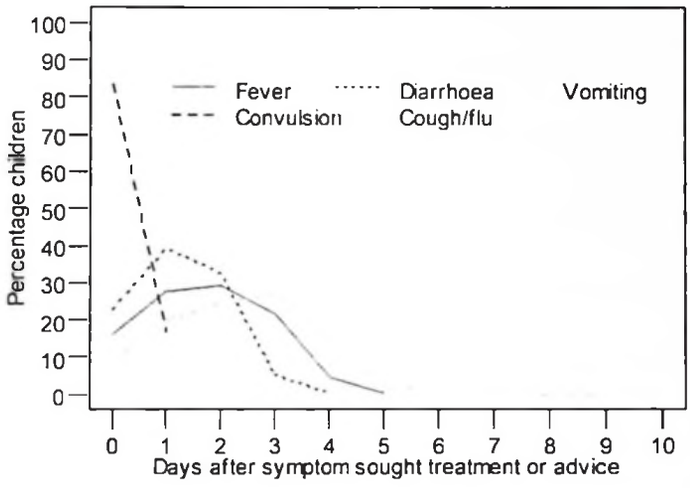


Figure 4.6: Profiles of days after symptom sought treatment or advice

Source: Own drawing based on field data (October, 2010-January, 2011)

4.4.4 Comparisons of Days before Treatment or Advice was Sought

Table 4.1 gives the results of the tests to compare simultaneously pairs of symptoms. As seen in the table, with the exception of the difference between convulsion and vomiting, which was found to be insignificant ($p>0.1$), all the other pairwise differences were statistically significant ($p<0.05$). In particular, relative to the other pairs, the difference in days before treatment or advice sought was greater (in absolute value) between convulsion and cough/flu. Moreover, as the findings show, significant differences exist between fever and convulsion ($p=0.001$), fever and diarrhoea ($p<0.001$), fever and cough/flu ($p<0.001$), and fever and vomiting ($p<0.001$).

The signs for the differences in the number of days, which elapsed before treatment or advice was sought between fever and convulsion, fever and diarrhoea, fever and cough/flu, and fever and vomiting are positive, positive, negative, and positive respectively. This implies that on average, there was greater promptness in seeking treatment or advice among children with convulsion than children with fever. Likewise, there was greater promptness in seeking medical care or advice among children who experienced diarrhoea or vomiting than was the case for children with fever. In contrast, there was less promptness in seeking treatment or advice among children with cough/flu than was the case for their counterpart children with fever (Table 4.1).

Table 4.1: Pairwise comparisons of promptness to seek treatment or advice

Group (i)	Group (j)	($i-j$)	S.E	p value	95 percent CI	
					Lower Bound	Upper Bound
Fever (1)	Convulsion (2)	1.5546	0.3514	0.0001	0.5657	2.5435
	Diarrhoea (3)	0.5053	0.1142	0.0001	0.1840	0.8267
	Cough/flu (4)	-0.6478	0.0947	0.0000	-0.9142	-0.3813
	Vomiting (5)	1.0644	0.1375	0.0000	0.6775	1.4513
Convulsion (2)	Diarrhoea (3)	-1.0492	0.3559	0.0327	-2.0506	-0.0479
	Cough/flu (4)	-2.2023	0.3501	0.0000	-3.1874	-1.2173
	Vomiting (5)	-0.4902	0.3640	1.0000	-1.5144	0.5340
Diarrhoea (3)	Cough/flu (4)	-1.1531	0.1100	0.0000	-1.4625	-0.8437
	Vomiting (5)	0.5590	0.1484	0.0018	0.1414	0.9767
Cough/flu (4)	Vomiting (5)	1.7122	0.1340	0.0000	1.3351	2.0892

Source: Field data (October 2010-January 2011)

4.5 Discussion

A total of 287 under-five children with fever in the four weeks preceding the date of the survey were studied to establish the distribution of time (days) that elapsed before treatment or advice for fever was first sought by their caretakers. The majority of the children received treatment or advice for fever after two days of onset of symptom. Less than half of the children were taken for medical care early as recommended by the Abuja target of treating malaria within 24 hours of onset of symptoms (WHO, 2000).

The finding in this study compares with studies in other countries, which show that a significant proportion of under-five children receive treatment after 24 hours. For example, a study in Ghana found that 33 percent of under-five children suspected of being infected with malaria, received treatment within 48 hours of symptom recognition, while only 11 percent received treatment within 24 hours (Ahorlu *et al.*, 2006). Similar findings were reported in Myanmar, 32.0 percent (Xu *et al.*, 2012) and in Nigeria, 22 percent (Chukwuocha *et al.*, 2014). Kwabe *et al.* (2013) found that 50 percent of children of nomadic Fulani mothers in the northeastern Nigeria did not receive timely treatment during an episode of fever.

In the context of Tanzania, caretakers in Dar es Salaam waited for at least 48 hours after the onset of fever before the decision to take a sick under-five child to a health provider was made (Kamat and Nyato, 2010). Baltzell *et al.* (2013) conducted a qualitative pilot study on primary health workers' practices in Zanzibar about the management of febrile

illness in under-five children. The authors found that the majority of health workers reported that frequently, caretakers delayed to take their sick under-five children to the health facilities.

4.6 Conclusion

The majority of caretakers in the study area seek medical care for fever late. Programmes are needed in order to sensitize caretakers of under-five children in Dodoma region on the importance of seeking timely medical care for fever. This may include the need to increase the understanding of caretakers about childhood febrile illnesses particularly those, which can progress from early to advanced stages within few hours of symptom onset.

CHAPTER FIVE

FACTORS ASSOCIATED WITH DELAY IN TREATMENT SEEKING FOR FEVER AMONG UNDER-FIVE CHILDREN

5.1 Introduction

Having focused on the extent of delay to seek medical care for fever in the under-five children in chapter four, the present chapter explored what factors influence the timing of health care seeking decision.

Previous studies (e.g., Turuse *et al.*, 2014; Dillip *et al.*, 2009; Malik *et al.*, 2006) on delay to seek health care have considered the impact of the demand-side, the supply-side, or both determinants of delay on a specific child's febrile illness, paying little attention on the influence of other symptoms or signs on the decision when to seek healthcare. Studies have shown for example, that factors including ease of access, satisfaction (Nuwaha, 2002) as well as cost (Hill, 2003) of services are associated with delay to seek care. Perception that fever/malaria is a normal disease has also been observed to contribute to delay (Dillip *et al.*, 2009). The impact of the demand-side, supply-side, or both barriers to prompt care for fever when integrated with other symptoms or signs of malaria in under-five children is not well examined. Explaining the role of demand or supply-side determinants of delay for fever while integrating with other febrile illnesses in under-five children may strengthen interventions that aim at promoting timely diagnosis and treatment for childhood malaria.

5.2 Literature Review

5.2.1 Theoretical Literature

There are several theoretical frameworks, which could be used to analyze factors affecting health care seeking behaviour in a given context. However, the present chapter adapted the framework provided by Thaddeus and Maine (1994), which identifies several causes of delays in health care services utilization. The framework identifies factors that contribute to delay in treatment seeking at three phases (deciding to seek care, identifying and reaching medical facility, and receiving adequate and appropriate treatment) of the illness decision-making process. Figure 5.1 provides the conceptual framework of the causes of delay o seek treatment for fever.

According the framework presented in Figure 5.1, the first major factors that may hinder caretakers to seek timely treatment are social and demographic characteristics of the primary caretaker and other members of the household. Such factors include education, age, and marital status. Age and sex of the sick under-five children may also affect the decision when to seek care.

The second factor that may obstruct caretakers to seek timely treatment is economic status. Economic status can affect the decision when to seek treatment through various pathways including choice (public or private) of type of health care facility to visit.

The third factor that may also hinder timely treatment seeking decision is caretakers' perceived severity of the symptom. This may affect the decision when to seek care especially if the symptom is perceived as mild not as an indicative of any serious illness.

The fourth factor is associated with accessibility of health care facilities. Physical infrastructures including availability of quality roads to the health facilities may affect the decision when to seek treatment in different ways. For example, poor quality roads, especially in rural areas may require more transport cost and travelling time to reach the nearest health facility.

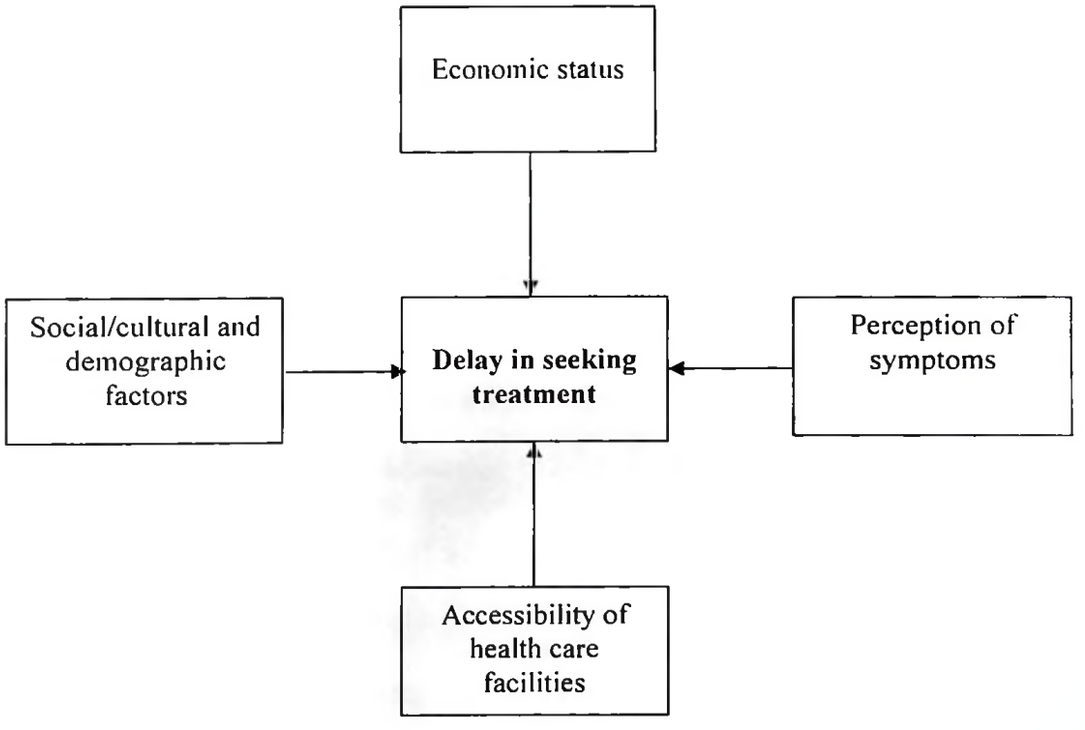


Figure 5.1: Conceptual framework

Source: Adapted from Thaddeus and Maine (1994)

5.2.2 Empirical Literature Review

Empirical evidence suggests that delayed treatment-seeking behaviour is influenced by numerous factors. A study on cancer patients indicated that patients that are more educated have similar patterns of delay to those of less educated patients (Conigliaro *et al.*, 2002). On the other hand, studies in malaria-endemic areas have shown that caretakers with low level of education were more likely to delay in seeking malaria treatment for children (Chukwuocha *et al.*, 2014; Nabyonga *et al.*, 2013). Greenwald *et al.* (1978) argue that failure of individuals to acknowledge that something is wrong or vulnerable to a disease may result into delay in presentation to a healthcare provider. Focusing on patients diagnosed with cancer disease, the authors (ibid) found that previous experience of use of healthcare facilities and occupation status of the patient were responsible factors for most variation in observed delays.

Tolhurst *et al.* (2008) identified women's autonomy as an important determining factor of the decision when to seek medical care for children experiencing fever in the Volta region in Ghana. Focusing on gendered dynamics of intra-household bargaining, Tolhurst and colleagues (ibid) found that absence of fathers at home at the time of illness recognition was associated with delay to seek medical care for the sick child. Refusal to pay for treatment costs was also associated with delay to seek medical care. Moreover, in some cases, even if access to treatment was guaranteed, mothers in the study had to first inform their husbands or close relatives in situations where the husband was not around before they sought treatment for the sick child.

Getahun *et al.* (2010) examined the determinants of delay in malaria treatment for under-five children in Ethiopia. The authors revealed that children of mothers who were in monogamous marriage and who were unable to meet transport costs were less likely to receive timely health care. Furthermore, children of mothers who reported past experience of side effects of antimalarial drugs and who had no history of death of a child were also less likely to be taken to the health facilities timely.

Using a dynamic framework, Alaba and Koch (2008) examined the role of a set of factors in health care seeking among a sample of under-five children in South Africa. Household structure particularly gender of head of household was found to be among the important factors influencing the timing of the decision to seek medical care when a child experienced a health shock. The authors found that children in female-headed households were less likely to receive delayed medical care than their male-headed counterparts were. Though not examined in Alaba and Koch's study, variables such as age and employment status of head of household, household economic status, and household size could as well affect the timing of medical attention for sick under-five children. Results of a rural health survey in Kenya (Mwabu, 1986) revealed that some patients or their caretakers could not seek treatment because they did not have a person to leave at home or at the farm. Baltzell *et al.* (2013) reported similar findings. The authors observed that some caretakers of under-five children in Zanzibar delayed to take their febrile children to the health facility because they had other responsibilities including caregiving and were unable to meet treatment-associated costs.

In a study to examine factors that affect decisions to seek medical care for sick children in Kerala, India, Pillai *et al.* (2003) consider a sample of children less than four years of age experiencing at least one symptom suggestive of acute respiratory infection or diarrhoea in the last two weeks preceding the survey. Medical care was less likely to be sought among children whose illnesses were perceived to be mild; the family was in the higher economic stratum, among the youngest children who lived in rural areas and of educated mothers. Boys especially from households in the lower SES were more likely to receive medical care than their female counterparts were.

5.3 Methodology

5.3.1 Exploratory Analysis

In order to explore the influence of a set of explanatory variables on how much time elapsed before medical care for fever was first sought, non-parametric survival functions were estimated. In particular, the Kaplan-Meier (KM) survival functions (see for example, Bull and Spiegelhalter, 1997 for details) were estimated. Following Hamilton (2003), and Venables and Ripley (1999), the KM survival functions were estimated using equation (5.1).

$$\hat{S}_{KM}(t) = \prod_{t_i<t} \frac{r(t_i) - d(t_i)}{r(t_i)} \tag{5.1}$$

Where r represents the number of children in whom the event of interest had not occurred at the beginning of time period t during the interval (t_0, t). That is, at the time when the symptom appeared during the previous four weeks preceding the date of the study, d represents the number of children in whom the event of interest occurred at any time t between the onset of fever and before the date of data collection.

To test for survival curves between groups one could first, compare the survival experience of groups at any chosen time point over the survival period by computing approximate p-values based on the observed survival difference and its estimated standard error (Bull and Spiegelhalter, 1997). Second, one could compare the survival curves over the entire survival experience of the groups. The second approach can be achieved using the log-rank test (ibid). Since the aim was to understand how the various groups compare overall, but not at specific time points, the present study adopted the second approach to compare the survival functions.

5.3.2 Multilevel Analysis

The dependent variable of interest in this chapter was the number of days elapsed from first appearance of fever to the time before an action to seek treatment or advice was made. Safer *et al.* (1979) argue that knowing what predicts total delay provides little information for improving individuals' health care seeking decision-making and utilization of the health care system. This is particular the case since factors, which predict a particular outcome within the total delay are likely to differ from those, which

predict the total delay. However, in the present study, because of short spells between segments within the total delays framework, hence between the onset of symptom and decision to seek medical care primarily due to the symptom (fever) considered, the study focused on factors that predict total delay instead of segments of delays within the total delay.

Consistent with the recommendation of treating malaria within 24 hours of the onset of symptoms (WHO, 2000), the total time between symptom onset and seeking treatment was dichotomized into two categories. These are zero (0) if care was sought within 24 hours after appearance of fever or between same day and one day after appearance of fever, and one (1) if care was sought after 24 hours of onset of fever or after one day of onset of fever. That is,

$$T_{ij} = \begin{cases} 1 & \text{if} \quad D > 1 \\ 0 & \text{Otherwise} \end{cases} \tag{5.1}$$

From the above discussion, a two-level random effect multilevel model given in equation (5.2) was fitted in the present chapter using the dependent variable given in equation (5.1). Moreover, the same explanatory variables described in chapter three were also used in the present chapter. Estimation of parameters of the model in equation (5.2) was carried out in the same manner as discussed in chapter three.

$$T_{ij} = x'_{ij}\beta + u_i \tag{5.2}$$

Where β is a vector of fixed effects representing individual and contextual factors and u_i as defined in chapter three.

5.3.3 Duration Analysis

The multilevel modelling approach described above for modelling the probability of delay to seek care does not model the event likelihood over time. That is, does not take into account the distribution of time from the onset of symptom to the time before care was first sought. In order to gain more insights about the influence of the explanatory variables on the decision when to seek health care, a time-dependent outcome variable was considered, thus modelled the event likelihood over time.

5.3.3.1 Model Specification and Estimation

Following SAS Institute Inc. (2008), the model for the response variable T (duration random variable representing total time elapsed before medical care was sought) can be expressed on a log scale as in equation (5.3) with $T \geq 0$ and probability density function $p(t) = \Pr(T = t)$ for $t = 1,2...$

$$\log(T) = \alpha + x'\beta + \upsilon \tag{5.3}$$

Where α is the intercept, x is a matrix of explanatory variables (covariates), β is a vector of unknown regression parameters to be estimated and υ is a random term assumed to be independent and identically distributed with some density function $f(\upsilon)$.

The distribution form of the random disturbance term υ determines the type of regression model. The distribution of the random error term can be taken from a family of any known distributions including the extreme value, which yields the exponential and the Weibull regression models; the normal, which yields the lognormal regression model; and logistic, which yields the loglogistic regression model (Sharma, 2008; SAS Institute Inc., 2008).

Some distributions (e.g., Weibull, lognormal) have an additional parameter σ that scales the random distribution term υ (SAS Institute Inc., 2008). Using this parameterization, the model in equation (4.18) takes the form presented in equation (5.4).

$$\log(T) = \alpha + x'\beta + \sigma\upsilon \qquad (5.4)$$

Estimation of model parameters proceeds as follows. According to SAS Institute Inc. (2008), if all the responses are observed (that is, no censoring) as in the present analysis, the log likelihood, L based on the regression model in equation (5.4) can be written as in equation (5.5).

$$L = \sum \log\left(\frac{f(w_i)}{\sigma}\right) \qquad (5.5)$$

Where $w_i = \frac{1}{\sigma}(y_i - x_i'\beta)$

In order to understand which model best describes delay to seek health care for fever, the model in equation (5.3) was fitted with the exponential, Weibull, lognormal, loglogistic, and generalized Gamma. Unlike in the multilevel modelling approach, in the model presented in equation (5.4), time T=0 (that is, medical care sought on the same day of the onset of fever) was not considered since it is not defined on the log scale. Accordingly, this reduced the sample size from n=287 used in the multilevel model in this chapter to n=235 used in the duration analysis.

The ML estimation technique was employed to estimate the model parameters by means of a ridge-stabilized Newton-Raphson algorithm also in SAS version 9.2 (SAS Institute Inc., 2008). The Akaike Information Criteria (AIC) was used to compare the models. The model with a smallest AIC value was considered appropriate and best to describe the relationship between the outcome measure and covariates. The likelihood ratio test (LRT) was further used to ascertain the model that best fitted the data in the present study. Using the LRT, the model with the maximum likelihood value was considered suitable.

5.3.4 Variables and Data Source

The variables used in the present chapter for both multilevel modelling and duration analysis approaches are listed in Table 5.1. The data for analysis in this chapter come from the same source, which is described in details in chapter three. That is, a cross-sectional survey of households, which was carried out in Dodoma region.

Table 5.1: Description of variables in the study

Variable	Description	Nature
Level-1 variables		
Agechild	Age group (in months) of child	Categorical (0=0-11; 1=12-23; 2=24-35; 3=36-47; 4=49-59)
Sexchild	Sex of child	Dummy (1=Male, 0=Female)
Convul	If child experienced convulsion during the past 4 weeks	Dummy (1=Yes; 0=No)
Diarrh	If child experienced diarrhoea during the past 4 weeks	Dummy (1=Yes; 0=No)
Coughf	If child experienced cough/flu during the past 4 weeks	Dummy (1=Yes; 0=No)
Vomit	If child experienced vomiting during the past 4 weeks	Dummy (1=Yes; 0=No)
Bothpar	If both biological parents of child stay at home	Dummy (1=Yes; 0=No)
Relhead	Relationship of child to head of household	Dummy (1=non-biological son/daughter; 0=biological son/daughter)
Under5	Number of under-five children in household	Dummy (0=one; 1=2-3)
Homemch	If biological mother of child stays at home	Dummy (1=Yes; 0=No)
Agecare	Age of main caretaker of children in the household	Count data (years at last birthday)
Educhead	Education of head of household	Categorical (0=No education; 1=Primary; 2=Secondary and above)
Educare	Education of main caretaker of children in the household	Categorical (0=No education; 1=Primary; 2=Secondary and above)
Mstatus	Caretaker's marital status	Dummy (1=Currently married/living with a man as if married; 0=Otherwise)
Careocc	Current occupation of caretaker	Categorical (0=unemployed;1=1 =Working in agricultural activities; 2=Employed in non-agricultural activities)
Sexhead	Sex of head of household	Dummy (1=Male, 0=Female)
Yearsplc	Years caretaker has been in the current place of residence	Dummy (1=Always; 0=Otherwise)
Sourceinf	Caretaker's main source of information in matters of child health	Dummy (1=Health Worker; 0=Otherwise)
Indicfev	Perception of fever-whether fever was indicative of certain disease	Dummy (1=Yes; 0=No)
Severefev	Perceived severity of fever	Categorical (0=Mild; 1=Moderate; 2=Severe)
Agehead	Age of head of household	Count data (years at last birthday)
Headocc	Current occupation of head of	Categorical (0=unemployed;1=1 =Working in agricultural

Variable	Description	Nature
	household	activities; 2=Employed in non-agricultural activities)
Household *size*	Number of household members	Count data
Wealthq	Wealth index	Categorical (0=Poorest; 1=Second; 2=Middle; 3=Fourth; 4=Highest)
Level-2 contextual variables		
Location	Place of residence	Dummy (1= Rural; 0= Urban)
Populv	Village population size	Count data
Eligbh	Number of households with under-five children in village	Count data
NearHF	Distance from household to nearest health facility	Dummy (1= ≥ 5 km ; 0=< 5 km)
Nearmkt	Distance from household to nearest market	Dummy (1= ≥ 5 km ; 0=< 5 km)
District	District of residence	Categorical (1=Kondoa; 2=Bahi; 3=Dodoma Urban; 4=Mpwapwa)
Passable	Main road passable throughout the year	Dummy (1=Yes, 0=No)
Qualityroad	Perceived quality of main road	Dummy (1=Fair or good; 0=Poor)

5.4 Results

5.4.1 Descriptive Statistics

Figure 5.2 gives the probabilities of delay to seek treatment or advice for fever among under-five children comparing between groups. In particular, comparison of survival functions were made between children from different wealth groups, district of residence, caretakers' beliefs about the health effects of fever, distance from household to the nearest health facility, age of child, and whether or not the biological mother of the child was living at home.

As the figure shows, there appears to be little difference in the survival functions of children across the various wealth groups. The log-rank test confirms this equality of the survival functions across the wealth groups (p=0.4115). However, though statistically not different, the survival function of children from the highest wealth group appears to

be consistently below those of children from the other wealth quintiles. This suggests that, children from the former group were less likely to be delayed to receive treatment or advice compared to their counterparts in the latter groups (plot i). In contrast, there exists a significant difference at < 0.1 level (p=0.0555) in the probabilities of delay for treatment or advice among children across districts (plot ii). In particular, the survival function for children in Dodoma Urban district appears to be consistently below that of the other districts in the study. Highly significant differences (p=0.0003) existed in the survival functions between children of caretakers who resided less than 5 km from the nearest health facility and that of five and above km from the nearest health facility (plot iii). The results show further that children whose biological mother were at home, appeared to have a survival curve that is consistently below that of their counterparts whose mothers were not at home as revealed in plot (iv). However, the difference seems to be statistically not significant (p=0.0912). The next section provides estimation results for multilevel modelling and duration analysis approaches.

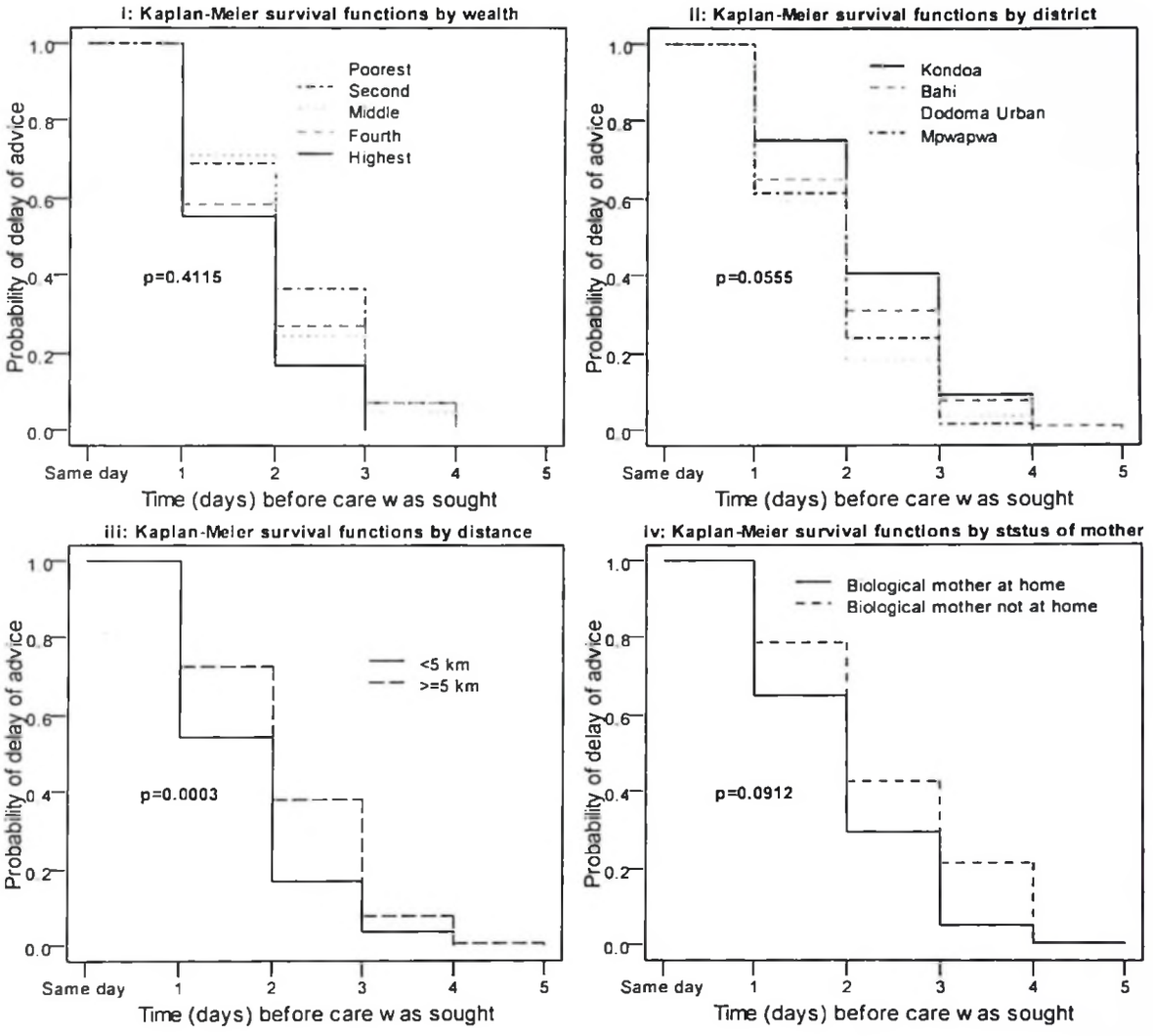


Figure 5.2: Probabilities of promptness to seek treatment for fever

Source: Own drawing based on field data (October, 2010-January, 2011)

5.4.2 Estimation Results

5.4.2.1 Multilevel Modelling Approach

Table 5.2 gives results of modelling the probability of delay for treatment or advice. That is, the probability that treatment or advice was sought two and above days after

onset of fever. As seen in the table, age of child appears not to be a significant determinant of delay to seek treatment or advice for fever. The only statistically significant difference in delay to seek treatment is between children aged 24-35 and those aged 0-11 months. The log-odds of delayed treatment seeking for fever is 0.5880 (p=0.0029) times higher among children aged 24-35 months compared to children in the age group 0-11 months, adjusting for the other variables in the model. In addition, there is a significant difference in delay to seek treatment or advice between children who had diarrhoea and those who did not have, adjusting for the other variables in the model. The estimated coefficient is -0.2321 (p=0.0031). The relationship of child to the head of household appears to be weakly associated (at 0.1 level) with delayed timely treatment seeking for fever. The log-odds of delayed treatment seeking for fever is 0.5133 (p=0. 0.0947) times higher among non-biological children compared to biological sons/daughters of heads of households. Likewise, the number of under-five children in the household seems to be significantly associated with delayed treatment seeking at the 0.1 level. The log-odds of delayed treatment seeking for fever is 0.2156 (p=0. 0.0571) times higher among children from households in which there were between 2 to 3 under-five children compared to children from households with only one under-five child.

The results show that there is a statistically significant difference in delays for treatment between children of heads of households with non-farm occupation and those of unemployed heads of households, adjusting for the other variables in the model. The estimated coefficient is 0.7092 (p=0.0028), suggesting an increased probability of

delayed treatment among children of heads of households in non-agriculture occupation compared to children of unemployed heads of households, adjusting for the other variables in the model. Fourth wealth group appears to be weakly significantly associated with decreased probability of delay for medical care. The log-odds of delayed treatment seeking for fever is -0.1947 (p=0. 0.0862) times higher among children from fourth income group compared to children from the poorest wealth category.

The log-odds of delayed treatment seeking is 0.9033 (p=0.0255) times higher for children in rural areas as compared to children in urban areas, indicating that rural location was significantly associated with increased probability of delayed treatment seeking. The variable *eligHH* is statistically significant (p=0.0162). The corresponding estimated coefficient is 0.0030, suggesting increased probability of delayed timely treatment seeking for fever among children from villages with large under-five children compared to villages with small under-five children, adjusted for all other variables in the model. In this study, long distance to the nearest health facility is highly significantly associated with increased probability of delayed treatment seeking. The log-odds of delayed treatment seeking is 0.2904 (p=0.0005) for children in households located a distance of $\geq$ 5 km away from the nearest health facility compared to those located < 5 km from the nearest health facility.

The results show that there is a marginally (at 0.1 level) statistically significant difference in delays for treatment between children in Bahi district and those in Dodoma

Urban district, adjusting for the other variables in the model. The estimated coefficient is -0.2044 (p=0.0811), suggesting a decreased probability of delayed treatment among children in Dodoma Urban district compared to children in Bahi district, adjusting for the other variables in the model.

Table 5.2: Multilevel logit model on delayed treatment seeking for fever, n=287

	Model 1		Model 2	
Variable	**Estimate (S.E)**	**P-value**	**Estimate (S.E)**	**P-value**
β intercept	1.1598 (0.2509)	0.0191	-1.0757 (1.1256)	0.3392
Age of child:				
0-11			Ref.	Ref.
12-23			0.1817 (0.3706)	0.6238
24-35			0.5880 (0.1975)	0.0029**
36-47			-0.1956 (0.4613)	0.6716
48-59			0.0727 (0.4973)	0.8837
Sex of child (male)			-0.1374 (0.1128)	0.2231
Convulsion (yes)			-0.1036 (0.5696)	0.8557
Diarrhoea (yes)			-0.2321 (0.0784)	0.0031***
Cough/flu (yes)			-0.2018 (0.1247)	0.1055
Vomiting (yes)			-0.0367 (0.0708)	0.6042
Both parents (yes)			-0.3217 (0.6368)	0.6135
Relhead (non-son/dau.)			0.5133 (0.3071)	0.0947*
# of <5 children (2-3)			0.2156 (0.1133)	0.0571*
Homemch (yes)			0.6758 (0.5169)	0.1911
Age (caretaker)			-0.0071 (0.0102)	0.4873
Education (caret.):				
No education			Ref.	Ref.
Primary			-0.1141 (0.2213)	0.6062
Secondary+			-0.1498 (0.6629)	0.8212
Occupation (caret.):				
Unemployed			Ref.	Ref.
Agricul. activities			0.0403 (0.4124)	0.9221
Non-agric. activities			0.0271 (0.2443)	0.9117
Yearspl (always)			-0.0137 (0.1306)	0.9162
Mstatus (married)			-0.6401 (0.5954)	0.2824
Sourceinf (HW)			-0.0521 (0.2413)	0.8290
Indicfev (yes)			-0.0292 (0.2640)	0.9119
Percsev. of fever:				
Mild			Ref.	Ref.
Moderate			-0.3353 (0.3375)	0.3205
Severe			0.2846 (0.3689)	0.4403
Age (head)			-0.0073 (0.0134)	0.5848
Sex-head (male)			0.4747 (0.6251)	0.4476

	Model 1		Model 2	
Variable	Estimate (S.E)	P-value	Estimate (S.E)	P-value
Education (head):				
No education			Ref.	Ref.
Primary			0.0707 (0.2372)	0.7655
Secondary+			0.3724 (0.5228)	0.4763
Occupation (head):				
Unemployed			Ref.	Ref.
Agricul. activities			0.2768 (0.3226)	0.3909
Non-agric. activities			0.7092 (0.2373)	0.0028***
HHsize			0.0036 (0.1133)	0.9746
Economic status:				
Poorest			Ref.	Ref.
Second			0.1420 (0.5980)	0.8123
Middle			-0.0300 (0.2704)	0.9117
Fourth			-0.1947 (0.1135)	0.0862*
Highest			0.0603 (0.8080)	0.9405
Location (rural)			0.9033 (0.4044)	0.0255**
Populv			-0.0004(0.0003)	0.1895
EligHH			0.0030 (0.00123)	0.0162**
NearHF (≥5 km)			0.2904 (0.0839)	0.0005***
Nearmkt (≥5 km)			0.3544 (0.2497)	0.1558
District of residence:				
Dodoma Urban			Ref.	Ref.
Bahi			-0.2044 (0.1172)	0.0811*
Kondoa			0.1076 (0.5367)	0.8411
Mpwapwa			-0.4184 (0.3102)	0.1775
Passable (yes)			-0.2589 (0.2574)	0.3144
Qualityroad (good)			-0.1085 (0.3474)	0.7549
σ_u^2	0.1787	0.0445**		

* significant at < 0.1 level; ** significant at < 0.05 level; *** significant at < 0.01 level

5.4.2.2 Duration Analysis Approach

Table 5.3 provides estimation results of fitting different duration models on delay to seek medical care. Comparing the AIC values for the different duration models, the lognormal regression model has the smallest AIC value (356.568) relative to all the other models (Table 5.3). Therefore, based on the AIC criterion, it appears that the lognormal distribution best describes the relationship between the duration of delay to seek medical care after the onset of fever and the explanatory variables shown in Table

5.3. A comparison of the log likelihood values using the LRT, reveals that the Gamma model has the maximum log likelihood value (-130.3583779) compared to all the remaining models. Based on the LRT, the Gamma model seems to be a reasonable model for the data. However, the Gamma model has more parameters compared to the other models, thus is comparatively more saturated. Further evaluation of the models in Table 5.3 through the LRT revealed the lognormal (Log likelihood value=-131.284216) and the Weibull (Log likelihood value=-132.3253661) models are also appropriate for the data. However, since the lognormal and the Weibull models have the same number of parameters, the lognormal model was considered the most appropriate model on both measures. That is, based on the AIC (smallest AIC value) and LRT (as it has the largest log likelihood value compared to that of the Weibull model).

The lognormal regression model suggests that the rate of seeking care for fever among under-five children in Dodoma region first increased and then decreased. This is because in the first day of the onset of fever caretakers tend to wait to see if the symptom will probably disappear or self-medicate the child but tend not to wait longer if the symptom persists beyond their initial expectation.

Looking at the results in Table 5.3 and with reference to the lognormal model, as it can be seen, only the coefficients for the group *moderate* (that is, fever perceived as moderate) and the variable *NearHF* (that is, distance to the nearest health facility) are statistically significantly associated with delayed health care decision-making. Based on

the duration analysis, it appears that fever perceived as moderate is associated with shorter waiting time for febrile under-five children to be taken for medical care. Likewise, as before, a distance ≥5 km to the nearest health facility is associated with larger waiting time. In contrast to the multilevel modelling results (Table 5.2), in the duration analysis (Table 5.3), rural location is not significantly associated with waiting time. Similarly, in contrast to the results in Table 5.2, in the duration analysis, there is no substantial evidence to suggest that variables such as diarrhoea, relationship of child to head of household, and number of under-five children in the household as associated with delayed treatment seeking.

Table 5.3: Parameter estimates (*p*-value) for different duration models, *n*=235

Variable	Exponential	Weibull	Lognormal	Loglogistic	Generalized Gamma
Intercept	0.5882 (0.5946)	0.8123 (0.0468)	0.3290 (0.4874)	0.3547 (0.4714)	0.5702 (0.2358)
Age of child:					
0-11	Ref.	Ref.	Ref.	Ref.	Ref.
12-23	0.0544 (0.7975)	0.0304 (0.7113)	0.0521 (0.5608)	0.0624 (0.5226)	0.0548 (0.5301)
24-35	0.0766 (0.7441)	0.0360 (0.6888)	0.1020 (0.3038)	0.1212 (0.2444)	0.0787 (0.4224)
36-47	-0.0287 (0.9103)	-0.0769 (0.4431)	-0.0017 (0.9873)	0.0256 (0.8163)	-0.0264 (0.8046)
48-59	-0.0280 (0.9155)	-0.0336 (0.7431)	-0.0203 (0.8547)	0.0024 (0.9839)	-0.0275 (0.7996)
Sex of child (male)	-0.0265 (0.8543)	-0.0195 (0.7274)	-0.0266 (0.6639)	-0.0202 (0.7456)	-0.0267 (0.6527)
Convulsion (yes)	0.0820 (0.8404)	0.0201 (0.8965)	0.1058 (0.5361)	0.1568 (0.3598)	0.0844 (0.6164)
Diarrhoea (yes)	0.0426 (0.8111)	0.0511 (0.5012)	0.0202 (0.7774)	0.0559 (0.4586)	0.0412 (0.5774)
Cough/flu (yes)	-0.1043 (0.5558)	-0.0656 (0.3394)	-0.1161 (0.1207)	-0.1556 (0.0498)**	-0.1056 (0.1512)
Vomiting (yes)	-0.0132 (0.9441)	-0.0093 (0.9058)	0.0024 (0.9754)	-0.0368 (0.6505)	-0.0124 (0.8737)
Both parents (yes)	-0.0768 (0.8903)	0.0115 (0.9565)	-0.1578 (0.5058)	-0.1404 (0.5524)	-0.0829 (0.7243)
Relhead (non-boil. son/daub.)	-0.0243 (0.9632)	-0.0463 (0.8190)	0.0003 (0.9989)	0.0153 (0.9447)	-0.0229 (0.9162)
Number of under-five	-0.0246	-0.0347 (0.5939)	-0.0103	-0.0270	-0.0236 (0.7387)

Variable	Exponential	Weibull	Lognormal	Loglogistic	Generalized Gamma
children in household (2-3)	(0.8855)		(0.8866)	(0.7181)	
Homemch (yes)	-0.0382 (0.9562)	-0.1115 (0.6682)	0.0739 (0.8041)	0.0329 (0.9112)	-0.0311 (0.9154)
Age (caretaker)	0.0014 (0.9406)	0.0010 (0.8995)	0.0025 (0.7456)	0.0022 (0.7738)	0.0014 (0.8500)
Education of caretaker:					
No education	Ref.	Ref.	Ref.	Ref.	Ref.
Primary	0.0336 (0.8718)	0.0549 (0.4997)	0.0021 (0.9812)	-0.0013 (0.9884)	0.0315 (0.7195)
Secondary+	-0.0360 (0.9326)	-0.0608 (0.7070)	-0.0303 (0.8666)	-0.0284 (0.8734)	-0.0353 (0.8405)
Occupation of caretaker:					
Unemployed	Ref.	Ref.	Ref.	Ref.	Ref.
Agricultural activities	0.1585 (0.7145)	0.1998 (0.2681)	0.146 (0.4044)	0.1549 (0.3816)	0.1574 (0.3756)
Non-agricultural activities	0.0721 (0.8661)	0.0914 (0.6005)	0.0827 (0.6384)	0.0837 (0.6420)	0.0726 (0.6789)
Yearspl (always)	-0.0582 (0.7113)	-0.0819 (0.1729)	-0.0377 (0.5754)	-0.0204 (0.7804)	-0.0566 (0.3913)
Mstatus (married)	-0.3908 (0.5738)	-0.3793 (0.2012)	-0.3538 (0.1878)	-0.4332 (0.1211)	-0.3888 (0.1714)
Sourceinf (health worker)	-0.0010 (0.9958)	-0.0193 (0.7923)	0.0068 (0.9264)	0.0131 (0.8608)	-0.0002 (0.9977)
Indicfev (yes)	-0.1010 (0.5549)	-0.0987 (0.1369)	-0.0959 (0.1847)	-0.1028 (0.1687)	-0.1007 (0.1521)
Percsev. of fever:					
Mild	Ref.	Ref.	Ref.	Ref.	Ref.
Moderate	-0.1639 (0.3229)	-0.1733 (0.0076)***	-0.1412 (0.0411)**	-0.1631 (0.0231)**	-0.1626 (0.0186)**
Severe	0.0092 (0.9685)	-0.0115 (0.9020)	0.0343 (0.7189)	0.0353 (0.7211)	0.0108 (0.9106)
Age (head)	-0.0011 (0.9403)	-0.0008 (0.8912)	-0.0017 (0.7703)	-0.0012 (0.8396)	-0.0011 (0.8512)
Sex of head of household (male)	0.2722 (0.6536)	0.1874 (0.4483)	0.3243 (0.1893)	0.3429 (0.1638)	0.2764 (0.2709)
Education (head):					
No education	Ref.	Ref.	Ref.	Ref.	Ref.
Primary	-0.0045 (0.9838)	-0.0150 (0.8653)	0.0061 (0.9483)	0.0244 (0.7969)	-0.0038 (0.9671)
Secondary+	-0.0487 (0.9063)	-0.0698 (0.6590)	-0.0329 (0.8519)	-0.0038 (0.9835)	-0.0474 (0.7806)
Occupation (head):					
Unemployed	Ref.	Ref.	Ref.	Ref.	Ref.
Agricultural activities	0.1812 (0.7003)	0.1805 (0.3266)	0.1834 (0.3507)	0.2319 (0.2483)	0.1817 (0.3476)
Non-agricultural activities	0.0222 (0.9691)	0.0182 (0.936)	0.0313 (0.8962)	0.040 (0.8675)	0.0228 (0.9229)
Household size	-0.0088 (0.8795)	-0.0036 (0.8824)	-0.0112 (0.6375)	-0.0164 (0.4969)	-0.0090 (0.7051)
Economic status:					
Poorest	Ref.	Ref.	Ref.	Ref.	Ref.
Second	-0.0083 (0.9668)	-0.0184 (0.8145)	0.0033 (0.9683)	-0.0202 (0.8179)	-0.0075 (0.9272)
Middle	-0.0021	-0.0123 (0.8901)	0.0164	-0.0002	-0.0009 (0.9921)

Variable	Exponential	Weibull	Lognormal	Loglogistic	Generalized Gamma
	(0.9927)		(0.8631)	(0.9986)	
Fourth	0.0271	0.0424 (0.6879)	0.0259	0.0142 (0.8996)	0.0269 (0.8078)
	(0.9197)		(0.8187)		
Highest	-0.0247	0.0366 (0.8650)	-0.0596	-0.1190	-0.0276 (0.9039)
	(0.9643)		(0.8024)	(0.6262)	
Location (rural)	0.1733	0.2155 (0.3020)	0.1425	0.1415 (0.4657)	0.1709 (0.4031)
	(0.7271)		(0.4754)		
Populv	-0.0000	-0.0001 (0.4444)	0.0000	0.0000 (0.8088)	-0.0000 (0.8629)
	(0.9316)		(0.8617)		
EligHH	0.0004	0.0006 (0.2088)	0.0002	0.0002 (0.7246)	0.0004 (0.4761)
	(0.7561)		(0.6839)		
NearHF ($\geq$ 5 km)	0.1808	0.1705	0.1732	0.2167	0.1806
	(0.3006)	(0.0147)**	(0.0174)**	(0.0043)***	(0.0118)**
Nearmkt ($\geq$ 5 km)	0.0728	0.0440 (0.6342)	0.0861	0.1170 (0.2127)	0.0739 (0.4148)
	(0.7409)		(0.3372)		
District of residence:					
Dodoma Urban	Ref.	Ref.	Ref.	Ref.	Ref.
Bahi	-0.3273	-0.4053	-0.2620	-0.3179	-0.3226 (0.1123)
	(0.5005)	(0.039)**	(0.1874)	(0.1415)	
Kondoa	-0.2300	-0.3454	-0.1443	-0.1519	-0.2234 (0.2957)
	(0.6475)	(0.0874)*	(0.4868)	(0.4971)	
Mpwapwa	-0.3849	-0.5095	-0.3052	-0.3227	-0.3784
	(0.4180)	(0.0080)***	(0.1169)	(0.1193)	(0.0618)**
Passable (yes)	0.0715	0.1161 (0.1717)	0.0400	0.0482 (0.6003)	0.0688 (0.4446)
	(0.7358)		(0.6485)		
Qualityroad (fair or good)	0.0633	0.0047 (0.9466)	0.0954	0.1054 (0.1710)	0.0662 (0.3893)
	(0.7215)		(0.1969)		
Shape and scale parameters		σ =0.3666	σ =0.4230	σ =0.2465	σ = 0.4115
					κ =0.3769
Log Likelihood	-255.2815228	-132.3253661	-131.284216	-136.901833	-130.3583779
AIC	602.563	358.651	356.568	367.804	356.717

* significant at < 0.1; ** significant at < 0.05 level; *** significant at < 0.01

5.5 Discussion

From the data shown above, 287 under-five children reported to have fever in the previous four weeks preceeding the date of the survey were studied about the time that elapsed before treatment for fever was sought. Of the 287 under-five children, 46 percent received timely treatment or advice, consistent with the Abuja target (WHO, 2000) or WHO's recommendation of treating malaria within 24 hours of the onset of symptoms and the remaining 54 percent received treatment or advice after 24 hours.

The present study has revealed through the multilevel modelling that distance to health facility, place of residence (rural or urban), relationship of child to head of household, number of children under-five years of age, number of households with under-five children in the village, and occupation of head of household were among the factors associated with delay to seek medical care. In particular, living in rural areas and far away from the nearest health facilities was associated with delayed health care seeking decisions. Meanwhile, being a non-biological son or daughter of the head of household was also associated with delayed health care seeking.

These findings are consistent with others from studies done before in many different contexts. For example, with respect to distance to health facility, Rutebemberwa *et al.* (2009) found that shorter distances were associated with timely treatment seeking for febrile under-five children in eastern Uganda. This is not unexpected because even if health services are free, as it is the case in Tanzania, long distances to the health facility may require out-of-pocket payment to cover transport costs to and from the health facility (Diaz *et al.*, 2013; Ansah *et al.*, 2009). In a study to examine determinants of delay in malaria treatment-seeking behaviour for under-five children in south-west Ethiopia, Getahun *et al.* (2010) found that children of caretakers who had difficulties to meet transport costs were more likely to receive delayed malaria treatment. In the context of Tanzania, because of existence of many competing needs for the same limited resources particularly in rural areas (NBS, 2009), caretakers may be persuaded to wait to

see if the symptom will disappear without taking the child to a health facility, something, which may result into delayed treatment seeking decision. Equally, because of limited resources, an individual caretaker may fail to take timely treatment seeking decision for her perceived sick under-five children because she might be forced to first attend to income generating activities in order to meet day-to-day basic needs, including food for the household.

With regard to occupation of head of household, the present study found an opposite association than anticipated. In this study, children from households in which the heads of the households were working in non-agricultural activities were taken for medical care late. It was expected that non-agriculture category of occupation provides a more stable source of household income than other categories including agricultural-related activities. Perhaps this could be due to the fact that a large part of the sample in the present study was from rural areas where there might be a few reliable non-agricultural activities based on which individuals engaged in, can earn resources to meet household needs. Another plausible reason could be that caretakers who are engaged in non-agricultural activities, because of having a more stable income, tend to have drugs at home thus first manage the fever at home. Home management of fever is widespread in many settings. For example, in Nigeria, Oshikoya and Senbanjo (2008) found that 66.7 percent of caretakers managed the fever at home and only 20.1 percent of caretakers took their sick children to a health facility (hospital or primary health care center).

In the present analysis, age, education, and occupation of caretaker as well as sex and age of head of household were found not to be associated with delayed treatment seeking behaviour. This observation appears unexpected in the context of earlier studies on family livelihoods, for example, Ellis (1998) and Bebbington (1999) who have shown that such characteristics as age can influence household's and individual's objectives including risk management practices or approaches available to deal with shocks.

This study found that the fourth wealth category was associated with timely health care seeking decision in relation to the poorest income group. This finding is supported by a number of studies which have reported an association between socioeconomic status-related characteristics and health care seeking behaviour (Burton *et al.*, 2011; Ndugwa and Zulu, 2008; Rutebemberwa *et al.*, 2009; Schellenberg *et al.*, 2003). However, a recent study by Diaz *et al.* (2013) found an opposite association between health care seeking behaviour and economic status of household in four rural districts in Sierra Leonean. Specifically, the authors found that children of lowest income group parents were more likely to be taken for medical care.

The results that being a non-biological child of the heads of the households and those households in which there were between two and three under-five children were associated with delayed treatment seeking behaviour is not surprising in the light of enormous literature on intra-household allocation of resources. Studies, for example, Pitt (1997) and Hoddinott *et al.* (1997) have shown that household resources for investment

in human capital such as health are allocated with a view to maximizing a particular utility function. The utility function is defined over a given set of goods and services subject to a set of constraints including the household budget. In situations of restricted resources coupled with non-collective decision-making process within the household, non-biological children of the head of household and children from households with many children under the age of five years may not receive due attention such as timely medical care.

In this study, findings from the multilevel modelling and those from the duration analysis are largely different. Several variables were found to be significant in the former analytical strategy while only two variables were significant in the latter approach. This could be attributed to differences in the sample sizes used in the two analyses. The former used 287 under-five children whereas the latter used 235 children.

5.6 Conclusion

The analysis in this chapter show that rural areas, long distances to the nearest health facility, number of under-five children in the household and relationship of the child to the head of household impede timely treatment seeking decisions for under-five children in Dodoma region. This implies that effective programmes that aim at improving outcomes for febrile under-five children through timely treatment seeking behaviour should consider promoting economic status of households, and the context/environment in which individuals live and make decisions.

CHAPTER SIX

CONCLUSION, POLICY IMPLICATIONS, AND AREAS FOR FURTHER RESEARCH

6.1 Introduction

This study has provided a contextual analysis of health care seeking behaviour for under-five children suspected of a malaria infection in Dodoma region, Tanzania. This has been carried out within the framework of the decision-making process of the demand for health care in an event of illness. The study considered two decision stages of the demand for health care among under-five children. While drawing from the concept of health belief with reference to children, the first decision stage considered was the symptoms appraisal stage. In this decision stage, the study examined socioeconomic differences in beliefs about the harmful effects of fever among under-five children. Second, the study considered the decision when to seek care. In this decision stage, the study considered the time (in days) elapsed between the onset of the symptom and action to seek treatment from a health care provider. In this regard, the study examined first, the extent of delay to seek treatment, and second, consumer or demand-side (individual, household, and community) factors associated with health care focusing on delay to seek treatment for fever among under-five children.

This study has generated evidence that has many policy implications in order to improve treatment-seeking behaviour for febrile under-five children in Dodoma region. However,

interpretation of the policy implications provided in this study is subject to limitations. The most important limitation of the study is concerning the design of the study. That is, cross-sectional study design, which limits the establishment of cause-and-effect relationships between the outcome variable of interest and explanatory variables. Consequently, the conclusion drawn from the study and associated policy implications need to be interpreted with caution, that is, taking into consideration the limitations of the study. The following sections provide the conclusion, policy inference based on the findings of the study and areas for further study.

6.2 Conclusion

A great proportion of caretakers perceive their under-five children to be at risk of experiencing the harmful effects of fever. Children of less educated caretakers are especially more vulnerable. Meanwhile, despite several government initiatives including the removal of user fees for under-five children in all public/government health facilities, more than half of the under-five children suspected of malaria infection in Dodoma region received delayed treatment. The major factors associated with delayed treatment seeking behaviour are those, which influence demand and operate at the individual, household, or community level. At the individual level, there appears to be insufficient knowledge among caretakers on malaria-related illnesses in Dodoma region since with the exception of diarrhoea; other malaria-related illnesses included in the analysis were not associated with delayed care-seeking decision. At the household level, demographic and economic characteristics of the households also contribute to delay in

care seeking. Households with more than one under-five child are prone to making delayed care seeking decisions. Moreover, in households where the head of the household was not a biological mother or father of the sick under-five child, the concerned child was at risk of receiving late medical care. Finally, at the community level, caretakers residing in rural areas and those located far away from the nearest health facilities do not make timely care seeking for their febrile under-five children. These findings warrant the need to devise mechanisms that aim at adjusting the existing inequality in health care seeking behaviour between communities in rural and urban areas in order to ensure great success in child health outcomes, especially of poor communities in Dodoma region.

6.3 Policy Implications

The results of this study have several important implications for policy. The finding that children of educated caretakers were less likely to be perceived to have some chances of occurrence of the harmful effects of fever than those of uneducated caretakers has one important policy implication. Education increases the level of health knowledge of caretakers, changes their perceptions about health issues, and enhances their level of autonomy hence their decision-making power and control over resources within the household (Buor, 2003). In view of this, long-term programmes and strategies that aim at reducing severe morbidity and mortality from malaria-related illnesses among the under-five children in Dodoma region need to consider emphasizing investment in the education of girls especially secondary education and above and ensuring their

participation in the labour market. Strategies could also include ensuring that girls acquire health-related knowledge during their primary education training so that those who fail to progress with secondary education and above would already have basic understanding on how to manage childhood illnesses later in life when they become mothers.

Meanwhile, the results in this study on the demand-side barriers to timely care seeking for fever point to the need to go further than ensuring free health care services for under-five children in all public health facilities, as it is currently the case in Tanzania. Besides free health services, efforts should also focus on empowering individuals especially women who are the primary caretakers of under-five children in order to be able to take advantage of the existing health care facilities in their respective areas of residence. Appropriate sensitization programmes are also needed in order to inform caretakers about the need to take timely health care seeking decisions for malaria-related illnesses given the context in which they live. This may include the need to increase the understanding of caretakers about childhood illnesses particularly those illnesses that can progress from early to advanced stages within few hours of symptom onset. Efforts are also needed to persuade people to consider family planning issues. Interventions also need to consider improving the supply-side barriers to health care. This includes reducing distances to health facilities and ensuring constant supply and availability of essential drugs in all public especially lower-level health facilities in resource-poor

settings such as rural areas where the majority of the population in Dodoma region in particular live.

6.4 Areas for Further Research

Data limitation necessitated the present study to use data derived from a cross-sectional research design. As opposed to longitudinal studies, cross-sectional study designs do not capture information to reflect the dynamic or changing pattern of different factors that influence the outcome variables of interest such as treatment seeking behaviour in the environment in which individuals live or grow up. It is possible that an individual's present treatment seeking behaviour in response to a health shock such as fever is influenced by previous behavioural and economic factors, among others, which cannot be measured using a cross-sectional sample design. As noted by Hoddinott *et al.* (1997) even temporary changes, for instance, in the composition of the household can affect the decision of the household about investment in human capital development. From that point of view, it is recommended that further study be conducted to examine in a dynamic framework all the aspects investigated in the present study in order to provide more insights.

It has been observed in the present study for example, that children of educated caretakers are less likely to be perceived to have some chances for occurrence of the harmful effects of fever in Dodoma region. However, because of data limitation, it was not feasible to establish whether the effect of maternal education on belief about the

occurrence of the harmful effects of fever was through knowledge of healthy behaviour or through preferences for child health. That is, household preferences for health relative to other goods and services. Therefore, further research that separates preference effects from the effect of maternal education on beliefs about the harmful effects of fever in under-five children would be more informative. In this regard, as noted by Grossman (1972), Rosenzweig and Schultz (1982), Schultz (1984), and Wagstaff (1986), the household production function model by Becker (1964) gives important practical insights for casual analysis.

REFERENCES

Aday, L.A. and Cornelius, L.J (2006), **Designing and conducting health surveys: a comprehensive guide**, John Wiley & Sons, Inc., New York.

Adler, N.E., Boyce, T., Chesney, M.A., Cohen, S., Folkman, S., Kahn, R.L. and Syme, L (1994), "Socioeconomic status and health: The challenge of the Gradient", *American Psychologist*, Volume 49, No. 1, pp. 15-24.

Adler, N.E., Boyce, T., Chesney, M.A., Folkman, S. and Syme, S.L (1993), "Socioeconomic Inequalities in Health: No Easy Solution", *JAMA*, Volume 269, No. 24, pp. 3140-3145.

Agu, A.P. and Nwojiji, J.O (2005), "Childhood malaria: mothers' perception and treatment seeking behaviour in a community in Ebonyi State, South East Nigeria",

Ahorlu, C.K., Koram, K.A., Ahorlu, C., de Savigny, D. and Weiss, M.G (2006), "Socio-cultural determinants of treatment delay for childhood malaria in southern Ghana", *Tropical Medicine and International Health*, Volume 11, No. 7, 1022-1031.

Akin, J.S., Guilkey, D.K. and Popkin, B.M (1981), "The demand for child health services in the Philippines", *Social Science and Medicine*, Volume 15, No. 4, pp. 249–257.

Alaba, O.A. and Koch, S.F (2008), "Dynamic Health Care Decisions and Child Health in South Africa", *University of Pretoria, Department of Economics Working Paper Series*, http://www.econrsa.org/papers/w_papers/wp142.pdf retrieved on Tuesday, 25th January, 2010.

Alderman, H. and Gertler, P (1997), **Family resources and Gender Differences in Human Capital Investments: The Demand for Children's Medical Care in Pakistan**, in Haddad, L., Hoddinott, J. and Alderman, H. eds. *Intrahousehold Resource Allocation in Developing Countries. Models, Methods, and Policy.* Baltimore: The John Hopkins University Press.

Alex-Hart, A.B and Frank-Briggs, A.I (2011), "Mothers' perception of fever management in children", *The Nigerian Health Journal*, Volume 11, No. 2.

Allendorf, A (2007), "Couples' reports of women's autonomy and health-care use in Nepal", *Studies in Family Planning*, Volume 38, No. 1, pp. 35-46.

Amorosa Jr, L.F., Corbellini, G. and Coluzzi, M (2005), "Lesseons learned from malaria: Italy's past and sub-Sahara's future", *Health and Place*, Volume 11, No. 1, pp. 67-73.

Andaleeb, S (2008), "Caring for children: a model of healthcare service quality in Bangladesh", *International Journal for Quality in Health Care*; Volume 20, No. 5, pp. 339-45.

Ansah, E.K., Narh-Bana, S., Asiamah, S., Dzordzordzi, V., Biantey, K., Dickson, K., Gyapong, J.O., Koram, K.A., Greenwood, B.M., Mills, A. and Whitty, C.J.M (2009), "Effect of Removing Direct Payment for Health Care on Utilisation and Health Outcomes in Ghanaian Children: A Randomised Controlled Trial", *PLoS Med*, Volume 6, No. 1.

Anwar, M., Green, J. and Norris, P (2012), "Health-seeking behaviour in Pakistan: A narrative review of the existing literature", *Public Health*, Volume 126, No. 6, pp. 507-517.

Anyanwu, J.C (2007), "Demand for Health Care Institutions' Services: Evidence from Malaria Fever Treatment in Nigeria", *African Development Review*, Volume 19, No. 2, pp. 304–334.

Aregawi, M.W., Ali, A.S., Al-mafazy, A., Molteni, F., Katikiti, S., Warsame, M., Njau, R.J.A., Komatsu, R., Korenromp, E., Hosseini, M., Low-Beer, D., Bjorkman, A., D'Alessandro, U., Coosemans, M. and Otten, M (2011), "Reductions in malaria and anaemia case and death burden at hospitals following scale-up of malaria control in Zanzibar, 1999-2008", *Malaria Journal*, Volume 10, No. 46.

Asenso-Okyere, W.K., Dzator, J.A. and osei-Akoto, I (1996), "The behaviour towards malaria care: A Multinomial Logit Approach", *Social Indicators Research*, Volume 39, No. 2, pp. 167-186.

Baltzell, K., Elfving, K., Shakely, D., Ali, A.S., Msellem, M., Gulati, S. and Mårtensson, A (2013), "Febrile illness management in children under five years of age: a qualitative pilot study on primary health care workers' practices in Zanzibar", *Malaria Journal*, Volume 12, No. 37.

Barker, D.J.P (1973), **Practical Epidemiology**, Churchill Livingstone.

Bebbington, A (1999), "Capitals and Capabilities: A Framework for Analyzing Peasant Viability, Rural Livelihoods and Poverty", *World Development*, Volume 27, No. 12, pp. 2021-2044.

Becker, G (1964), **Human Capital: A Theoretical and Empirical Analysis With Special Reference to Education**, National Bureau of Economic Research, New York

Birdsall, N., Ross, D. and Sabot, R (1995), "Inequality and Growth Reconsidered: Lessons from East Asia", *The World Bank Economic Review*, Volume 9, No. 3, pp. 477-508.

Borah, B.J (2006), "A mixed logit model of health care provider choice: analysis of NSS data for rural India", *Health Econ.*, Volume 15, No. 9, pp. 915-932.

Bowling, A (2009), **Research Methods in Health: Investigating health and health services**, 3rd edn. McGraw-Hill: Open University Press.

Bradburn, N.M. and Mason, W.M (1964), "The Effect of Question Order on Responses", *Journal of Marketing Research*, Volume 1, No. 4, pp. 57-61.

Bull, K. and Spiegelhalter, D.J (1997), "Survival Analysis in Observational Studies" *Statistics in Medicine*, Volume 16, No. 9, pp. 1041-1074.

Buor, D (2003), "Mothers' education and childhood mortality in Ghana", *Health Policy*, Volume 64, No. 3, pp. 297-309.

Burton, D.C., Flannery, B. and Onyango, B (2011), "Healthcare-seeking behavior for common infectious disease-related illnesses in rural Kenya: a community-based house-to-house survey", *J Health Popul Nutr*, Volume 29, No. 1, pp. 61-70.

Bush, P.J. and Iannotti, R. J (1990), "A Children's Health Belief Model", *Medical Care*, Volume 28, No. 1, pp. 69-86.

Cabrera, J. and McDougall, A (2002), **Statistical Consulting**, Springer-Verlag New York, Inc.

Canaviri, J (2007), "A random Parametric Logit model for modelling Health Care Choice in Bolivia", *MPRA Paper No. 3263.*

Case, A., Paxson, C. and Vogl, T (2007), "Socioeconomic status and health in childhood: A comment on Chen, Martin, and Matthews, "Socioeconomic status and health: Do gradients differ within childhood and adolescence? (62:9, 2006, 2161-2170)", *Social Science and Medicine*, Volume 64, No. 4, pp. 757-761.

Cavalini, L.T. and de Leon, A.C (2008), "Morbidity and mortality in Brazilian municipalities: a multilevel study of the association between socioeconomic and healthcare indicators", *International Journal of Epidemiology*, Volume 37, No. 4, pp. 775-783.

Chalasani, S (2012), "Understanding wealth-based inequalities in child health in India: A decomposition approach", *Social Science & Medicine*, Volume 75, No. 12, pp. 2160-2169.

Chandler, C.I.R., Jones, C., Boniface, G., Juma, K., Reyburn, H and Whitty, C.J.M (2008), "Guidelines and mindlines: why do clinical staff over-diagnose malaria in Tanzania? A qualitative study", *Malaria Journal*, Volume 7, No. 53.

Chen, E., Martin, A.D. and Matthews, K.A (2006), "Socioeconomic status and health: Do gradients differ within childhood and adolescence?, *Social Science and Medicine*, Volume 62, No. 9, pp. 2161-2170.

Chen, M-S. and Land, K. C (1986), "Testing the Health Belief Model: LISREL Analysis of Alternative Models of Causal Relationships Between Health Beliefs and Preventive Dental Behavior", *Social Psychology Quarterly*, Volume 49, No. 1, pp. 45-60.

Chiappori, P (1997), **Collective'' Models of household Behaviour: The Sharing Rule Approach**, in Haddad, L., Hoddinott, J. and Alderman, H. eds. *Intrahousehold Resource Allocation in Developing Countries. Models, Methods, and Policy.* Baltimore: The John Hopkins University Press.

Chibwana, A., Mathanga, D.P., Chinkhumba, J. and Campbell Jr, C.H (2009), "Socio-cultural predictors of health-seeking behaviour for febrile under-five children in Mwanza-Neno district, Malawi", *Malaria Journal*, Volume 8, No. 219.

children: its danger and treatment practices", *Indian Pediatrics*, Volume 28, No. 5, pp. 501-515.

Chow, T.Y (1999), "What is a Closed-Form Number?", *The American Mathematical Monthly*, Volume 106, No. 5, pp. 440-448.

Chukwuocha, U.M., Okpanma, A.C., Nwakwuo, G.C. and Dozie, I.N.S (2014), "Determinants of delay in seeking malaria treatment for children under-five years in parts of South Eastern Nigeria", *Journal of Community Health*, Volume 39, No. 6, pp. 1171-1178.

Cochran, W.G (1977), **Sampling Techniques (Third Edition)**, John Wiley & Sons, Inc., New York.

Cody, R.P. and Smith, J.K (1997), **Applied Statistics and the SAS® Programming Language**. *4th Ed.* Prentice-Hall, Inc. New Jersey, United States of America.

Cohen, S., Doyle, W.J., Turner, R.B., Alper, C.M. and Skoner, D.P (2004), "Childhood Socioeconomic Status and Host Resistance to Infectious Illness in adulthood", *Psychosomatic Medicine*, Volume 66, No. 4, pp. 553-558.

Conigliaro, J., Whittle, J., Good, C.B., Skanderson, M., Kelley, M. and Goldberg, K (2002), "Delay in presentation for cardiac care by race, age, and site of care", *Medical Care*, Volume 40, No. 1, pp. I97-105.

Contoyannis, P. and Jones, A.M (2004), "Socio-economic status, health and lifestyle", *Journal of Health Economics*, Volume 23, No. 5, pp. 965-995.

Crawley, J. and Nahlen, B (2004), "Prevention and Treatment of Malaria in Young African Children", *Seminars in Pediatric Infections Diseases*, Volume 15, No. 3, pp. 169-180.

Crocetti M., Moghbeli, N. and Serwint, J (2001), "Fever phobia revisited: have parental misconceptions about fever changed in 20 years?", *Pediatrics*, Volume 107, No. 6, pp. 1241-1246.

Cronbach, L (1951), "Coefficient alpha and the internal structure of tests", *Psychomerika*, Volume 16, No. 3, pp. 297-334.

David, V., Moncada, M. and Ordonez, F (2004), "Private and public determinants of child nutrition in Nicaragua and Western Honduras", *Economics and Human Biology*, Volume 2, No. 3, pp. 457-488.

de Bartolome, C.A.M. and Vosti, S.A (1995), "Choosing between public and private health-care: A case study of malaria treatment in Brazil", *Journal of Health Economics*, Volume 14, No. 2, pp. 191-205.

Demir, F. and Sekreter, O (2012), "Knowledge, attitudes and misconceptions of primary care physicians regarding fever in children: a cross sectional study", *Italian Journal of Pediatrics*, Volume 38, No. 40

Department of Economic and Social Affairs of the United Nations Secretariat (2005). *Designing household Survey Samples: Practical Guidelines*. New York. United Nations, 2005. http://unstats.un.org/unsd/demographic/sources/surveys/Handbook23June05.pdf retrieved on Tuesday, 25th January, 2010.

Di Iorio, C.K (2005), **Measurement in Health Behaviour: Methods for Research and Education**, John Wiley & Sons, Inc.

Diallo, D.A., Habluetzel, A., Cuzin-Ouattara, N., Nebié, I., Sanogo, E., Cousens, S.N. and Esposito, F (1999), "Widespread distribution of insecticide-impregnated curtains reduces child mortality, prevalence and intensity of malaria infection, and malaria transmission in rural Burkina Faso", Parassitologia, Volume 41, No. 1-3, pp. 377-381.

Diaz, T., George, A.S., Rao, S.R., Bangura, P.S., Baimba, J.B., Shannon A McMahon, S. A. and Kabano, A (2013), "Healthcare seeking for diarrhoea, malaria and pneumonia among children in four poor rural districts in Sierra Leone in the

context of free health care: results of a cross-sectional survey", *BMC Public Health*, Volume 13, No. 157.

Diez-Roux, A.V (2000), "Multilevel Analysis in Public Health Research", *Annual Review of Public Health*, Volume 21, pp. 171-92.

Dillip, A., Hetzel, M.W., Gosoniu, D., Kessy, F., Lengeler, C., Mayumana, I., Mshana, C., Mshinda, H., Schulze, A., Makemba, A., Pfeiffer, C., Weiss, M.G. and Obrist, B (2009), "Socio-cultural factors explaining timely and appropriate use of health facilities for *degedege* in south-eastern Tanzania", *Malaria Journal*, Volume 8, No. 144.

Dodoma Regional Hospital Annual Report 2010. Dodoma Regional Referal Hospital, Dodoma, Tanzania.

Dong, H., Gbangou, A., Allegri, M.D., Pokhrel, S. and Sauerborn, R (2008), "The differences in characteristics between health-care users and non-users: implications for introducing community-based health insurance in Burkina Faso", *Eur J Health Econ*, Volume 9, No. 1, pp. 41-50.

Duncan, S.C., Strycker, L.A., Duncan, T.E. and Okut, H (2002), "A Multilevel Contextual Model of Family Conflict and Deviance", *Journal of Psychopathology and Behavioral Assessment*, Volume 24, No. 3, pp. 169-175.

Dunn, C.E., Mare, A.L. and Makungu, C (2011), "Malaria risk behaviours, socio-cultural practices and rural livelihoods in southern Tanzania: Implications for bednet usage", *Social Science and Medicine*, Volume 72, No. 3, pp. 408-417.

Ehiri, J.E., Anyanwu, E.C. and Scarlett, H (2004), "Mass Use of Insecticide-Treated Bednets in Malaria Endemic Poor Countries: Public Health Concerns and Remedies", *Journal of Public Health Policy*, Volume 25, No. 1, pp. 9-22.

Eisele, T.P. Larsen, D. and Steketee, R.W (2010), "Protective efficacy of interventions for preventing malaria mortality in children in *Plasmodium falciparum* endemic areas", *International Journal of Epidemiology*, Volume 39, pp. i88–i101.

Ellis, F (1998), "Household Strategies and Rural Livelihood Diversification", *The Journal of Development Studies,* Volume 35, No. 1, pp. 1-38.

Eng, J.L.V, Thwing, J., Wolkon, A., Kulkarni, M.A., Manya, A., Erskine, M., Hightower, A. and Slutsker, L (2010) "Assessing bed net use and non-use after long-lasting insecticidal net distribution: a simple framework to guide programmatic strategies", *Malaria Journal*, Volume 9, No. 133.

Ermisch, J., Francesconi, M. and Pevalin, D.J (2004), "Parental partnership and joblessness in childhood and their influence on young people's outcomes", *Journal of the Royal Statistical Society*: series A, Volume 167, No. 1, pp. 69-101.

Espino, F. and Manderson, L (2000), "Treatment seeking for malaria in Morong, Bataan, The Philippines", *Social Science and Medicine*, Volume 50, No. 9, pp. 1309-1316.

Ettarh, R., Galiwango, E., Rutebemberwa, E., Pariyo, G. and Peterson, S (2011), "Spatial analysis of determinants of choice of treatment provider for fever in under-five children in Iganga, Uganda", Health & Place, Volume 17, No. 1, pp. 320-326.

Fosu, G.B (1994), "Childhood morbidity and health services utilization: Cross-national comparisons of user-related factors from DHS data", *Social Science and Medicine*, Volume 38, No. 9, pp. 1209-1220.

Fotouhi, A. R (2007), "The initial conditions problem in longitudinal count process: A simulation study", *Simulation Modelling Practice and Theory*. Volume 15, No. 5, pp. 589–604.

Fotso, J. and Kuate-Defo, B (2005), "Measuring Socioeconomic Status in Health Research in Developing Countries: Should we be focusing on households, Communities or Both?", *Social Indicators Research*, Volume 72, No. 2, pp. 189-237.

Frederickx, I (1998), "Health in Rural Tanzania: The Determinants of Health Status, Health Care Demand and Health Care Choice", *Development Economics, Centre for Economic Studies. Discussion Paper Series DPS 98.03*.

Getahun, A., Deribe, K. and Deribew, A (2010), "Determinants of delay in malaria treatment-seeking behaviour for under-five children in south-west Ethiopia: a case control study", *Malaria Journal*, Volume 9, No. 320.

Ghuman, S. J (2003), "Women's Autonomy and Child Survival: A Comparison of Muslims and Non-Muslims in Four Asian Countries", *Demography*, Volume 40, No. 3, pp. 419-436.

Gibbons, R.D. and Hedeker, D (1997), "Random Effects Probit and Logistic Regression Models for Three-Level Data", *Biometrics*, Volume 53, No. 4, pp. 1527-1537.

Giri, N.C (1996), **Multivariate Statistical Analysis**, Marcel Dekker, New York.

Glik, D.C., Ward, B.W., Gordon, A. and Haba, F (1989), "Malaria Treatment Practices Among Mothers in Guinea", *Journal of Health and Social Behavior*, Volume 30, No. 4, pp. 421-435.

Goldstein, H (1987), **Multilevel Models in Educational and Social Research**, New York: Oxford University Press.

Gosoniu, L., Vounatsou, P., Tami, A., Nathan, R., Grundmann, H. and Lengeler, C (2008), "Spatial effects of mosquito bednets on child mortality", *BMC Public Health*, Volume 8, No. 356.

Graubard, B.I. and Korn, E.L (1996), "Modelling the sampling design in the analysis of health surveys", *Statistical Methods in Medical Research*, Volume 5, No. 3, pp. 263-281.

Greenwald, H.P., Becker, S.W. and Nevitt, M.C (1978), "Delay and Noncompliance in Cancer Detection: A Behavioral Perspective for Health Planners", *The Milbank Memorial Fund Quarterly. Health and Society*, Volume 56, No. 2, pp. 212-230.

Greenwood, B (1999), "What can the residents of malaria endemic countries do to protect themselves against malaria?", *Parassitologia*, Volume 41, No. 1-3, pp. 295-299.

Grossman, M (1972). "On the Concept of Health and the Demand for Health", *The Journal of Political Economy*, Volume 80, No. 2, pp. 223-255.

Guo, G. and Zhao, H (2000), "Multilevel Modelling for Binary Data", *Annual Review of Sociology*, Volume 26, pp. 441-462.

Guo, S (2005), "Analyzing grouped data with hierarchical linear modelling", *Children and Youth Services Review*, Volume 27, No. 6, pp. 637-652.

Haines, M.R (1995), "Socio-economic Differentials in Infant and Child Mortality during Mortality Decline: England and Wales, 1890-1911", *Population Studies*, Volume 49, No. 2, pp. 297-315.

Hamilton, L. C (2003), **Statistics with Stata**, Wadsworth Group/Thomson Learning, USA.

Harchut, K., Standley, C., Dobson, A., Klaassen, B., Rambaud-Althaus, C., Althaus, F. and Nowak, K (2013), "Over-diagnosis of malaria by microscopy in the Kilombero Valley, Southern Tanzania: an evaluation of the utility and cost-effectiveness of rapid diagnostic tests", *Malaria Journal*, Volume 12, No. 159.

Hatcher, L (994), **A Step-by-Step Approach to sing the SAS System for Factor Analysis and Structural Equation Modelling**, Cary, NC: SAS Institute, US.

HBS (2007), *Household Budget Survey 2007*, National Bureau of Statistics, Tanzania Mainland. United Republic of Tanzania.

Heaton, T.B., Forste, R., Hoffmann, J.P. and Flake, D (2005), "Cross-national variation in family influences on child health", *Social Science and Medicine*, Volume 60, No. 1, pp. 97-108.

Hedeker, D (2003), "A mixed-effects multinomial logistic regression model", *Statistic in Medicine*, Volume 22, No. 9, pp. 1433-1446.

Hedeker, D. and Gibbons, R. D (1994), "A Random-Effects Ordinal Regression Model for Multilevel Analysis", *Biometrics*, Volume 50, No. 4, pp. 933-944.

Heishman, S.J., Singleton, E.G. and Pickworth, W.B (2008), "Reliability and validity of a Short Form of the Tobacco Craving Questionnaire", *Nicotine & Tobacco Research*, Volume 10, No. 4, pp. 643-651.

Heller, P.S (1982), "A model of the demand for medical and health services in Peninsular Malaysia", *Social Science and Medicine*, Volume 16, No. 3, pp. 267-284.

Hill, Z., Kendall, C., Arthur, P., Kirkwood, B. and Adjei, E (2003), "Recognizing childhood illnesses and their traditional explanations: exploring options for care-seeking interventions in the context of the IMCI strategy in rural Ghana", *Tropical Medicine and International Health*, Volume 8, No.7, pp. 668-76.

Hoddinott, J., Alderman, H. and Haddad, L (1997), **Testing Competing Models of Intrahousehold Allocation**, in Haddad, L., Hoddinott, J. and Alderman, H. eds. *Intrahousehold Resource Allocation in Developing Countries. Models, Methods, and Policy*. Baltimore: The John Hopkins University Press.

Holtz, T.H., Kachur, S.P., Marum, L.H., Mkandala, C., Chizani, N., Roberts, J.M., Macheso, A. and Parise, M.E (2003), "Care seeking behaviour and treatment of febrile illness in children aged less than five years: a household survey in Blantyre District, Malawi", *Transactions of the Royal Society of Tropical Medicine and Hygiene*, Volume 97, No. 5, pp. 491-497.

Howe, L.D., Hargreaves, J.R. and Huttly, S.R.A (2008), "Issues in the construction of wealth indices for the measurement of socio-economic position in low-income countries", *Emerging Themes in Epidemiology*, Volume 5, No. 3.

Hume, J.C.C., Barnish, G., Tara Mangal, T., Luiz Armázio, L., Streat, E. and Bates. I (2008), "Household cost of malaria overdiagnosis in rural Mozambique", *Malaria Journal*, Volume 7, No. 33.

IIPS and Macro International (2007), *National Family Health Survey (NFHS-3), 2005–06: India: Volume II*. Mumbai: IIPS.

Jacobson, L (2000), "The family as producer of health-an extended grossman model", *Journal of Health Economics*, Volume 19, No. 5, pp. 611-637.

Jaenisch, T., Sullivan, D.J., Dutta, A., Deb, S., Ramsan, M., Othman, M.K., Gaczkowski R., Tielsch, J. and Sazawal, S (2010), "Malaria incidence and prevalence on Pemba Island before the onset of the successful control intervention on the Zanzibar archipelago", *Malaria Journal*, Volume 9, No. 32.

James, C., Morris, S.S., Keith, R. and Taylor, A (2005), "Impact on child mortality of removing user fees: simulation model", *BMJ*, Volume 331, No. 747.

Jejeebhoy, S.J. and Sathar, Z.A (2001), "Women's autonomy in India and Pakistan: The influence of religion and region", *Population and Development Review*, Volume 27, No. 4, pp. 687–712.

Jhamba, T (1996), "Childhood mortality differentials in Zimbabwe: evidence from two surveys", *Genus*, Volume 52, No. 3-4, pp. 155-172.

Johnson, A., Goss, A., Beckerman, J. and Castro, A (2012), "Hidden costs: The direct and indirect impact of user fees on access to malaria treatment and primary care in Mali", *Social Science and Medicine*, Volume 75, No. 10, pp. 1786-1792.

Johnson, R.A. and Wichern, D.W (1998), **Applied Multivariate Statistical Analysis**. 4th edn. Prentice Hall, NJ.

Jolliffe, I. T (1986), **Principal Component Analysis**, Springer-Verlag, New York, Inc

Jombo, G.T.A., Araoye, M.A. and Damen, J.G (2011), "Malaria self medications and choices of drugs for its treatment among residents of a malaria endemic community in West Africa", *Asian Pacific Journal of Tropical Disease*, Volume 1, No. 1, pp. 10-16.

Jones, R. A, Wiese, H. J., Moore, R. W, and Haley, J. V (1981), "On the Perceived Meaning of Symptoms", *Medical Care*, Volume 19, No. 7, pp. 710-717.

Journal of Community Medicine and Primary Health Care, Volume 17, No. 1, pp. 45-50.

Kahabuka, C., Kvåle, G. and Hinderaker, S.G (2013), "Care-Seeking and Management of Common Childhood Illnesses in Tanzania – Results from the 2010 Demographic and Health Survey", *PLoS ONE*, Volume 8, No. 3.

Kalichman, S.C., Benotsch, E., Suarez, T., Gatz, S., Miller, J. and Rompa, D (2000), "Health literacy and health-related knowledge among people living with HIV/AIDS", *Am J Prev Med*, Volume 18, No. 4, pp. 325-331.

Kalton, G. and Schuman, H (1982), "The Effect of the Question on Survey Responses: A Review", *Journal of the Royal Statistical Society, Series A*, Volume 145, No. 1, pp. 42-73.

Kamat, V.R. and Nyato, D.J (2010), "Community response to artemisinin-based combination therapy for childhood malaria: a case study from Dar es Salaam. Tanzania", *Malaria Journal*, Volume 9, No.61.

Kamgnia, B.D (2008), "Distribution Impact of Public Spending in Cameroon: The Case of Health Care", *African Economic Consortium Research Paper 179.*

Kengeya-Kayondo, J.F., Seeley, J.A., Kajura-Bajenja, E., Kabunga, E., Mubiru, E., Sembajja, F. and Mulder, D.W (1994), "Recognition, treatment seeking behaviour and perception of cause of malaria among rural women in Uganda", *Acta Tropica,* Volume 58, No. 3-4, pp. 267-273.

Kerry, S.M. and Bland, J.M (2001), "Unequal cluster sizes for trials in English and Welsh general practice: implications for sample calculations", *Statistics in Medicine*, Volume 20, No. 3, pp.

Khandker, S.R (1987), "Women's time allocation and household nonmarket production in rural Bangladesh", *The Journal of Developing Areas*, Volume 22, No. 1, pp. 85-102.

Killeen, G.F., Smith, T.A., Ferguson, H.M., Mshinda, H., Abdulla, S., Lengeler, C. and Kachur, S.P. (2007), "Preventing Childhood Malaria in Africa by Protecting Adults from Mosquitoes with Insecticide-Treated Nets", *PLoS Med*, Volume 4, No. 7.

Kim, J. and Mueller, C. W (1978), **Introduction to Factor Analysis: What it is and How to do it**, Thousand Oaks, CA: Sage Publications, Quantitative Applications in the Social Sciences Series, No. 13.

Kinung'hi, S.M., Mashauri, F., Mwanga, J.R., Nnko, S.E., Kaatano, G.M., Malima, R., Kishamawe, C., Magesa, S. and Mboera, L.E.G (2010), "Knowledge, attitudes and practices about malaria among communities: Comparing epidemic and non-epidemic prone communities of Muleba district, North-western Tanzania. *BMC Public Health*, Volume 10, No. 395.

Kish, L (1965), **Survey Sampling**, John Wiley & Sons, Inc.

Kofoed, P-E., Rodrigues, A., Có, F., Hedegaard, K., Rombo, L. and Aaby, P (2004). "Which children come to the health centre for treatment of malaria?" *Acta Tropica*, Volume 90, No. 1, pp. 17-22.

Koram, K.A., Abuaku, B., Duah, N. and Quashie, N (2005), "Comparative efficacy of antimalarial drugs including ACTs in the treatment of uncomplicated malaria among children under 5 years in Ghana", *Acta Tropica*, Volume 95, No. 3, pp. 194-203.

Korn, E.L. and Graubard, B.I (1995), "Analysis of Large Health Surveys: Accounting for the Sampling Design", *Journal of the Royal Statistical Society. Series A*, Volume 158, No. 2, pp. 263-295.

Kramer, R.A., Dickinson, K.L., Anderson, R.M., Fowler, V.G., Miranda, M.L., Mutero, C.M., Saterson, K.A., and Wiener, J.B (2009), "Using decision analysis to improve malaria control policy making", Health Policy, Volume 92, No. 2-3, pp. 133-140.

Kutner, B. and Gordan, G (1961), "Seeking Care for Cancer", *Journal of Health and Human Behavior*, Volume 2, No. 3, pp. 171-178.

Kwabe, T.S., Abdulfatai, O., Agbam, E.F., Usman, A. and Bashiru, A.M (2013), "Mothers Management of Malaria Fever among Under-Five Nomadic Fulani Children of Northeastern Nigeria", *American Journal of Infectious Diseases and Microbiology*, Volume 1, No. 2, pp. 26-33.

Lalchhuanawma, R. and Murhekar, M.V (2012), "Health-seeking behaviour for febrile illness in malaria-endemic Kolasib district, Mizoram, India", *International Health* Volume 4, No. 4, pp. 314-319.

Langlie, J.K (1977), "Social Networks, Health Beliefs, and Preventive Health Behavior", *Journal of Health and Social Behavior*, Volume 18, No. 3, pp. 244-260.

Lau, J.T.F., Yu, X., Chu, Y., Shing, M.M.K., Wong, E.M.C., Leung, T.F., Li, C.K., Fok, T.F. and Mak, W.W.S (2010), "Validation of the Chinese version of the Pediatric Quality of Life InventoryTM (PedsQLTM) Cancer Module", *Journal of Pediatric Psychology*, Volume 35, No. 1, pp. 99-109.

Lavy, V., Strauss, J. and Thomas, D (1996), "Quality of health care, survival and health outcomes in Ghana" *Journal of Health Economics*, Volume 15, No. 3, pp. 333-357.

Lawson, D (2004), *Determinants of Health Seeking Behaviour in Uganda: Is it Just Income and User Fees That Are Important?*, http://unpan1.un.org/intradoc/groups/public/documents/NISPAcee/UNPAN018976.pdf retrieved on Wednesday, 24th April, 2011.

Lin, C-C., Wu, C-C., Anderson, R. M., Chang, C-S., Chang, S-C., Hwang, S-J. and Chen, H-C (2012), "The chronic kidney disease self-efficacy (CKD-SE) instrument: development and psychometric evaluation", *Nephrol Dial Transplant*. Volume 27, No. 10, pp. 3828-3834.

Lindelow, M (2003), **The Utilization of Curative Health Care in Mozambique: Does Income Matter?** The World Bank, Centre for Study of African Economies, Oxford University.

Lindsey, J.K (2001), **Nonlinear Models in Medical Statistics**. Oxford: Oxford University Press.

Ludwig, E.G. and Gibson, G (1969), "Self Perception of Sickness and the Seeking of Medical Care", *Journal of Health and Social Behavior*, Volume 10. No. 2, pp. 125-133.

Maddala, G.S (1983), **Limited dependent and qualitative variables in econometrics**. Cambridge University Press.

Magesa, S.M., Lengeler, C., deSavigny, D., Miller, J. E., Njau, R.J.A., Kramer, K., Kitua, A. and Mwita, A (2005), "Creating an "enabling environment" for taking insecticide treated nets to national scale: the Tanzanian experience", *Malaria Journal*, Volume 4, No. 34.

Malik, E.M., Hanafi, K., Ali, S.H., Ahmed, E.S. and Mohamed, K.A (2006). "Treatment-seeking behaviour for malaria in children under five years of age: implication for home management in rural areas with high seasonal transmission in Sudan". *Malaria Journal*, Volume 5, No. 60.

Marcinowicz, L., Rybaczuk, M., Grebowski, R. and Chlabicz, S (2010), "A short questionnaire for measuring the quality of patient visits to family practices", *International Journal for Quality in Health Care*, Volume 22, No. 4, pp. 294-301.

Martin, P. and Bateson, P (1993), **Measuring Behaviour: An Introductory Guide**. 2nd edn. Cambridge University Press.

Masanja, H., de Savigny, D., Smithson, P., Schellenberg, J., John, T., Mbuya, C., Upunda, G., Boerma, T., Victora, C., Smith, T. and Mshinda, H (2008), "Child survival gains in Tanzania: analysis of data from demographic and health surveys", *Lancet*, Volume 371, No. 9620.

Mashreky, S. R., Rahman, A., Chowdhury, S. M., Svanström, L., Shafinaz, S., Khan, T. F. and Rahman, F (2010), "Health seeking behaviour of parents of burned children in Bangladesh is related to family socioeconomics", *Injury, International Journal of Care of the Injured*, Voulme 41, No. 5, pp. 528-532.

Maslove, D.M., Mnyusiwalla, A., Mills, E.J., McGowan, J., Attaran, A. and Wilson, K (2009), "Barriers to the effective treatment and prevention of malaria in Africa: A systematic review of qualitative studies", *BMC International Health and Human Rights*, Volume 9, No. 26.

Mason, W.B., Bedwell, C.L., Zwaag, R.V. and Runyan, J.W. Jr. (1980), "Why People Are Hospitalized: A Description of Preventable Factors Leading to Admission for Medical Illness", *Medical Care*, Volume 18, No. 2, pp. 147-63.

Mazigo, H.D., Meza, W., Ambrose, E.E., Kidenya, B.R. and Kweka, E.J (2011), "Confirmed malaria cases among children under-five with fever and history of fever in rural western Tanzania", *BMC Research Notes*, Volume 4, No. 359.

Mboera, L.E.G., Bwana, V.M., Rumisha, S.F., Malima, R.C., Mlozi, M.R.S., Mayala, B.K., Stanley, G. and Mlacha, T (2015), "Malaria, anaemia and nutritional status among schoolchildren in relation to ecosystems, livelihoods and health systems in Kilosa District in central Tanzania", *BMC Public Health*, Volume 15, No. 553.

Mboera, L.E.G., Kamugisha, M.L., Rumisha, S.F., Kisinza, W.N., Senkoro, K.P. and Kitua, A.Y (2008), "Malaria and mosquito net utilisation among schoolchildren in villages with or without healthcare facilities at different altitudes in Iringa District, Tanzania", *African Health Sciences*, Volume 8, No. 2, pp. 114-119.

Mboera, L.E.G., Kamugisha, M.L., Rumisha, S.F., Msangeni, H.A., Barongo, V., Molteni, F. and Kitua, A.Y (2006), "The relationship between malaria parasitaemia and availability of healthcare facility in Mpwapwa District, central Tanzania", *Tanzania Health Research Bulletin*, Volume 8, No. 1, pp. 22-27.

Mboera, L.E.G., Mazigo, H.D., Rumisha, S.F. and Kramer, R.A (2013), "Towards malaria elimination and its implication for vector control, disease management and livelihoods in Tanzania", *Malaria World Journal*, Volume 4, No. 19.

McCauley, A.P., West, S. and Lynch, M (1992), "Household decisions among the Gogo people of Tanzania: Determining the roles of men, women and the community in implementing a trachoma prevention program", *Social Science and Medicine*, Volume 34. No. 7, pp. 817-824.

McCombie, S.C (1996), "Treatment seeking for malaria: a review of recent research", *Social Science and Medicine*, Volume 43, No. 6, pp. 933-945.

McFarland, S. G (1981), "Effects of Question Order on Survey Responses", *The Public Opinion Quarterly*, Volume 45, No. 2, pp. 208-215.

Meeker, J. and Meekers, D (1997), "The Precarious Socio-Economic Position of Women in Rural Africa: The Case of the Kaguru ofTanzania", *African Studies Review*, Volume 40, No. 1, pp. 35-58.

Meyer-Weitz, A., Reddy, P., Van den Borne, H.W., Kok, G. and Pietersen, J (2000), "Health care seeking behaviour of patients with sexually transmitted diseases: determinants of delay behaviour", *Patient Education and Counselling*, Volume 41, No. 3, pp. 263-274.

Meyer-Weitz, A., Reddy, P., Van den Borne, H.W., Kok, G. and Pietersen, J (2000), "Health care seeking behaviour of patients with sexually transmitted diseases: determinants of delay behaviour", *Patient Education and Counselling*, Volume 41, No. 3, pp. 263-274.

Mmbando, B.P., Kamugisha, M.L., Lusingu, J.P., Francis, F., Ishengoma, D.S., Theander, T.G. Lemnge, M.M. and Scheike, T.H (2011), "Spatial variation and socio-economic determinants of Plasmodium falciparum infection in northeastern Tanzania", *Malaria Journal*, Volume 10, No. 145.

Mmbando, B.P., Vestergaard, L.S., Kitua, A.Y., Lemnge, M.M., Theander, T.G. and Lusingu, J.P.A (2010), "A progressive declining in the burden of malaria in north-eastern Tanzania", *Malaria Journal*, Volume 9, No. 216.

MoHSW (2006), *Annual Health Statistical Abstract*, Ministry of Health and Social Welfare, United Republic of Tanzania.

MoHSW (2009), *Malaria: Medium Term Strategic Plan 2008-2013*. National Malaria Control Programme, Ministry of Health and Social Welfare, United Republic of Tanzania.

MoHSW (2010), *Health Sector Performance Profile Report*, Ministry of Health and Social Welfare, Mainland Tanzania July 2009-June 2010.

MoHSW (2011), *Health Sector Performance Profile Report*, Ministry of Health and Social Welfare, Mainland Tanzania.

Moss, W.J., Norris, D.E., Mharakurwa, S.M., Scott, A., Mulenga, M., Mason, P.R., Chipeta, J. and Thuma, P.E (2012), "Challenges and prospects for malaria elimination in the Southern Africa region", *Acta Tropica*, Volume 121, No. 3, pp. 207-211.

Moursund, A. and Kravdal, Ø (2003), "Individual and Community Effects of Women's Education and Autonomy on Contraceptive Use in India", *Population Studies*, Volume 57, No. 3, pp. 285-301.

Msisha, W.M., Kapiga, S.H., Earls, F. and Subramanian, S.V (2008), "Socioeconomic status and HIV seroprevalence in Tanzania: a counterintuitive relationship", *International Journal of Epidemiology*, Volume 37, No. 6, pp. 1297-1303.

Mubyazi, G.M. and Gonzalez-Block, M.A (2005), "Research influence on antimalarial drug policy change in Tanzania: case study of replacing chloroquine with

sulfadoxine-pyrimethamine as the first-line drug", *Malaria Journal*, Volume 4, No.51.

Mubyazi, G.M., Bloch, P., Magnussen, P.,Olsen, Ø.E., Byskov, J., Hansen, K.S., Bygbjerg, Ib. C (2010), "Women's experiences and views about costs of seeking malaria chemoprevention and other antenatal services: a qualitative study from two districts in rural Tanzania", *Malaria Journal*, Volume 9, No. 54.

Murasko, J.E (2008), "An evaluation of the age-profile in the relationship between income and the health of children in the United States", *Journal of Health Economics*, Volume 27, No. 6, pp. 1489–1502.

Mwabu, G (2008), *The Production of Child Health in Kenya: A Structural Model of Birth Weight*, University of Nairobi, Department of Economics, June 27, 2008

Mwabu, G. M (1986), "Health Care Decisions at the household Level: Results of a Rural Health Survey in Kenya", *Social Science and Medicine,* Volume 22, No. 3, pp. 315-319.

Mwabu, G., Ainsworth, M. and Nyamete, A (1993), "Quality of Medical Care and Choice of Medical Treatment in Kenya. An Empirical Analysis", *The Journal of Human Resources*, Volume 28. No. 4, pp. 838-862.

Mwenesi, H.A (2005), "Social science research in malaria prevention, management and control in the last two decades: An overview", *Acta Tropica*, Volume 95, No. 3. pp. 292-297.

Nabyonga, O.J., Mugisha, F., Okui, A.P., Musango, L. and Kirigia, J.M (2013), "Health care seeking patterns and determinants of out-of-pocket expenditure for malaria for the children under-five in Uganda", *Malaria Journal*, Volume 12, No. 175.

Nacher, M., Singhasivanon, P., Vannaphan, S., Treeprasertsuk, S., Phanumaphorn, M., Traore, B., Looareesuwan, S. and Gay, F (2001), "Socio-economic and environmental protective: risk factors for severe malaria in Thailand", *Acta Tropica*, Volume 78, No. 2, pp. 139-46.

Nansel, T.R., Rovner, A.J., Haynie, D., Iannotti, R.J., Simons-Morton, B., Wysocki, T., Anderson, B., Weissberg-Benchell, J. and Laffel, L (2009), "Development and Validation of the Collaborative Parent Involvement Scale for Youths with Type 1 Diabetes", *Journal of Pediatric Psychology*, Volume 34, No. 1, pp. 30-40.

National Bureau of Statistics (NBS) [Tanzania] and Macro International Inc.. 2007. *Tanzania Service Provision Assessment Survey 2006*. Dar es Salaam, Tanzania: National Bureau of Statistics and Macro International Inc.

Navarro, C., Ayala, L. and Labeaga, J.M (2009), "Housing deprivation and health status: evidence from Spain", *Empirical Economics*, Volume 38, No. 3, pp. 555-582.

NBS (2006). National Bureau of Statistics. Regional and District Projections. Dodoma. Volume XII, http://www.nbs.go.tz/projections/dodoma_projections.pdf retrieved on Tuesday, 25th January, 2010.

Ndugwa, R.P. and Zulu, E.M (2008), "Child morbidity and care-seeking in Nairobi slum settlements: the role of environmental and socio-economic factors", *J Child Health Care*, Volume 12, No. 4, pp. 314-328.

Ndyomugyenyi, R., Magnussen, P. and Clarke, S (2007), "Malaria treatment-seeking behaviour and drug prescription practices in an area of low transmission in Uganda: implications for prevention and control", *Transactions of the Royal Society of Tropical Medicine and Hygiene*, Volume 101, No. 3, pp. 209-215.

Neter, J., Kutner, M., Nachetshein, C.J. and Wasserman, W (1996), **Applied Linear Statistical Models**, Irwin, Chicago.

Ngasala, B.E., Malmberg, M., Carlsson, A. M., Ferreira, P.E., Petzold, M.G., Blessborn, D., Bergqvist, Y., Gil, J.P., Premji, Z. and Mårtensson, A (2011), "Effectiveness of artemether-lumefantrine provided by community health workers in underfive children with uncomplicated malaria in rural Tanzania: an open label prospective study", *Malaria Journal*, Volume 10, No. 64.

Nnedu, N. O., Rimel, B., Terry, C., Jalloh-Vos, H., Baryon, B., Bausch, G. D (2010), "Syndromic diagnosis of malaria in rural Sierra Leone and proposed additions to the national integrated management of childhood illness guidelines for fever", *American Journal of Tropical Medicine and Hygiene*, Volume 82, No. 4, pp. 525–528.

Noortgate, W.V., Boeck, P.D. and Meulders, M (2003), "Cross-classification multilevel logistic models in psychiatrics", *Journal of Educational and Behavioural Statistics*, Volume 28, No. 4, pp. 369–386.

Norman, G.R. and Streiner, D.L (1994), **Biostatistics: The bare essentials**, St. Louis, MO: Mosby.

Northcott, H.C. and Harvey, M.D (2012), "Public perceptions of key performance indicators of healthcare in Alberta, Canada", *International Journal for Quality in Health Care*, Volume 24, No.3, pp. 214-223.

Novignon, J. and Nonvignon, J (2012). "Socioeconomic status and the prevalence of fever in children under age five: evidence from four sub-Saharan African countries", *BMC Research Notes*, Volume 5, No. 380.

Nuwaha, F (2002), "People's perception of malaria in Mbarara, Uganda", *Tropical Medicine and International Health*, Volume 7, No. 5, pp. 462-470.

O'Meara, W.P., Mangeni, J.N., Steketee, R. and Greenwood, B (2010), "Changes in the burden of malaria in sub-Saharan Africa", *Lancet Infectious Diseases*, Volume 10, No. 8, pp. 545-555.

Oakes, J. M. and Rossi, P.H (2003), "The measurement of SES in health research: current practice and steps towards a new approach", *Social Science and Medicine*, Volume 56, No. 4, pp. 769-784.

Okiro, E.A. and Snow, R.W (2010), "The relationship between reported fever and *Plasmodium falciparum* infection in African children", *Malaria Journal*, Volume 9, No. 99.

Okoko, B.J. and Yamuah, L.K (2006), "Household Decision-Making Process and Childhood Cerebral Malaria in The Gambia", *Archives of Medical Research*, Volume 37, No. 3, pp. 399-402.

Oladosu, O.O. and Oyibo, W.A (2013), "Overdiagnosis and Overtreatment of Malaria in Children That Presented with Fever in Lagos, Nigeria", *ISRN Infectious Diseases*, Volume 2013.

Oresanya, O.B., Hoshen, M. and Sofola, O.T (2008), "Utilization of insecticide-treated nets by under-five children in Nigeria: Assessing progress towards the Abuja targets", *Malaria Journal*, Volume 7, No. 145.

Oshikoya, K.A. and Senbanjo, I.O (2008), "Fever in Children: Mothers' Perceptions and their Home Management", *Iranian Journal of Pediatrics*, Volume 18, No. 3, pp. 229-236.

Otten, M., Aregawi, M., Were, W., Karema, C., Medin, A., Bekele, W., Jima, D., Gausi, K., Komatsu, R., Korenromp, E., Low-Beer, D. and Grabowsky, M (2009), "Initial evidence of reduction of malaria cases and deaths in Rwanda and Ethiopia due to rapid scale-up of malaria prevention and treatment", *Malaria Journal*, Volume 8, No. 14.

Peugh, J.L (2010), "A practical guide to multilevel modelling", *Journal of School Psychology*, Volume 48, No. 1, 85-112.

Pfeffermann, D (1993), "The Role of Sampling Weights When Modeling Survey Data. *International Statistical Review / Revue Internationale de Statistique*, Volume 61, No. 2, pp. 317-337.

Pfeffermann, D., Skinner, C.J., Holmes, D.J., Goldstein, H. and Rasbash, J (1998), "Weighting for Unequal Selection Probabilities in Multilevel Models", *Journal of*

the Royal Statistical Society. Series B (Statistical Methodology), Volume 60, No. 1, pp. 23-40.

Picquelle, S.J. and Mier, K.L (2011), "A practical guide to statistical methods for comparing means from two-stage sampling", *Fisheries Research*, Volume 107, No. 1-3.

Pillai, R. K., Williams, S. V. , Glick, H. A., Polsky, D., Berlin, J. A. and Lowe, R. A (2003), "Factors affecting decisions to seek treatment for sick children in Kerala, India", *Social Science and Medicine*, Volume 57, No. 5, pp. 783-790.

Pitt, M.M (1997), **Specification and Estimation of the Demand for Goods and Services within the household**, in Haddad, L., Hoddinott, J. and Alderman, H. eds. *Intrahousehold Resource Allocation in Developing Countries. Models, Methods, and Policy*. Baltimore: The John Hopkins University Press.

Platt, R.W. and Harper, S.B (2013), "Survey data with sampling weights: Is there a "best" approach?", *Environ. Res.*, Volume 120, pp. 143-144.

Pokhrel, S. and Sauerborn, R (2004), "Household decision-making on child health care in developing countries: the case of Nepal", *Health Policy and Planning*, Volume 19, No. 4, pp. 218–233.

Pokhrel, S., Snow, R., Dong, H., Hidayat, B., Flessa, S. and Sauerborn, R (2005), "Gender role and child health care utilization in Nepal", *Health Policy*, Volume 74, No. 1, pp. 100-109.

Power, C., Manor, O., Fox, A.J. and Fogelman, K (1990), "Health in Childhood and Social Inequalities in Health in Young Adults", *Journal of Royal Statistical Society*, Volume 153, No. 1, pp. 17-28.

Qu, Y., Piedmonte, M.R. and Medendorp, S.V (1995), "Latent Variable Models for Clustered Ordinal Data", *Biometrics*, Volume 51, No. 1, pp. 268-275.

Renard, D (2002), Topics in Modeling Multilevel and Longitudinal Data. Ph.D Thesis. Limburgs Universitair Centrum, Belgium. http://ibiostat.be/publications/phd/didierrenard.pdf retrieved on Monday, 9th February, 2009.

Research and Analysis Working Group (2005). Tanzania Poverty and Human Development Report 2005. United Republic of Tanzania

Reyburn, H., Mbatia, R., Drakeley, C., Carneiro, I., Mwakasungula, E., Mwerinde, O., Saganda, K., Shao, J., Kitua, A., Olomi, R., Greenwood, B.M. and Whitty, C.J.M (2004), "Overdiagnosis of malaria in patients with severe febrile illness in Tanzania: a prospective study", *BMJ*, Volume 329, No. 7476:1212.

Rhee, M., Sissoko, M., Perry, S., McFarland, W., Parsonnet, J. and Doumbo, O (2005), "Use of insecticide-treated nets (ITNs) following a malaria education intervention in Piron, Mali: a control trial with systematic allocation of households", *Malaria Journal*, Volume 4, No. 35.

Rodríguez, G. and Goldman, N (2001), "Improved estimation procedures for multilevel models with binary response: a case-study", *Journal of the Royal Statistical Society*: series *A*, Volume 164, No. 2, pp. 339-355.

Rosenblueth, A., Wiener, N. and Bigelow, J (1943), "Behavior, Purpose and Teleology", *Philosophy of Science*, Volume 10, No. 1, pp. 18-24.

Rosenzweig, M.R. and Schultz, T.P (1982), "*Market Opportunity, Genetic Endowments and Intrafamily Resource Allocation: Child Survival in Rural India*", *American Economic Review*, Volume 72, No. 4, pp.

Ross, C.E. and Wu, C (1995), "The Links Between Education and Health", *American Sociological Review*, Volume 60, No. 5, pp. 719-745.

Ross, L. F (1998), **Children, families, and health care decision-making**, Oxford University Press Inc., NewYork.

Rubenstein, A., Boyle, J., Odoroff, C.L. and Kunitz, S.J (1969), "Effect of Improved Sanitary Facilities on Infant Diarrhea in a Hopi Village", *Public Health Reports (1896-1970)*, Volume 84, No. 12, pp. 1093-1097.

Rutebemberwa, E., Kallander, K., Tomson, G., Peterson, S. and Pariyo, G (2009), "Determinants of delay in care-seeking for febrile children in eastern Uganda" *Tropical Medicine and International Health*, Volume 14, No. 4, pp. 472-479.

Safer, M.A., Tharps, Q.J., Jackson, T.C. and Leventhal, H (1979), "Determinants of Three Stages of Delay in Seeking Care at a Medical Clinic", *Medical Care*, Volume 17, No. 1, pp. 11-29.

Sahn, D.E., Younger, S.D. and Genicot, G (2003), "The Demand for Health Care Services in Rural Tanzania", *Oxford Bulletin of Economics and Statistics*, Volume 65, No. 2, pp. 241–260.

Salah, M.T., Adam, I. and Malik, E.M (2007), "Care-seeking behaviour for fever in children under five years in an urban area in Eastern Sudan", *Journal of Family and Community Medicine*, Volume 14, No. 1, pp. 25-28.

SAS Institute Inc. (2008), *SAS/STAT® 9.2 User's Guide*, Cary, NC: SAS Institute Inc.

Sauerborn, R., Berman, P. and Nougtara, A (1996), "Age bias, but no gender bias, in the intrahousehold resource allocation for health care in rural Burkina Faso", *Health Transition Review*, Volume 6, No. 2, pp. 131-145.

Savigny, D. de, Mayombana, C., Mwageni, E., Masanja, H., Minhaj, A., Mkilindi, Y., Mbuya, C., Kasale, H. and Reid, G (2004), "Care-seeking patterns for fatal malaria in Tanzania", *Malaria Journal*, Volume 3, No. 27.

Schellenberg, J.A., Victoria, C.G. and Mushi, A (2003), "Inequities among the very poor: health care for children in rural southern Tanzania", *Lancet*, Volume 15, No. 9357, pp. 561-566.

Schultz, T.P (1984), "Studing the Impact of Household Economic and Community Variables on Child Mortality", *Population and Development Review*, Volume 10, pp. 215-235.

Seale, C (2004), **Social Research Methods: a Reader**, Routledge

Semba, R. D., de Pee, S. Sun, K., Sari, M., Akhter, M., Bloem, M.W (2008), "Effect of parental formal education on risk of child stunting in Indonesia and Bangladesh: a cross-sectional study", *Lancet*, Volume 371, No. 9609, pp. 322-328.

Sepehri, A., Moshiri, S., Simpson, W. and Sarma, S (2008), "Taking account of context: how important are household characteristics in explaining adult health-seeking behaviour? The case of Vietnam", *Health Policy and Planning*, Volume 23, No. No. 6, pp. 397–407.

Shapiro, S.S. and Wilk, M.B (1965), "An Analysis of Variance Test for Normality (Complete Samples)", *Biometrika*, Volume 52, No. 3/4, pp. 591-611.

Sharma, V.R (2008), "When to seek health care: A duration analysis for malaria patients in Nepal", *Social Science and Medicine*, Volume 66, No. 12, pp. 2486-94.

Shaw, C., Brittain, K., Tansey, R. and Williams, K (2008), "How people decide to seek health care: A qualitative study", *International Journal of Nursing Studies*, Volume 45, No. 10, pp. 1516-1524.

Shehzad, S (2006), "The Determinants of Child Health in Pakistan: An Economic Analysis", *Social Indicators Research*, Volume 78, No. 3, pp. 531-556.

Sherrill-Mittleman, D.A., Klesges, L.M., Lanctot, J.Q., Stockton, M.B. and Klesges, R.C (2009), "Measurement characteristics of dietary psychosocial scales in a Weight Gain Prevention Study with 8- to 10-year-old African-American girls", *Health Education Research*, Volume 24, No.4, pp. 586–595.

Short, S.E. and Zhang, F (2004), "Use of Maternal Health Services in Rural China", *Population Studies*, Volume 58, No. 1, pp. 3-19.

Singhi, S., Padmini, P. and Sood, V (1991), "Urban parents' understanding of fever in

Snedecor, G.W. and Cochran, W.G (1980), **Statistical Methods. Seventh Edition,** Iowa State University Press.

Srholecy, M (2011), "A multilevel analysis of innovation in developing countries", *Industrial and Corporate Change*, Volume 20, No. 6, pp. 1539-1569.

Ssewanyana, S., Nabyonga, J.O., Kasirye, I. and Lawson, D (2004), "Demand for Health Care Services in Uganda: Implication for Poverty Reduction", *Research Series No. 40. Economic Policy Center, Makerere University.*

Steele, J.L. and McBroom, W.H (1972), "Conceptual and Empirical Dimensions of Health Behavior", *Journal of Health and Social Behavior*, Volume 13, No. 4, pp. 382-92.

Steketee, R.W. and Campbell, C.C (2010), "Impact of national malaria control scale-up programmes in Africa: magnitude and attribution of effects", *Malaria Journal*, Volume, 9, No. 299.

Stephenson, R. and Tsui, A.O (2002), "Contextual Influences on Reproductive Health Service Use in Uttar Pradesh, India", *Studies in Family Planning*, Volume 33, No. 4, pp. 309-320.

Stevens, J (1996), **Applied Multivariate Statistics for the Social Sciences**, Lawrence Erlbaum Associates, NJ.

Stresman, G.H (2010), "Beyond temperature and precipitation: Ecological risk factors that modify malaria transmission", *Acta Tropica*, Volume 116, No. 3, pp. 167-172.

Stukel, D.M. and Rao, J. N.K (1997), "Estimation of regression models with nested error structure and unequal error variances under two and three stage cluster sampling", *Statistics & Probability Letters*, Volume 35, No. 4, pp. 401–407.

Su, T.T., Pokhrel, S., Gbangou, A., Flessa, S (2006), "Determinants of household Health Expenditure on Western Institutional Health Care", *The European Journal of Health Economics*, Volume 7, No. 3, pp.:199-207.

Subedi, J (1989), "Modern Health Services and Health Care Behavior: A Survey in Kathmandu, Nepal", *Journal of Health and Social Behavior*, Volume 30, No. 4, pp. 412-20.

Subramanian, S.V., Nandy, S., Kelly, M., Gordon, D. and Smith, G.D (2004), "Health Behaviour in Context: Exploratory Multi-Level Analysis of Smoking, Drinking and Tobacco Chewing in Four States", *Economic and Political Weekly*, Volume 39, No. 7, pp. 684-693.

Suchman, E.A (1965), "Stage of illness and medical care", *Journal of Health and Human Behaviour*, Volume 6, No. 3, pp. 114-28.

Sujatha, D.S. and Reddy, G.B (2009), "Women's Education, Autonomy, and Fertility Behaviour", *Asia-Pacific Journal of Social Sciences*, Volume I, No. 1, pp. 35-50.

Sweetland, S.R (1996), "Human Capital Theory: Foundations of a Field of Inquiry", *Review of Educational Research*, Volume 66, No. 3, pp. 341-359.

Taffa, N. and Chepngeno, G (2005), "The determinants of health care seeking for childhood illnesses in Nairobi slums", *Tropical Medicine and International Health*, Volume 10, No. 3, pp. 240-245.

Tavakol, M. and Dennick, R (2011), "Making sense of Cronbach's alpha", *International Journal of Medical* Education, Volume 2. pp. 53-55.

TDHS (2005), **Tanzania Demographic and Health Survey 2004-05**, National Bureau of Statistics (NBS) [Tanzania] and ORC Macro 2005, Dar es Salaam, Tanzania: National Bureau of Statistics and ORC Macro.

TDHS (2011), **Tanzania Demographic and Health Survey 2010**. National Bureau of Statistics, Dar es Salaam, Tanzania and ICF Macro.

Teerawichitchainan, B. and Phillips, J.F (2008), "Ethnic differentials in parental health seeking for childhood illness in Vietnam", *Social Science and Medicine*. Volume 66, No. 5, 1118-1130.

Thaddeus, S. and Maine, D (1994), "Too far to walk: maternal mortality in context", *Social Science and Medicine*, Volume 38, No. 8, pp. 1091-1110.

THDR (2014), **Tanzania Human Development Report 2014: Economic Transformation for Human Development**. Economic and Social Research Foundation, Dar es Salaam, Tanzania; United Nations Development Programme. Tanzania Office; and Ministry of Finance, United Republic of Tanzania.

THMIS (2008), *Tanzania HIV/AIDS and Malaria Indicator Survey 2007-08*, Tanzania Commission for AIDS, Zanzibar AIDS Commission, National Bureau of Statistics, Office of the Chief Government Statistician, and Macro International Inc. Dar es Salaam, Tanzania.

Thongsuksai, P., Chongsuvivatwong, V. and Sriplung, H (2000), "Delay in Breast Cancer Care: A Study in Thai Women", *Medical Care*, Volume 38, No. 1, pp. 108-114.

Tolhurst, R., Amekudzi, Y.P., Nyonator, F.K., Squire, S.B. and Theobald, S (2008), "He will ask why the child gets sick so often": The gendered dynamics of intra-household bargaining over healthcare for children with fever in the Volta Region of Ghana", *Social Science and Medicine*, Volume 66, No. 5, pp. 1106-1117.

Trigg, P.I. and Wernsdorfer, W.H. (1999), "Malaria control priorities and constraints", *Parassitologia*, Volume 41, No. 1-3, pp. 329-332.

TSAM (2006), **Tanzania Service Availability Mapping 2005-2006**. Ministry of Health and Social Welfare Tanzania Mainland and Ministry of Health and Social Welfare, Zanzibar in collaboration with the World Health Organization.

TSPA (2007), **Tanzania Service Provision Assessment Survey 2006**, National Bureau of Statistics, Dar es Salaam, Tanzania and Macro International Inc.

Turuse, E.A., Gelaye, K.A. and Beyen, T.K (2014), "Determinants of delay in malaria prompt diagnosis and timely treatment among under-five children in Shashogo Woreda, Hadiya Zone, Southern Ethiopia: a case control study", *Health*, Volume 6, pp. 950-959.

Ukwaja, K.N., Talabi, A.A. and Aina, O.B (2012), "Pre-hospital care seeking behaviour for childhood acute respiratory infections in south-western Nigeria", *International Health*, Volume 4, No. 4, pp. 289-294.

Uzochukwu, B.S.C., Onwujekwe, E. O., Onoka, C. A. and Ughasoro, M. D (2008), "Rural-Urban Differences in Maternal Responses to Childhood Fever in South East Nigeria", *PLoS ONE,* Volume 3, No. 3.

Vardoulakis, S. and Heaviside, C (2012), *Health Effects of Climate Change in the UK 2012: Current evidence, recommendations and research gaps*, http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1317135969235 retrieved on Thursday, 28th March, 2014

Vella, C. and Ndiku, J (1993), "Construction of Socioeconomic index to facilitate analysis of health data in developing countries", *Social Science and Medicine*, Volume 36, No. 8, pp. 1087-1097.

Venables, W.N. and Ripley, B.D (1999), **Modern Applied Statistics with S-Plus**. Springer-Verlag New York, Inc.

Verbeke, G. and Molenberghs, G (2000), **Linear Mixed Models for Longitudinal Data**. Springer-Verlag New York, Inc.

Victora, C. G (2007), "Socio-Economic Differences in Health, Nutrition, and Population Within Developing Countries: An Overview", *JAMA*, Volume 298, No. 16, pp. 1943-1949.

Vosti, S. A (1990), "Malaria among gold miners in southern Para, Brazil: estimates of determinants and individual costs", *Social Science and Medicine*, Volume 30, No. 10, pp. 1097-1105.

Vuorisalmi, M (2007), *Examining Self-Rated Health in Old Age: A Methodological Study of Survey Questions*. PhD Dissertation, University of Tampere, School of Public Health. Doctoral Programs in Public Health (DPPH), Finland.

Wagstaff, A (1986), "The Damand for Health: Some New Empirical Evidence", *Journal of Health* Economics, Volume 94, No. 3, pp. 195-233.

Wagstaff, A., Bustreo, F., Bryce, J. and Claeson, M (2004), "Chile Health: Reaching the Poor", *American Journal of Public Health*, Volume 94, No. 5, pp. 726-736.

Walsh, A.M., Edwards, H.E (2006), "Management of childhood fever by parents: literature review", *Journal of Advanced Nursing*, Volume 54, No. 2, pp. 217-227

Wang, J., Xie, H., and Fisher, J. H (2012), **Multilevel Models: Applications using SAS®**. Higher Education Press and Walter de Gruyter GmbH & Co. KG. Berlin/Boston.

Warne, R.T., Li, Y., McKyer, E.L.J, Condie, R., Diep, C.S. and Murano, P.S (2012), "Managing Clustered Data Using Hierarchical Linear Modeling" *Journal of Nutrition Education and Behavior*, Volume 44, No. 3, pp. 271–277.

Whittemore, A.S (1997), "Multistage Sampling Designs and Estimating Equations", *Journal of the Royal Statistical Society. Series B (Methodological)*, Volume 59, No. 3, pp. 589-602.

WHO (2000), **The African summit on Roll Back Malaria, Abuja**. Nigeria. *Geneva* (WHO/CDS/RBM/2000.17).

WHO (2006), *Guidelines for the treatment of malaria*, Geveva: World Health Organisation; 2006, http://www.scribd.com/doc/218995684/WHO-Guidelines-for-the-Treatment-of-Malaria-2006 retrieved on Monday, 6th August, 2012.

WHO (2008), *World Malaria Repor*t. World Health Organisation, http://whqlibdoc.who.int/publications/2008/9789241563697_eng.pdf retrieved on Monday, 6th August, 2012.

WHO (2010), *World malaria report 2010*, http://www.who.int/malaria/world_malaria_report_2010/worldmalariareport2010.pdf?ua=1 retrieved on Monday, 6th August, 2012.

WHO (2011), *WHO Global Malaria Programme, World Malaria Report 2011*, http://www.who.int/malaria/publications/atoz/9789241564403/en/ retrieved on Monday, 6th August, 2012.

WHO (2014), *World malaria report 2014*, file:///C:/Users/user/Downloads/9789241564830_eng.pdf retrieved on Thursday, 1st October, 2015.

Widaman, K. F (1993), "Common factor analysis versus principal component analysis: Differential bias in representing model parameters?", *Multivariate Behavioural Research*, Volume 28, No. 3, pp. 263-311.

Williams, H.A. and Jones, C.O.H (2004), "A critical review of behavioral issues related to malaria control in sub-Saharan Africa: what contributions have social scientists made?" *Social Science and Medicine*, Volume 59, No. 3, pp. 501-523.

Wiseman, V., Scott, A., Conteh, L., McElroy, B. and Stevens, W (2008), "Determinants of provider choice for malaria treatment: Experiences from The Gambia", *Social Science and Medicine*, Volume 67, No. 4, pp. 487-496.

Xu, J.W., Xu, Q.Z., Liu, H. and Zeng, Y.R (2012), "Malaria treatment-seeking behaviour and related factors of Wa ethnic minority in Myanmar: a cross-sectional study", *Malaria Journal*, Volume 11, No. 417.

Yakob, L., Dunning, R. and Yan, G (2010), "Indoor residual spray and insecticidetreated bednets for malaria control: theoretical synergisms and antagonisms", *Journal of The Royal Society Interface*, Volume 8, No. 59, pp. 799-806.

Yu, X., Xiao, D., Li, B., Liu, Y., Wang, G., Chen, J., Bai, C., Pan, J., Wan, H., Li, Q., Zhou, X., Liao, R., Li, Q., Wang, C., Chen, R., Tang, Y., Mo, H., Zhao, M., Du, J., Li, J., Kang, L., and Wang, C (2010), "Evaluation of the Chinese versions of the Minnesota Nicotine Withdrawal Scale and the Questionnaire on Smoking Urges-Brief", *Nicotine & Tobacco Research*, Volume 12, No. 6, pp. 630-634.

Yueh, L.Y (2001), "A Model of Parental Investment in Children's Human Capital". *SKOPE Research Paper No 15 Spring 2001.*

Zar, J. H (1984), **Biostatistical Analysis**. 2nd Edn.. Prentice-Hall

Zottarelli, L.K., Sunil, T.S. and Rajaram, S (2007), "Influence of parental and socioeconomic factors on stunting in children under 5 years in Egypt", *Eastern Mediterranean Health Journal*, Volume 13, No. 6, pp. 1330-1342.

Zyoud, S.H., Al-Jabi, S.W., Sweileh, W.M., Nabulsi, M.M., Tubaila, M.F., Awang, R. and Sawalha, A.F (2013), "Beliefs and practices regarding childhood fever among parents: a cross-sectional study from Palestine", *BMC Pediatrics*, Volume 13, No. 66.

APPENDICES

Appendix A: Descriptive Statistics of Variables used in Multilevel Models

Table A1: Children whose caretakers believed that the harmful effects of fever could occur and those whose caretakers did not believe when fever appeared (*n*=329). Data are frequency (percentage) or mean (SE) for categorical and continuous variables, respectively.

	Harmful effects of fever could occur		
Characteristic	**Some chances *n*=246 (74.8 percent)**	**No chance *n*=83 (25.2 percent)**	**All children, *n*=329**
Characteristics of child			
Age (in months):			
0-11	46 (18.7)	14 (16..9)	60 (18.2)
12-23	73 (29.7)	17 (20.5)	90 (27.4)
24-35	46 (18.7)	20 24.1)	66 (20.1)
36-47	48 (19.5)	16 (19.3)	64 (19.5)
48-59	33 (13.4)	16 (19.3)	49 (14.9)
Sex (male)	130 (52.8)	44 (53.0)	174 (52.9)
Relationship to head of household (non-biol. son/daughter)	18 (7.3)	8 (9.6)	26 (7.9)
Child had convulsion (yes)	9 (3.7)	3 (3.6)	12 (3.6)
Child had diarrhoea (yes)	112 (45.5)	30 (36.1)	142 (43.2)
Child had cough/flu (yes)	169 (68.7)	61 (73.5)	230 (69.9)
Child had vomiting (yes)	80 (32.5)	20 (24.1)	100 (30.4)
Fever perceived as a sign of a disease (yes)	183 (74.4)	44 (53.0)	227 (69.0)
Perceived severity of fever for child:			
Mild	111 (45.1)	31 (37.3)	142 (43.2)
Moderate	93 (37.8)	26 (31.3)	119 (36.2)
Severe	42 (17.1)	26 (31.3)	68 (20.7)
Both biological parents stay at home (yes)	180 (73.2)	56 (67.5)	236 (71.7)
Biological mother stays at home (yes)	240 (97.6)	79 (95.2)	319 (97.0)
Number of under-five children in the household (2-3)	51 (20.7)	21 (25.3)	72 (21.9)
Characteristics of caretaker			
Age (years), mean (SE)	30.3 (0.2)	30.3 (0.2)	30.3 (0.2)
Education:			
No education	53 (21.5)	23 (27.7)	76 (23.1)
Primary	182 (74.0)	56 (67.5)	236 (71.7)
Secondary and above	11 (4.5)	6 (7.2)	17 (5.2)
Occupation:			

Characteristic	Harmful effects of fever could occur		
	Some chances *n*=246 (74.8 percent)	No chance *n*=83 (25.2 percent)	All children, *n*=329
Unemployed	23 (9.3)	2 (2.4)	25 (7.6)
Agricultural activities	174 (70.7)	66 (79.5)	240 (72.9)
Non-agricultural activities	49 (19.9)	15 (18.1)	64 (19.5)
Years in current place of residence (always)	135 (54.9)	39 (47.0)	174 (52.9)
Marital status (married)	187 (76.0)	60 (72.3)	247 (75.1)
Main source of information (HW)	190 (77.2)	67 (80.7)	257 (78.1)
Characteristics of head of household			
Sex (1=male)	192 (78.0)	63 (76.0)	255 (77.5)
Age (years), mean (SE)	37.1 (1.6)	37.6 (1.6)	37.2 (1.6)
Education:			
No education	44 (17.9)	24 (28.9)	68 (20.7)
Primary	184 (74.8)	57 (68.7)	241 (73.3)
Secondary and above	18 (7.3)	2 (2.4)	20 (6.1)
Occupation:			
Unemployed	7 (2.8)	1 (1.2)	8 (2.4)
Agricultural activities	196 (79.7)	71 (85.5)	267 (81.2)
Non-agricultural activities	43 (17.5)	11 (13.3)	54 (16.4)
Characteristics of household			
Household size, mean (SE)	5.1 (0.3)	5.4 (0.7)	5.2 (0.3)
Economic status:			
Poorest	59 (24.0)	22 (26.5)	81 (24.6)
Second	65 (26.4)	27 (32.5)	92 (28.0)
Middle	48 (19.5)	15 (18.1)	63 (19.1)
Fourth	44 (17.9)	17 (20.4)	61 (18.5)
Highest	30 (12.2)	2 (2.4)	32 (9.7)
Community characteristics			
Place of residence (rural)	200 (81.3)	75 (90.4)	275 (83.6)
Populv, mean (SE)	907.2 (67.8)	948.9 (55.0)	917.7 (51.6)
EligHH, mean (SE)	341.7 (19.8)	385.5 (23.9)	352.5 (21.5)
District of residence:			
Dodoma Urban	43 (17.5)	6 (7..2)	49 (14.9)
Bahi	77 (31.3)	27 (32.5)	104 (31.6)
Kondoa	57 (23.2)	31 (37.3)	88 (26.7)
Mpwapwa	69 (28.0)	19 (22.9)	88 (26.7)
Distance to nearest health facility (≥5 km)	174 (70.7)	65 (78.3)	239 (72.6)
Distance to nearest market (1=≥5 km)	151 (61.4)	58 (69.9)	209 (63.5)
Main road passable throughout the year (yes)	179 (72.8)	54 (65.1)	233 (70.8)
Perceived quality of main road (fair or good)	150 (61.0	42 (50.6)	192 (58.4)

Note: *HW=Health worker; HH=household; HF=health facility*

Table A2: Children whose caretakers sought timely (same or latest one day after onset of fever) treatment or advice and those whose caretakers sought late (after two or more days) treatment or advice (*n*=287). Data are frequency (percentage) or mean (SE) for categorical and continuous variables respectively. Probability modelled is delay=1.

	Sought early or delayed treatment		
Characteristic	**Early treatment, *n*=132 (46 percent)**	**Delayed treatment, *n*=155 (54 percent)**	**All children, *n*=287**
Characteristics of child			
Age (in months):			
0-11	30 (22.7)	23 (14.8)	53 (18.5)
12-23	36 (27.3)	50 (32.3)	86 (30.0)
24-35	22 (16.7)	32 (20.6)	54 (18.8)
36-47	26 (19.7)	29 (18.7)	55 (19.2)
48-59	18 (13.6)	21 (13.5)	39 (13.6)
Sex (1=male)	68 (51.5)	81 (52.3)	149 (51.9)
Relationship to head of HH (non-biol. son/daughter)	7 (5.3)	17 (11.3)	24 (8.4)
Child had convulsion (yes)	6 (4.5)	6 (3.9)	12 (4.2)
Child had diarrhoea (yes)	65 (49.2)	67 (43.2)	132 (46.0)
Child had cough/flu (yes)	96 (72.7)	109 (70.3)	205 (71.4)
Child had vomiting (yes)	47 (35.6)	45 (29.0)	92 (32.1)
Fever perceived as a sign of a disease (yes)	103 (78.0)	111 (71.6)	214 (74.6)
Perceived severity of fever for child:			
Mild	57 (43.2)	81 (52.3)	138 (48.1)
Moderate	58 (43.9)	50 (32.3)	108 (37.6)
Severe	17 (12.9)	24 (15.5)	41 (14.3)
Both biological parents stay at home (yes)	102 (77.3)	104 (67.1)	206 (71.8)
Biological mother stays at home (yes)	129 (97.7)	151 (97.4)	280 (97.6)
Number of under-five children in household (2-3)	24 (18.2)	37 (23.9)	61 (21.3)
Characteristics of caretaker			
Age (years), mean (SE)	30.2 (0.6)	29.8 (0.5)	30.0 (0.2)
Education:			
No education	27 (20.5)	36 (23.2)	63 (22.0)
Primary	98 (74.2)	110 (71.0)	208 (72.5)
Secondary and above	7 (5.3)	9 (5.8)	16 (5.6)
Occupation:			
Unemployed	16 (12.1)	6 (3.9)	22 (7.7)
Agricultural activities	90 (68.2)	117 (75.5)	207 (72.1)
Non-agricultural activities	26 (19.7)	32 (20.6)	58 (20.2)
Years in current place of residence (always)	67 (50.8)	80 (51.6)	147 (51.2)
Marital status (1=married)	106 (80.3)	109 (70.3)	215 (74.9)
Main source of information (HW)	104 (78.8)	121 (78.1)	225 (78.4)

Characteristic	Sought early or delayed treatment		
	Early treatment, *n*=132 (46 percent)	Delayed treatment, *n*=155 (54 percent)	All children, *n*=287
Characteristics of head of household			
Sex (1=male)	108 (81.8)	116 (74.8)	63 (22.0)
Age (years), mean (SE)	36.6 (2.1)	37.5 (1.6)	37.1 (1.7)
Education:			
No education	23 (17.4)	33 (21.3)	56 (19.5)
Primary	98 (74.2)	114 (73.5)	212 (73.9)
Secondary and above	11 (8.3)	8 (5.2)	19 (6.6)
Occupation:			
Unemployed	4 (3.0)	4 (2.6)	8 (2.8)
Agricultural activities	98 (74.2)	133 (85.8)	231 (80.5)
Non-agricultural activities	30 (22.7)	18 (11.6)	48 (16.7)
Characteristics of household			
Household size, mean (SE)	5.1 (0.4)	5.3 (0.2)	5.2 (0.3)
Economic status:			
Poorest	28 (21.2)	40 (25.8)	68 (23.7)
Second	31 (23.5)	49 (31.6)	80 (27.9)
Middle	25 (18.9)	32 (20.6)	57 (19.9)
Fourth	30 (22.7)	24 (15.5)	54 (18.8)
Highest	18 (13.6)	10 (6.5)	28 (9.8)
Community characteristics			
Place of residence (rural)	98 (74.2)	139 (89.7)	237 (82.6)
Populv, mean (SE)	848.6 (34.8)	971.3 (77.6)	914.8 (48.6)
EligHH, mean (SE)	321.4 (33.2)	376.4 (7.8)	351.1 (20.8)
District of residence:			
Dodoma Urban	28 (21.2)	16 (10.3)	44 (15.3)
Bahi	35 (26.5)	50 (32.3)	85 (29.6)
Kondoa	32 (24.2)	48 (31.0)	80 (27.9)
Mpwapwa	37 (28.0)	41 (26.5)	78 (27.2)
Distance to nearest HF ($\geq$ 5 km)	71 (53.8)	107 (69.0)	178 (62.0)
Distance to nearest market ($\geq$ 5 km)	81 (61.4)	124 (80.0)	205 (71.4)
Main road passable throughout the year (yes)	95 (72.0)	115 (74.2)	210 (73.2)
Perceived quality of main road (fair or good)	78 (59.1)	94 (60.6)	172 (59.9)

Note: *HW=Health worker; HH=household; HF=health facility*

Appendix B: Descriptions of Key Concepts of the Study

Perceptions of health

The term "health" has been described differently in many disciplines. However, many descriptions share common phrases, which typically differentiate the term health from terms such as disease, illness, or sickness. Vuorisalmi (2007) and the references therein, provide a discussion of four distinct models for which the term health is defined in the contexts of medical, sociology and psychology. These are: (i) the medical model; (ii) the functional model; (iii) the well-being model; and (iv) the adaptive model. According to Vuorisalmi (2007), in the medical model, health is defined as the absence of an illness. In contrast, social scientists argue that the medical model does not encompass all aspects of health to permit a complete understanding of all factors relatable to health status in general and on the decisions that people make about health and illness in particular.

Bowling (2009) notes that the traditional medical model described above focuses only on the body and on technology ignoring the personal context as well as the social context in which individuals live. Instead, the social model of health regards health as a fusion of the medical model, personal experiences and social factors due to illness. In this construction, the terms disease, illness, and sickness are distinctly defined as referring to: "the pathology of the body and to diagnoses and treatment by physicians; the individual experience of disease; and the social condition of people who are ill or diseased" respectively (Vuorisalmi, 2007: 14). Thus, unlike disease, biomedical indicators do not always detect illness and sickness. Some people can be diseased in the

biomedical context, but not really feeling sick or ill and others can feel ill without any biochemical evidence of being diseased (Bowling, 2009). On the other hand, the functional and the well-being models respectively, define health as the ability to execute one's usual activities and a state of being physically, mentally, and emotionally well. Conversely, as the word adaptive suggests, the adaptive model defines health as the ability or tendency to adapt to different health conditions (Vuorisalmi, 2007). In acknowledging the fact that both personal and social contexts have an influence on one's health status, the present study adopted the social scientists' construct of health as described above. This is the case here since the focus of the present study was to garner evidence that would improve our understanding of how best individual and contextual (household and community) factors can be modified to improve health care seeking decisions for under-five children.

The concept of behaviour

As is the case with the term health, the word behaviour has also been described in a number of articles and in different contexts. For example, Rosenblueth *et al.* (1943) define behaviour as any change of an entity in relation to its environment. Martin and Bateson (1993)[11] on the other hand, describe behaviour as the activities and responses made by all organisms. In the context of the present study, these descriptions and

[11] Cambridge University Press (1993), *Measuring Behaviour: An Introductory Guide. Second Edition.* http://books.google.co.tz/books?id=XFocGI3cgG4C&pg=PA1&lpg=PP1#v=onepage&q&f=false retrieved on Sunday, 8th April, 2012

perhaps other similar in the behaviour literature may be abridged to mean simply an action in response to a particular health condition or illness.

Individuals' actions in response to a situation are premised within the theory of planned behaviour (TPB). According to Meyer-Weitz *et al.* (2000), the TPB suggests that personal and normative as well as perceptions of control are the key determining factors of behaviour. Personal determinants of behaviour on the one hand include knowledge, beliefs, and attitude. The latter concepts (beliefs and attitude) are in turn determined by one's perceptions of risk and the perceived seriousness of a particular disease. In contrast, determinants of normative relate to the social influence and community behavioural customs whereas perceptions of control relate to people's perceptions vis-à-vis their ability to carry out the required behaviour and overcome barriers in performing the behaviour (Meyer-Weitz *et al.*, 2000).

As implicitly pointed out above, of significant importance with respect to behaviour is its measurement. Among the measures of behaviour as discussed by Martin and Bateson (1993: 62-63) include latency (seconds, minutes or hours), frequency (inverse of units of time) and duration (seconds, minutes or hours). The authors describe latency, frequency, and duration respectively as being the time from occurrence of particular events to the commencement of the first incidence of the behaviour; the frequency at which the behaviour pattern occurs per unit time; and the period of time from beginning to end of a single behaviour pattern.

Health and illness behaviours

For understanding utilization of health services, modern or professional services in particular, a distinction has been made in literature (for example, Steele and McBroom, 1972) between the concepts of health behaviour and illness behaviour. The latter authors note that illness behaviour is distinguished from health behaviour. The former refers to perceptions and actions consequent from one's recognition of the symptoms, rather than utilization of health services with a goal of improving one's health status in order to evade likely negative impacts of the illness. This contrast between illness behaviour and health behaviour has also been noted by Bowling (2009) who argues that illness behaviour is an action, which aims specifically at seeking treatment. More broadly as the behaviour, that is linked to perception and appraisal of symptoms and action taken in situations of ill health (ibid). On the contrary, health behaviour is defined as an action taken to sustain health and obviate ill health. The concept of health care seeking behaviour from which the present study was designed to assess, is described in the next section.

Health care seeking behaviour

From the above review, in the context of the demand for health care in an event of illness, the concept of health care seeking behaviour could be described as a sequence of actions that individuals or their caretakers take in order to solve their own health problems or the problems of their children. Moreover, as observed previously and supported by Salah *et al.* (2007), the sequence of action begins with recognition of

danger signs or symptoms followed by formulation of treatment strategy. A recent review by Anwar *et al.* (2012) revealed that the term health-seeking behaviour is used interchangeably with the term illness behaviour and is described as the way people interpret symptoms and the actions they take to respond to the symptoms from formal health care systems and other sources of help.

Appendix C: Questionnaire

SECTION 1: Household Questionnaire

PART A: Identification

To be filled in by **Interviewer**

Name of District: District ID No. |__|__|

Name of Ward: Ward ID No. |__|__|

Name of Cluster: Cluster ID No. |__|__|

This cluster Location: Urban....1 Rural....2

Household ID Number: HH ID NO. |__|__|

Name of Head of household: Line No. |__|__|

Sex of Head of household: Male....1 Female....2

INTERVIEWER VISITS

Visit		1	2	3	Final Visit
Date (dd/mm/yyyy)					
Interviewer's Name					ID NO.
Result*					Final Result*
Next Visit	Date				Total Number of Visits
	Time				

*Result Codes:
1=Completed
2=No household member at home or no competent respondent at home at time of visit
3=Entire household absent for extended period of time
4=Postponed
5=Refused
6=Dwelling vacant or address not a dwelling
7=Dwelling destroyed
8=Dwelling not found
9=Other_____
(Specify)

Total persons in household

Total number of children under-five years of age

Line NO. of respondent to household Questionnaire

To be filled in by **Supervisor**: ID NO. |__|__|

Date of acceptance: |__|__|/|__|__|/201|__|

Signature of acceptance:

To be filled in by **1st data entry clerk**: ID NO. |__|__|

Date of data entry (**1st entry**): |__|__|/|__|__|/201|__|

To be filled in by **2nd data entry clerk**: ID NO. |__|__|

Date of data entry (**2nd entry**): |__|__|/|__|__|/201|__|

PART B: Household Schedule

Introduction and Consent

Hello, my name is _____ and I am part of the research team in a survey about various health issues particularly of children under the age of five in Dodoma region. The survey is being conducted by researchers from SUA and trained research assistants from various institutions Your participation and cooperation is very important to the success of this survey. However, participation in this survey is absolutely voluntary-you may choose not to participate. If you agree to participate, we would first like to ask some questions about your household. All the answers you give will be kept strictly confidential. We would appreciate if you could answer the questions as openly and as truly as you can.
At this time, do you have any question that you would like to ask about the research? May I begin the interview now?

Signature of interviewer: Date:

Respondent agrees to be interviewed: 1 ↓ **Respondent does not agree to be interviewed : 2 →*END***

Line NO.	Usual Residents and Visitors	Relationship to Head of household	Sex	Residence		Age	Eligibility
	Pease give me the names of the persons who usually live in your household and guests of the household who stayed here last night, starting with the head of household, followed by his/her spouse and their children in order of age Are there any other persons not now present but who normally live and eat there meals here?	What is the relationship of (*name*) to the head of the household? *See codes below.*	Is (*name*) male of female? 1=Male (M) 2=Female (F)	Does (*name*) usually live here? 1=Yes (Y) 2=No (N)	Did (*name*) stay here last night? 1=Yes (Y) 2=No (N)	What is (*name*)'s date of birth/how old is (*name*) now? ***Write down date of birth or age. If the respondent has any difficult with his/her age, use the calendar of events to make an estimate.*** ***For children under-five years of age, ask for birth certificate or equivalent document to confirm date of birth.***	***Circle line NO. of all children age 0–4 who are members of household***
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
01		____	M F 1 2	Y N 1 2	Y N 1 2	Date____/____/____ Years old____	01
02		____	1 2	1 2	1 2	Date____/____/____ Years old____	02
03		____	1 2	1 2	1 2	Date____/____/____ Years old____	03
04		____	1 2	1 2	1 2	Date____/____/____ Years old____	04
05		____	1 2	1 2	1 2	Date____/____/____ Years old____	05
06		____	1 2	1 2	1 2	Date____/____/____ Years old____	06
07		____	1 2	1 2	1 2	Date____/____/____ Years old____	07
08		____	1 2	1 2	1 2	Date____/____/____ Years old____	08
09		____	1 2	1 2	1 2	Date____/____/____ Years old____	09
10		____	1 2	1 2	1 2	Date____/____/____ Years old____	10
11		____	1 2	1 2	1 2	Date____/____/____ Years old____	11
12		____	1 2	1 2	1 2	Date____/____/____ Years old____	12
13		____	1 2	1 2	1 2	Date____/____/____ Years old____	13
14		____	1 2	1 2	1 2	Date____/____/____ Years old____	14
15		____	1 2	1 2	1 2	Date____/____/____ Years old____	15

Codes for Q. 3: Relationship to Head of household

01=Head	04=Son or daughter-in-law	07=Parent-in- law	11=Adopted/foster/stepchild
02=Wife or husband	05=Grand child	08=Brother or sister	12=Not related
03=Son or daughter	06=Parent	09=Co-wife	98=Don't know
		10=Other relative	

	If age 0-17 years								
Line NO.	**Survivorship and Residence of Biological Parents**								
	Is (*name*)'s natural mother alive? D=Don't Know ***If "N" or "D" →12***	Does (*name*)'s natural mother usually live in this household or was she a guest last night? *If yes*, what is her name? ***Record mother's line NO.*** ***If no write "00"***	***If mother not listed in household*** Has (*name*)'s mother been sick for at least 3 months during the past 12 months, that is, she was too sick to work or do normal activities?	Is (*name*)'s natural father alive? D=Don't Know ***If "N" or "D" →15***	Does (*name*)'s natural father usually live in this household or was he a guest last night? *If yes*, what is his name? ***Record father's line NO.*** ***If no write "00"***	***If father not listed in household*** Has (*name*)'s father been sick for at least 3 months during the past 12 months, that is, she was too sick to work or do normal activities?	***Mother/father dead/sick*** ***Circle line NO. if child's mother and/or father has died (Q.9 or 12=N) or been sick (Q.11 or 14=Y)***	***Both parents alive*** ***If Y to Q.9 and Q. 12 (both alive) circle "1" for all other cases circle "2"*** ***If "1" →18***	***Care taker*** Who is (*name*)'s main caretaker? ***Write caretaker's line NO.***
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
	Y N D		Y N D	Y N D		Y N D			
01	1 2 8	___	1 2 8	1 2 8	___	1 2 8	01	1 2	___
02	1 2 8	___	1 2 8	1 2 8	___	1 2 8	12	1 2	___
03	1 2 8	___	1 2 8	1 2 8	___	1 2 8	13	1 2	___
04	1 2 8	___	1 2 8	1 2 8	___	1 2 8	12	1 2	___
05	1 2 8	___	1 2 8	1 2 8	___	1 2 8	13	1 2	___
06	1 2 8	___	1 2 8	1 2 8	___	1 2 8	12	1 2	___
07	1 2 8	___	1 2 8	1 2 8	___	1 2 8	13	1 2	___
08	1 2 8	___	1 2 8	1 2 8	___	1 2 8	12	1 2	___
09	1 2 8	___	1 2 8	1 2 8	___	1 2 8	13	1 2	___
10	1 2 8	___	1 2 8	1 2 8	___	1 2 8	12	1 2	___
11	1 2 8	___	1 2 8	1 2 8	___	1 2 8	13	1 2	___
12	1 2 8	___	1 2 8	1 2 8	___	1 2 8	12	1 2	___
13	1 2 8	___	1 2 8	1 2 8	___	1 2 8	13	1 2	___
14	1 2 8	___	1 2 8	1 2 8	___	1 2 8	14	1 2	___
15	1 2 8	___	1 2 8	1 2 8	___	1 2 8	15	1 2	___

Line NO.	*If age 0-17 years*			Education				Literacy			Employment
	Brothers and Sisters			*If age 5 years or older*		*If age 5-24 years*		*If standard 7 of less*			*If age 5 years or older*
	Does (*name*)'s have any brothers or sisters under age 18 who have the same mother and father? *If "N" or "D" →20*		Do any of these brothers and sisters under age 18 not live in this household?	Has (*name*) ever attended school? *If "N" →25*	What is the highest grade or form of school (*name*) completed? *See codes below.* *If primary of less→24*	Is (*name*) currently attending school?	Did (*name*) attend school at any time during the 2010 school year?	Can (*name*) read and understand a newspaper or a letter easily (E), with difficulty (D), not at all (N)?			During the last 12 months what was (*name*)'s main activity?
	(18)			(19)		(20)		(21)	(22)		(23)		(24)			(25)
01	Y 1	N 2	D 8	Y 1	N 2	Y 1	N 2	Grade ___	Y 1	N 2	Y 1	N 2	E 1	D 2	N 3	Activity ___
02	1	2	8	1	2	1	2	___	1	2	1	2	1	2	3	___
03	1	2	8	1	2	1	2	___	1	2	1	2	1	2	3	___
04	1	2	8	1	2	1	2	___	1	2	1	2	1	2	3	___
05	1	2	8	1	2	1	2	___	1	2	1	2	1	2	3	___
06	1	2	8	1	2	1	2	___	1	2	1	2	1	2	3	___
07	1	2	8	1	2	1	2	___	1	2	1	2	1	2	3	___
08	1	2	8	1	2	1	2	___	1	2	1	2	1	2	3	___
09	1	2	8	1	2	1	2	___	1	2	1	2	1	2	3	___
10	1	2	8	1	2	1	2	___	1	2	1	2	1	2	3	___
11	1	2	8	1	2	1	2	___	1	2	1	2	1	2	3	___
12	1	2	8	1	2	1	2	___	1	2	1	2	1	2	3	___
13	1	2	8	1	2	1	2	___	1	2	1	2	1	2	3	___
14	1	2	8	1	2	1	2	___	1	2	1	2	1	2	3	___
15	1	2	8	1	2	1	2	___	1	2	1	2	1	2	3	___

Codes for Q. 21: Education

00 = Less than 1 year
01 = Standard 1
02 = Standard 2
03 = Standard 3
04 = Standard 4
05 = Standard 5
06 = Standard 6
07 = Standard 7
08 = Standard 8
09 = Train. after primary
10 = Pre-secondary
11 = Form 1
12 = Form 2
13 = Form 3
14 = Form 4
15 = Form 5
16 = Form 6
17 = Training after secondary
18 = University
98 = Don't know

Codes for Q. 25: Main Activity

Agriculture
01=Farming/livestock keeping
02=Fishing
Paid employee
03=Government and parastatal
04=Private
Self-employed (not in agriculture/livestock)
05=with employees
06=without employees
07=unpaid family helper in a business (non-agric.)
Not working
08=And available for work
09=And not available for work
10=House maker/housewife/house chores
11=Student
12=Unable to work (old, retired, sick, disabled)
13=Other (Specify)

Part C: Household and Community Characteristics

NO.	Questions and filters	Response	Skip to
101	What is the main source of drinking water for members of your household? *If multiple sources, probe the one used MOST.*	**Piped water** Piped into dwelling ..... 11 Piped into yard/plot ..... 12 Public tap ..... 13 Neighbour's tap ..... 14 **Water from open well** Open well in dwelling ..... 21 Open well in yard/plot ..... 22 Open public well ..... 23 Neighbour's open well ..... 24 **Water from covered well or borehole protected well in dwelling** ..... 31 Protected well in yard/plot ..... 32 Protected public well ..... 33 Borehole ..... 34 **Surface water** Spring ..... 41 Rivers/stream ..... 42 Pond/lake ..... 43 Dam ..... 44 Rain water ..... 51 Tanker truck ..... 61 Water vendor ..... 62 Bottled water ..... 71 Other ..... 96 (Specify)_____	→101B →101B →101B →101B →101B →101B →101B →101B →101B →101B →101B →101B →101B →101B
101A	Who is providing water at your main source?	Authority ..... 1 CBO/NGO ..... 2 Private operator ..... 3 Don't know 8	
101B	How long does it take to go there, get water, and come back? ***Circle 996 if on premises.***	Time in minutes ..... _____ On premises 996	
102	What kind of toilet facility do members of your household usually use?	Flush or pour flush toilet ..... 11 Pit latrine Ventilated improved pit latrine (VIP) ..... 21 Traditional pit latrine ..... 22 No facility/latrine/bush/field ..... 31 Other ..... 96 (Specify)_____	→104
103	Do you share this toilet facility with other households?	Yes ..... 1 No 2	
104	Does your household have: Electricity? A lantern (e.g., paraffin lamp)? A radio? A television? A mobile telephone? A non-mobile telephone (landline) An iron (charcoal or electric)? A refrigerator/freezer?	Electricity ..... Y 1 N 2 Lantern (e.g., paraffin lamp) ..... Y 1 N 2 Radio ..... Y 1 N 2 Television ..... Y 1 N 2 Mobile telephone ..... Y 1 N 2 Non-mobile telephone ..... Y 1 N 2 Iron (charcoal or electric) ..... Y 1 N 2 Refrigerator/freezer ..... Y 1 N 2	
105	What type of fuel does your household mainly use for cooking?	Electricity ..... 01 Bottled Gas ..... 02 Paraffin/Kerosene ..... 03 Charcoal ..... 04 Firewood ..... 05 Crop residuals, straw, grass ..... 06 Animal dung ..... 07 No food cooked in household ..... 95 Other 96	

		(Specify)	
106	What is the main source of energy for lighting in the household?	Electricity 01 Solar 02 Gas 03 Paraffin-Hurricane lamp 04 Paraffin-Pressure lamp 05 Paraffin-wick lamp 06 Firewood 07 Candles 08 Other 96 (Specify)_____	
107	Main Material of the floor. ***Record observation. Mark only one***	Earth, sand, dung 11 Wood planks, bamboo, palm 21 Parquet or polished wood 31 Vinyl or asphalt strips 32 Ceramic tiles, terrazzo 33 Cement 34 Carpet 35 Other 96 (Specify)	
108	Wall material ***Record observation. Mark only one***	Grass 01 Poles and mud 02 Sun-dried Bricks 03 Baked bricks 04 Timber 05 Cement bricks 06 Stones 07 Other 96 (Specify)	
109	Roofing material. ***Record observation. Mark only one.***	Grass thatch mud 01 Iron sheets 02 Tiles 03 Concrete 04 Asbestos 05 Other 96 (Specify)	
110	How many rooms in your household are used for sleeping? (***including rooms outside the main dwelling***)	Rooms ___	
111	Does any member of your household own A watch? A bicycle? A motorcycle or motor scooter? A car or truck? A bank account?	Y N Watch 1 2 Bicycle 1 2 Motorcycle or motor scooter 1 2 Car or truck 1 2 Bank account 1 2	
112	How many acres of land for farming or grazing does this household own? ***Record '0000.0' If none and 9999.8 If doesn't know.***	Acres for farming ____._ Acres for grazing ____._	
113	Does the household use land for farming or grazing that it does not own? ***If yes,*** is it rented, sharecropped, private land provided free, or opens access/communal/other?	Yes, rented 1 Yes, sharecropped 2 Yes, private land provided free 3 Yes, open access/communal 4 No 5	→115
114	How many acres are used? ***Record '0000.0' If none and 9999.8 If doesn't know.***	Acres for farming ____._ Acres for grazing ____._	
115	What is the most important source of income for your household?	Sales of food crops 01 Sales of cash crops 02 Wages or salaries in cash 03 Employment paid in kind 04 Non-farm self-employment 05 Sales of livestock and product 06 Selling of local brew 07 Fishing 08	

		Sales of charcoal/timber/poles ... 09 Sales of other non-timber products ... 10 Other casual cash earning ... 11 Transfers and other receipts ... 12 Rent received ... 13 Other ... 96 (Specify)_____	
116	How far is it to the nearest market place/how long does it take to get there? ***Record "00" if less than one kilometre.***	Kilometres ... |___|___| Time (minutes) ... |___|___|___|	
117A	How far is it to the nearest health facility/how long does it take to get there? ***Record "00" if less than one kilometre and "99" if more than one hundred kilometre.***	Kilometres ... |___|___| Time (minutes) ... |___|___|___|___|	
117B	If you were to go to (***name of hospital, health centre, or health post***), how would you go there?	Car/motorcycle ... 1 Public transport (bus, taxi) ... 2 Animal/animal cart ... 3 Walking ... 4 Bicycle ... 5 Other ... 6 (Specify)_____	
118	How is the condition of public transport to (***name of hospital, health centre, or health post***)?	Easy ... 1 Fair ... 2 Difficult ... 3 Don't Know ... 8	
119	How long does it take you to go to the nearest public transport?	Time (minutes) ... |___|___|___|	
120	How long does it take you to go to the nearest motorable road?	Time (minutes) ... |___|___|___|	
121	Is the main road passable throughout the year?	Yes ... 1 No ... 2	
122	How is the quality of the road to important social, health, economic, etc services/facilities?	Fair or good ... 1 Poor ... 2 Don't know ... 8	
123	Now I would like to ask you about the food your household eats. How many meals does your household usually have per day?	Meals ... |___|___| Don't know ... 8	
124	In the past week, on how many days did the household eat meat? ***Record "00" if did not eat.***	Days ... |___|___|	
125	How often in the last year did you have problems in satisfying the food needs of the household?	Never ... 1 Seldom ... 2 Sometimes ... 3 Often ... 4 Always ... 5 Don't know ... 8	
126	At any time in the past 12 months, has anyone sprayed the interior walls of your dwelling against mosquitoes?	Yes ... 1 No ... 2 Don't know ... 8	→128 →128
127A	How many months ago was the house last sprayed? ***If less than one month, record "00" months ago.***	Months ago ... |___|___|	
127B	Who sprayed the house?	Government worker/programme ... 1 Private company ... 2 household member ... 3 Other ... 6 (Specify)_____ Don't know ... 8	
128	Does your household have any mosquito nets that can be used while sleeping?	Yes ... 1 No ... 2	→201
129	How many mosquito nets does your household have? ***If 3 of more nets, record "3"***	Number of nets ... |___|	

		Net # 1	Net # 2	Net # 3	
130	How many months ago did your household obtain the mosquito net? ***If less than one month record "00"***	Months ago |___|___| 37 or more months ... 95 Not sure ... 98	Months ago |___|___| 37 or more months ... 95 Not sure ... 98	Months ago |___|___| 37 or more months ... 95 Not sure ... 98	
131	When you got the net, was it already treated with an insecticide to kill or repel mosquitoes?	Yes ... 1 No ... 2 Not sure ... 8	Yes ... 1 No ... 2 Not sure ... 8	Yes ... 1 No ... 2 Not sure ... 8	
132	Did anyone sleep under this mosquito net last night?	Yes ... 1 No ... 2 Not sure ... 8	Yes ... 1 No ... 2 Not sure ... 8	Yes ... 1 No ... 2 Not sure ... 8	→201 →201

133	Who slept under this mosquito net last night? ***Record name and line NO. of persons from household SCHEDULE***	Name__________ Line NO. |__|__| Name__________ Line NO. |__|__| Name__________ Line NO. |__|__| Name__________ Line NO. |__|__| Name__________ Line NO. |__|__|	Name__________ Line NO. |__|__| Name__________ Line NO. |__|__| Name__________ Line NO. |__|__| Name__________ Line NO. |__|__| Name__________ Line NO. |__|__|	Name__________ Line NO. |__|__| Name__________ Line NO. |__|__| Name__________ Line NO. |__|__| Name__________ Line NO. |__|__| Name__________ Line NO. |__|__|	

Section 2: Individual Questionnaire (Caretakers)
Respondent's Background

201	Check name and line number of respondent from household questionnaire:			
	If mother or guardian is different from the one interviewed, seek consent ↓|__|	If same respondent and education is standard 7 or less go to |__|— 205	If same respondent and education is standard 8 or above go to |__|—	→206

Informed Consent

Hello, my name is and I am part of the research team in a survey about various health issues particularly of children under the age of five in Dodoma region. The survey is being conducted by researchers from SUA and trained research assistants from various institutions. Your participation and cooperation is very important to the success of this survey. However, participation in this survey is absolutely voluntary-you may choose not to participate. All the answers you give will be confidential. We would appreciate if you could answer the questions as openly and as truly as you can.
At this time, do you have any question that you would like to ask about the survey? May I begin the interview now?

Signature of interviewer: Date:

Respondent agrees to be interviewed: 1 ↓ 202 (*now start the interview*) Respondent does not agree to be interviewed:2 →*END*

	Record name and line number of respondent: Name:_____ Line NO. |__|__|		
NO.	**Questions and filters**	**Response**	**Skip to**
202	In what month and year were you born/how old are you now? ***Compare and correct Q.7 and/or Q. 202 if inconsistent.***	Date of birth |__|__|/|__|__|/|__|__|__|__| Years old |__|__|	
203	Have you ever attended school?	Yes.....1 No.....2	→205
204	What is the highest standard or form you completed?	Pre-primary.....00 Standard 1.....01 Standard 2.....02 Standard 3.....03 Standard 4.....04 Standard 5.....05 Standard 6.....06 Standard 7.....07 Standard 8.....08 Training after primary.....09 Pre-form 1.....10 Form 1.....11 Form 2.....12 Form 3.....13 Form 4.....14 Form 5.....15 Form 6.....16 Training after secondary.....17 University.....18 Other.....96 (Specify)_____	→206 →206 →206 →206 →206 →206 →206 →206 →206 →206 →206 →206 →206
205	Can you read and understand a newspaper or a letter easily, with difficulty, not at all?	Easily.....1 With difficulty.....2 Not at all.....3	→207
206	Do you read a newspaper or magazine almost every day, at least once a week, less than once a week or not at all?	Almost every day.....1 At least once a week.....2 Less than once a week.....3 Not at all.....4	
207	Do you listen to the radio almost every day, at least once a week, less than once a week or not at all?	Almost every day.....1 At least once a week.....2 Less than once a week.....3 Not al all.....4	
208	Do you watch television almost every day, at least once a week, less than once a week or not at all?	Almost every day.....1 At least once a week.....2 Less than once a week.....3 Not al all.....4	
209	How long have you been living continuously in (***name of current place of residence***)? ***If less than one year, record "00"years***	Years.....|__|__| Always.....95	→211
210	Just before you moved here, did you live in Arusha/D'Salaam/Mbeya/Mwanza//Tanga/, other urban area or rural area?	Arusha/D'Salaam/Mbeya/Mwanza/Tanga.....1 Other urban area.....2 Rural area/village.....3	

211	In the last 12 months, on how many separate occasions have you travelled away from your home community and slept away?	Number of trips ..__|__| None ..00	→213
212	In the last 12 months, have you been away from your home community for more than one month at a time?	Yes ..1 No ..2	
213	What is your religion/religious affiliation? *If answer is "Christian" ask for detail.* *If answer is "Anglican, Adventist, AIC", etc., circle code 2.*	Catholic ..1 Protestant ..2 Muslim ..3 Traditional ..4 No religion ..5 Other ..7 (Specify)_____	
214	Are you currently married or living together with a man as if married?	Yes, currently married ..1 Yes, living with a man ..2 No, not in union ..3	→217 →217
215	Have you ever been married or lived together with a man as if married?	Yes, formerly married ..1 Yes, lived with a man ..2 No ..3	→228
216	What is your marital status now: are you widowed, divorced or separated?	Widowed ..1 Divorced ..2 Separated ..3	→221 →221 →221
217	Is your husband/partner living with you now or is he staying elsewhere?	Living together ..1 Staying elsewhere ..2	
218	Does your husband/partner have other wives or does he live with other women as if married?	Yes ..1 No ..2 Don't know ..3	→221 →221
219	Including yourself, in total, how many wives or other partners does your husband live with now as if married?	Number of wives and live-in partners __|__| Don't know ..8	
220	*Write line number of husband/partner from household questionnaire. If not listed record "00"*	Line NO. ..__|__|	
221	How old were you when you married for the first time? *If respondent does not remember, PROBE month and year of marriage and calculate years at married from date of birth*	Years at marriage ..__|__|	
222	Check 214 and 215: If currently married/living with a man, go on with 223|__| / If formerly married/lived with a man, go to→ 224|__|	If never married and never lived with a man, go to → 228|__|	
223	*If respondent is different ask:* How old was your husband/ partner on his last birthday?	Age in complete years ..__|__| Don't know ..8	
224	*If respondent is different ask:* Did your (last) husband/partner ever attend school?	Yes ..1 No ..2	→226
225	What was the highest standard or form he completed?	Pre-primary ..00 Standard 1 ..01 Standard 2 ..02 Standard 3 ..03 Standard 4 ..04 Standard 5 ..05 Standard 6 ..06 Standard 7 ..07 Standard 8 ..08 Training after primary ..09 Pre-form 1 ..10 Form 1 ..11 Form 2 ..12 Form 3 ..13 Form 4 ..14 Form 5 ..15 Form 6 ..16 Training after secondary ..17 University ..18 Other ..96 (Specify)_____ Don't know ..98	

226	**Check 222:** Currently married/living with a man ↓|__|	Formerly married/lived with a man ↓|__|		
227	What is your husband's/partner's main occupation? That is, what kind of work does he mainly do?	What was your (last) husband's/partner's main occupation? That is, what kind of work did he mainly do?	_____ _____ |__|__|	
228	Aside from your own housework, are you currently working?		Yes.....1 No.....2	→232
229	As you know, some women take up jobs for which they are paid in cash or kind. Others sell things, have a small business or work on the family farm or in the family business. Are you currently doing any of these things or any other work?		Yes.....1 No.....2	→232
230	Have you done any work in the last 12 months?		Yes.....1 No.....2	→232
231	What have you been doing for most of the time over the last 12 months?		Going to school.....01 Looking for work.....02 Retired.....03 Too ill to work.....04 Handicapped, cannot work.....05 Housework/childcare.....06 Other.....96 (Specify) _____	241A
232	What is your occupation, that is, what kind of work do you mainly do? ***PROBE to obtain detailed information on the kind of work respondent does.***		_____ _____ |__|__|	
233	**Check 232:** If works in agriculture, go on with 234 ↓|__|	If does not work in agriculture, go to |__|		→235
234	Do you work mainly on your own land or on family land, or do you work on land that you rent from someone else, or do you work on someone else's land?		Own land.....1 Family land.....2 Rented land.....3 Someone else's land.....4	
235	Do you do this work for a member of your family, for someone else, or are you self-employed?		Family member.....1 For someone else.....2 Self-employed.....3	
236	Do you usually work at home or away from home?		Home.....1 Away.....2	
237	Do you usually work throughout the year, or do you work seasonally, or only once in a while?		Throughout the year.....1 Seasonally/part of the year.....2 Once in a while.....3	
238	Are you paid or do you earn in cash or kind for this work or are you not paid at all?		Cash only.....1 Cash and kind.....2 In-kind only.....3 Not paid.....3	241A 241
239	Who mainly decides how the money you earn will be used?		Respondent.....1 Husband/partner.....2 Respondent and husband/partner Jointly.....3 Someone else.....4 Respondent and someone else Jointly.....5	
240	On average, how much of your household's expenditures do your earnings pay for: almost none, less than half, about half, more than half, or all?		Almost none.....1 Less than half.....2 About half.....3 More than half.....4 All.....5	
241A	Now I would like to ask you some questions about financial matters. I ask these questions only to understand more about the financial position of women. Do you yourself control the money needed to buy the following? (a) Vegetables or fruits		Y N D	

	(b) Clothes for yourself I Any kind of medicine for yourself (d) Toiletries for yourself like (soap, shampoo, etc)	Vegetables/fruits Clothes Medicine Toiletries				1 1 1 1	2 2 2 2	8 8 8 8	
241B	Please tell me if you alone, or jointly with your husband or someone else own.....		Doesn't own↓	Own jointly↓	Own alone	239C: If you ever need to, can you sell (*asset*) without anyone else's permission? Y	N	D	
	(a) Land? (b) House/dwelling you live in? I Any other house/dwelling/apartment? (d) Jewelry or gems? (e) Livestock such as (cattle, goats, sheep, etc.)?		1 1 1 1 1	2 2 2 2 2	3→ 3→ 3→ 3→ 3→	1 1 1 1 1	1 1 1 1 1	8 8 8 8 8	
242	Who in your family usually has the final say on the following decisions.	Respondent=1 Husband/partner=2 Respondent and husband/partner jointly=3 Someone else=4 Respondent and someone else jointly=5 Decision not made/not applicable=6							
	(a) Your own health care? (b) Marking large household purchases? I Making household purchase for daily needs? (d) Visits to family or relatives? (e) What food should be cooked each day?		1 1 1 1 1	2 2 2 2 2	3 3 3 3 3	4 4 4 4 4	5 5 5 5 5	6 6 6 6 6	
243	Now I would like to ask about all the births you have had during your life. Have you ever given birth?					Yes.....1 No.....2			
244	Do you have any sons or daughters to whom you have given birth who are now living with you?					Yes.....1 No.....2			→246
245	How many living children (sons or daughters) do you have who live with you? ***If none, record "00"***					Sons.....___ Daughters.....___			
246	Do you have any sons or daughters to whom you have given birth who are alive but do not live with you?					Yes.....1 No.....2			→248
247	How many living children (sons or daughters) do you have who live elsewhere? ***If none, record "00"***					Sons elsewhere.....___ Daughters elsewhere.....___			
248	Because our study is about health matters, we would like to know about any of your children who have died. Have you ever had a son or daughter who was born alive but died later? This includes babies who cried after birth or showed other signs of life but survived only for a few hours or days					Yes.....1 No.....2			→250
249	How many children (sons or daughters) have died?					Sons.....___ Daughters.....___			
250	***Add up the living children (245 plus 247) and those who have died (249). Check with the respondent.*** Just to make sure that I have this right: You have XX living children, and YY have died. In total you have given birth ZZ times. Is that correct? ***If the respondent answers "no", probe and correct the responses 247 to 249.***	Total number of children, alive or dead.....___							
251	Where did you deliver the last time?	**Home** Your home.....01 Other home.....02 **Gov./Parastatal** Referral/special hospital.....03 Regional hospital.....04 District hospital.....05 Health centre.....06 Dispensary.....07 Village health post.....08 CBD worker.....09				**Religious/Voluntary** Referral/special hospital.....10 District hospital.....11 Health centre.....12 Dispensary.....13 **Private** Specialized hospital.....14 Health centre.....15 Dispensary.....16 Other.....96 (Specify)			

Section 3: Child Health Issues

301	*Check Q.8 (eligible children): enter in the table the name and line NO. of each child under-five years of age. Ask the questions about all of these children. Begin with the youngest.* Now I would like to ask you some questions about the health of all children under-five years of age at your household. We will talk about each separately.									
302	Name and line NO. from household questionnaire-(1)	Name______ Line NO. |__|__|			Name______ Line NO. |__|__|			Name______ Line NO. |__|__|		
303	Is (*name of child*) the first, second,…,child?	Rank…… |__|__| Don't know ………8			Rank…… |__|__| Don't know ………8			Rank…… |__|__| Don't know ………8		
304	Did (*name of child*) experience (*name of illness symptom*) at any time during the past 4 weeks?		*If "N" or "D" any symptom →328*			*If "N" or "D" any symptom →328*			*If "N" or "D" any symptom →328*	
		Y	N	D	Y	N	D	Y	N	D
	Fever?	1	2	8	1	2	8	1	2	8
	Convulsion?	1	2	8	1	2	8	1	2	8
	Diarrhoea?	1	2	8	1	2	8	1	2	8
	Cough/flu?	1	2	8	1	2	8	1	2	8
	Vomiting	1	2	8	1	2	8	1	2	8
305	How would you describe the degree of concern at first appearance of (*name of illness symptom*) that (*name of child*) had. Would you say that you had a high, medium or low concern about the (*illness symptom*)?	High=1 Medium=2 Low=3			High=1 Medium=2 Low=3			High=1 Medium=2 Low=3		
	Fever?	1	2	3	1	2	3	1	2	3
	Convulsion?	1	2	3	1	2	3	1	2	3
	Diarrhoea?	1	2	3	1	2	3	1	2	3
	Cough/flu?	1	2	3	1	2	3	1	2	3
	Vomiting	1	2	3	1	2	3	1	2	3
306A	Think back to the time of onset of (*name of illness symptom*) that (*name of child*) experience at any time during the past 4 weeks. Do you think the (*name of illness symptom*) that (*name of child*) experienced was/were indicative of a certain disease?	Yes……1 No……2			Yes……1 No……2			Yes……1 No……2		→307
306B	Which disease(s) did you immediately think-of?									
		Perceived Disease			Perceived Disease			Perceived Disease		
	Fever?	________			________			________		
	Convulsion?	________			________			________		
	Diarrhoea?	________			________			________		
	Cough/flu?	________			________			________		
	Vomiting	________			________			________		
307	When you recognise that (*name of child*) has any illness symptom, in your opinion, do you think knowing which disease (*name of child*) is suffering from prompts you to take a decision about the symptom?	Yes……1 No……2			Yes……1 No……2			Yes……1 No……2		
308	Now I would like to know how much (*name of child*) was given to eat when he/she had (*name of illness symptom*). Was he/she given less than usual to eat, about the same amount, or more than usual to eat? *If less, PROBE by asking:* was he/she given much less than usual to eat or somewhat less?	Fever… |__| Convulsion… |__| Diarrhoea… |__| Cough/flu… |__| Vomiting… |__| Much less……1 Somewhat less……2 About the same……3 More……4 Stopped food……5 Never gave food……6			Fever… |__| Convulsion… |__| Diarrhoea… |__| Cough/flu… |__| Vomiting… |__| Much less……1 Somewhat less……2 About the same……3 More……4 Stopped food……5 Never gave food……6			Fever… |__| Convulsion… |__| Diarrhoea… |__| Cough/flu… |__| Vomiting… |__| Much less……1 Somewhat less……2 About the same……3 More……4 Stopped food……5 Never gave food……6		

		Don't know......8	Don't know......8	Don't know......8	
309	When (***name of child***) had (***name of illness symptom***) was he/she given less than usual to drink (including breast milk), about the same amount, more than usual or nothing to eat? ***If less, PROBE by asking***: was he/she given much less than usual to drink or somewhat less?	Fever: |__| Convulsion: |__| Diarrhoea: |__| Cough/flu: |__| Vomiting: |__| Much less......1 Somewhat less......2 About the same......3 More......4 Stopped drink......5 Don't know......8	Fever: |__| Convulsion: |__| Diarrhoea: |__| Cough/flu: |__| Vomiting: |__| Much less......1 Somewhat less......2 About the same......3 More......4 Stopped drink......5 Don't know......8	Fever: |__| Convulsion: |__| Diarrhoea: |__| Cough/flu: |__| Vomiting: |__| Much less......1 Somewhat less......2 About the same......3 More......4 Stopped drink......5 Don't know......8	
310	***Check 304, whether child had cough/flu.*** When (***name of child***) had an illness with a cough, did he/she breathe faster than usual with short, rapid breaths?	Yes......1 No......2 Don't Know......8	Yes......1 No......2 Don't Know......8	Yes......1 No......2 Don't Know......8	
311	***Check 304, whether child had a fever.*** Think back to the time of onset of the fever that (***name of child***) experienced at any time during the past 4 weeks. How would you describe the degree of severity? Would you say that it was severe, moderate or mild?	Mild......1 Moderate......2 Severe......3	Mild......1 Moderate......2 Severe......3	Mild......1 Moderate......2 Severe......3	
312	For how many days during the past 4 weeks (***name of child***) had (***name of illness symptom***)? Fever? Convulsion? Diarrhoea? Cough/flu? Vomiting	 Days......... |__|__| Days......... |__|__| Days......... |__|__| Days......... |__|__| Days......... |__|__|	 Days......... |__|__| Days......... |__|__| Days......... |__|__| Days......... |__|__| Days......... |__|__|	 Days......... |__|__| Days......... |__|__| Days......... |__|__| Days......... |__|__| Days......... |__|__|	
313	For how many days during the past 4 weeks were you unable to carry on your usual activities (e.g., paid work, house chores, etc.) because of (***name of illness symptom***) that (***name of child***) experienced? ***Write "00" if not affected.***	Fever: |__| Convulsion: |__| Diarrhoea: |__| Cough/flu: |__| Vomiting: |__| Days......... |__|__|	Fever: |__| Convulsion: |__| Diarrhoea: |__| Cough/flu: |__| Vomiting: |__| Days......... |__|__|	Fever: |__| Convulsion: |__| Diarrhoea: |__| Cough/flu: |__| Vomiting: |__| Days......... |__|__|	

314	Did you seek advice or treatment for (***name of illness symptom***) from any source during the past 4 weeks?		***If "N" or "D" any symptom →324***			***If "N" or "D" any symptom →324***			***If "N" or "D" any symptom →324***		
		Y	N	D	Y	N	D	Y	N	D	
	Fever?	1	2	8	1	2	8	1	2	8	
	Convulsion?	1	2	8	1	2	8	1	2	8	
	Diarrhoea?	1	2	8	1	2	8	1	2	8	
	Cough/flu?	1	2	8	1	2	8	1	2	8	
	Vomiting	1	2	8	1	2	8	1	2	8	

315	Where did you seek advice or treatment for (*name of illness symptom*) during the past 4 weeks? Anywhere else? *Circle all mentioned places. If more than one place, record the letter of the first, second and third places in the order visited by asking: which was the first, second, etc.? Put the letters against the symptom that the child had.* *If unable to determine if a health facility is public or private medical, write the name of the place.* ________________ (*Name of place*)	Fev.: |__|__|__| Conv.: |__|__|__| Diar.: |__|__|__| Cou./flu: |__|__|__| Vom.: |__|__|__| **Gov. Parastatal** Referral/spec. hosp.....B Regional hosp......C District hospital......D Health centre.......E Dispensary.......F Village health post.......G CBD worker.......H **Religious/Voluntary** Referral/spec. hosp.......I District hospital ....J Health centre.......K Dispensary.......L **Private** Specialized hospital......M Health centre...... N Dispensary...... O **Other** Pharmacy.......P Other.......X (Specify)_________	Fev.: |__|__|__| Conv.: |__|__|__| Diar.: |__|__|__| Cou./flu: |__|__|__| Vom.: |__|__|__| **Gov. Parastatal** Referral/spec. hosp......B Regional hosp...... C District hospital......D Health centre.......E Dispensary.......F Village health post.......G CBD worker......H **Religious/Voluntary** Referral/spec. hosp.......I District hospital ....J Health centre.......K Dispensary...... L **Private** Specialized hospital.......M Health centre.......N Dispensary.......O **Other** Pharmacy....... P Other.......X (Specify) _________	Fev.: |__|__|__| Conv.: |__|__|__| Diar.: |__|__|__| Cou./flu: |__|__|__| Vom.: |__|__|__| **Gov. Parastatal** Referral/spec. hosp.......B Regional hosp.......C District hospital.......D Health centre.......E Dispensary.......F Village health post.......G CBD worker...... H **Religious/Voluntary** Referral/spec. hosp.......I District hospital.......J Health centre.......K Dispensary.......L **Private** Specialized hospital.......M Health centre.......N Dispensary.......O **Other** Pharmacy.......P Other.......X (Specify)_________	
316	People select the place where to seek advice/treatment from for various reasons. What were the main reasons that you first sought advice/treatment from (*name of first place*) for (*name of child*)?	Free medical care...01 Cheaper...02 Shorter waiting time......03 Closer to home...04 Only available...05 Staff more friendly...06 Staff more competent...07 More privacy...08 child specific services available...09 Drugs available...10 Other...96 (Specify)_________	Free medical care...01 Cheaper...02 Shorter waiting time...03 Closer to home...04 Only available...05 Staff more friendly...06 Staff more competent......07 More privacy...08 child specific services available...09 Drugs available...10 Other...96 (Specify)_________	Free medical care...01 Cheaper...02 Shorter waiting time...03 Closer to home...04 Only available...05 Staff more friendly...06 Staff more competent...07 More privacy...08 child specific services available...09 Drugs available...10 Other...96 (Specify)_________	
317	How many days after the (*name of illness symptom*) began did you first seek advice or treatment for (*name of child*)? *If the same day, record '00'.*	Days: Fever: |__|__| Convulsion: |__|__| Diarrhoea: |__|__| Cough/flu: |__|__| Vomit:: |__|__|	Days: Fever: |__|__| Convulsion: |__|__| Diarrhoea: |__|__| Cough/flu: |__|__| Vomit:: |__|__|	Days: Fever: |__|__| Convulsion: |__|__| Diarrhoea: |__|__| Cough/flu: |__|__| Vomit:: |__|__|	
318	People decide what to do and when for various reasons. What is the main reason that made you to go to seek care for (*name of child*) the same day of onset of (*name of illness symptom*)/after (*number of days of Q.317*) since the symptom began?	__________	__________	__________	

319	How long did it take you to go to (*name of place of Q. 315*)? *If multiple consultations, ask for each separately.*	1. |__|__|h|__|__|min 2. |__|__|h|__|__|min 3. |__|__|h|__|__|min Don't know........8	1. |__|__|h|__|__|min 2. |__|__|h|__|__|min 3. |__|__|h|__|__|min Don't know........8	1. |__|__|h|__|__|min 2. |__|__|h|__|__|min 3. |__|__|h|__|__|min Don't know........8	
320	How far was (*name of place*) from here? *Record "00" if less than one kilometre and "99" if more than 100 kilometres*	Kilometres 1. |__|__| Kilometres 2. |__|__| Kilometres 3. |__|__| Don't know........8	Kilometres 1. |__|__| Kilometres 2. |__|__| Kilometres 3. |__|__| Don't know........8	Kilometres 1. |__|__| Kilometres 2. |__|__| Kilometres 3. |__|__| Don't know........8	
321	How much has been spent altogether for (*name of place*) for the (*illness symptom*) that (*name of child*) experienced in the past 4 weeks? *If none, record "00"*	Fever: |__| Convulsion: |__| Diarrhoea: |__| Cough/flu: |__| Vomiting: |__| Amount (Tsh.) 1st consultation Transport________ Con. fee________ Medicines________ Total________ 2nd consultation Transport________ Con. fee________ Medicines________ Total________ 3rd consultation Transport________ Con. fee________ Medicines________ Total________	Fever: |__| Convulsion: |__| Diarrhoea: |__| Cough/flu: |__| Vomiting: |__| Amount (Tsh.) 1st consultation Transport________ Con. fee________ Medicines________ Total________ 2nd consultation Transport________ Con. fee________ Medicines________ Total________ 3rd consultation Transport________ Con. fee________ Medicines________ Total________	Fever: |__| Convulsion: |__| Diarrhoea: |__| Cough/flu: |__| Vomiting: |__| Amount (Tsh.) 1st consultation Transport________ Con. fee________ Medicines________ Total________ 2nd consultation Transport________ Con. fee________ Medicines________ Total________ 3rd consultation Transport________ Con. fee________ Medicines________ Total________	
322	Did you have to spend a night in a hospital or other establishment during the past 4 weeks because of (*name of illness symptom*)?	Fever: |__| Convulsion: |__| Diarrhoea: |__| Cough/flu: |__| Vomiting: |__| Yes......1 No......2	Fever: |__| Convulsion: |__| Diarrhoea: |__| Cough/flu: |__| Vomiting: |__| Yes......1 No......2	Fever: |__| Convulsion: |__| Diarrhoea: |__| Cough/flu: |__| Vomiting: |__| Yes......1 No......2	→324
323	How many nights during the past 4 weeks?	Nights |__|__|	Nights |__|__|	Nights |__|__|	
324	Is (*name of child*) still sick with (*name of illness symptom*) now?	Fever: |__| Convulsion: |__| Diarrhoea: |__| Cough/flu: |__| Vomiting: |__| Yes......1 No......2 Died......3	Fever: |__| Convulsion: |__| Diarrhoea: |__| Cough/flu: |__| Vomiting: |__| Yes......1 No......2 Died......3	Fever: |__| Convulsion: |__| Diarrhoea: |__| Cough/flu: |__| Vomiting: |__| Yes......1 No......2 Died......3	
325	At any time during the past 4 weeks, did (*name of child*) take any drugs for the (*illness symptom*)?	Yes......1 No......2	Yes......1 No......2	Yes......1 No......2	→327
326	Did you already have the drugs at home when (*name of child*) became ill?	Yes......1 No......2	Yes......1 No......2	Yes......1 No......2	
327	*Check 414, if did not seek advice treatment.* What is the <u>main reason</u> that you did not seek any advice/treatment from a health care provider for (*name of illness symptom*) that (*name of child*) experienced?	Poor service......1 Too far/no transport......2 Lack of knowledge......3 Not necessary/illness minor/mild......4 No body to leave at home......5	Poor service......1 Too far/no transport......2 Lack of knowledge......3 Not necessary/illness minor/mild......4 No body to leave at home......5	Poor service......1 Too far/no transport......2 Lack of knowledge......3 Not necessary/illness minor/mild......4 No body to leave at home......5 Other...96 (Specify)	

		Other 96 (Specify)_____	Other 96 (Specify)_____		
328	In your household who usually decides what to do when (*name of child*) is ill?	Respondent 1 Husband/partner 2 Respondent and husband/partner 3 Female relative 4 Male relative 5 Other 96 (Specify)_____	Respondent 1 Husband/partner 2 Respondent and husband/partner 3 Female relative 4 Male relative 5 Other 96 (Specify)	Respondent 1 Husband/partner 2 Respondent and husband/partner 3 Female relative 4 Male relative 5 Other 96 (Specify)_____	
329	What is your most important source of information in matters of child health?			Health officers 1 Health worker at health facility 2 Drama groups 3 Friends/family 4 Radio 5 Television 6 Magazine/newspapers/posters 7 Leaflets 7 Other 96 (Specify)_____ Don't know 8	
330	*Check 404, if chid was ill with a fever at any time during the past 4 weeks*. Do you know any health effects of fever to a child? *If yes, PROBE which*.			Yes 1 No 2	→332
331	Think back to the time of onset of fever at any time during the past 4 weeks. Do you think there was no chance, low chance, or high chance that (*name of child*) would experience any of the adverse health effects of fever that you know?	No chance 1 Low chance 2 High chance 3 Don't know 8	No chance 1 Low chance 2 High chance 3 Don't know 8	No chance 1 Low chance 2 High chance 3 Don't know 8	
332	***Check 304, if chid did not experience any illness symptom at any time during the past 4 weeks. Record name and line number of child from household schedule.***	**Name** _____ **Line No.**|__|__|	**Name** _____ **Line No.**|__|__|	**Name** _____ **Line No.**|__|__|	
333	How would you generally describe the health condition of (*name of child*) over the past 4 weeks? Would you it was excellent, very good, good, fair or poor?	Excellent 1 Very good 2 Good 3 Fair 4 Poor 5 Don't know 8	Excellent 1 Very good 2 Good 3 Fair 4 Poor 5 Don't know 8	Excellent 1 Very good 2 Good 3 Fair 4 Poor 5 Don't know 8	

END

THANK YOU VERY MUCH FOR YOUR PARTICIPATION AND COOPERATION

Appendix D: Calculation of Sampling Weights

Sampling design requires to be accounted for in the statistical analysis of the resulting data (Picquelle and Mier, 2011). Analyses of data that come from complex sample designs needs adjustment of the estimates by sampling weights w_{ijk} defined (e.g., Chalasani, 2012) as the reciprocal of the probability of selection. The sampling weights represent the number of individuals in the population that each sampled individual represents (Graubard and Korn, 1996). Pfeffermann *et al.* (1998) argue that for data arising from a multistage sampling, failing to account for disproportionate probabilities of selection at each stage of sampling may result into biased estimates. Therefore, sampling weights adjusts for the inequality of the sample with respect to the target population of interest (Pfeffermann, 1993; Platt and Harper, 2013) thus yields unbiased (Korn and Graubard, 1995) or representative estimates (HBS, 2007). In this study, calculation of the sampling weights was carried out as described below. However, the analysis in the empirical chapters used design-related variables (number of under-five children and number of households) to account for disproportionate probabilities of sampling.

As described in chapter three, there were three stages of selection (districts, villages/streets, and households) in the present study. At the first stage, four districts were selected with PPS using number of households in the *i*th district as MoS. At the second stage, 18 villages/streets were selected from each sampled district, again with PPS using number of households in the *j*th village as MoS. At the third stage, 15

households were selected by SRSWR from a frame list of households in each sampled village.

Following technical notes from the International Institute for Population Sciences (IIPS) and Macro International (2007); Department of Economic and Social Affairs of the United Nations Secretariat (2005); and HBS (2007), the following notations were adapted:

d_i represents the number of households in district i, h_{ij} denotes the number of households in village j of district i, and h'_{ij} denotes the number of eligible households in village j of district i. Using these notations, the sampling weights at the first, second, and third stages were estimated as described below.

First stage sampling weight

At the first stage, the probability of selection of the ith district was estimated as in equation (D.1).

$$p'_{ij} = \frac{n_{ij} \times d_i}{\sum d_i} \qquad \text{(D.1)}$$

Where n_d is the number of districts sampled and that in the present case $0 < p_d^i < 1$. Accordingly, the first stage weight for the *i*th-sampled district was estimated as in equation (D.2)

$$w_d^i = \frac{1}{p_d^i} = \frac{D}{n_d \times d_i} \tag{D.2}$$

in which case $D = \sum_{i=1}^{N} d_i$

Second stage sampling weight

At the second stage, the probability of selection of the *j*th village in the *i*th district was estimated as in equation (D.3).

$$p_v^{ij} = \frac{n_v \times h_{ij}}{\sum h_{ij}} \tag{D.3}$$

Where n_v is the number of villages sampled in the *i*th district. Accordingly, the second stage weight for the *j*th-sampled village in the *i*th district was estimated as in equation (D.4).

$$w_v^{ij} = \frac{1}{p_v^{i,j}} = \frac{H}{n_v \times h_{ij}} \tag{D.4}$$

Where $H = \sum_{j=1}^{n_v} h_{ij}$

Third stage sampling weight

At the third and final stage, the probability of selection of the *k*th household in the *j*th village in the *i*th district was estimated as in equation (D.5).

$$p_h^{ijk} = \frac{n_h}{h'_{ij}} \tag{D.5}$$

Where n_h is the number of households sampled in the *j*th village in the *i*th district and h'_{ij} is as defined before. Accordingly, the third stage weight for the *k*th sampled household in the *j*th village in the *i*th district was estimated as in equation (D.6)

$$w_h^{ijk} = \frac{1}{p_h^{ijk}} = \frac{h'_{ij}}{n_h} \tag{D.6}$$

Therefore, the overall probability of sampling of the *k*th household in the *j*th village of district *i* was estimated as the product of the individual probabilities of sampling at the three stages represented by equations D.1, D.3, and D.5. That is,

$$p_{ijk} = p'_d \times p''_v \times p_h^{ijk} \tag{D.7}$$

or

$$p_{ijk} = \frac{n_d \times d_i}{D} \times \frac{n_v \times h_{ij}}{H} \times \frac{n_h}{h'_{ij}} \tag{D.8}$$

Overall sampling weight

Taking the reciprocal of equation A.8 or taking the product of the right hand side terms of equations D.2, D.4, and D.6 yields the overall sampling weight (w_{ijk}) of selection of a household into the sample is given as equation (D.9). That is.

$$w_{ijk} = \frac{D \times H \times h'_{ij}}{n_d \times d_i \times n_v \times h_{ij} \times n_h} \qquad \text{(D.9)}$$