A SITUATIONAL ANALYSIS OF HEALTH-SEEKING BEHAVIOR FOR MALARIA AND DIABETES MELLITUS IN TANZANIA

CARA NORDBERG
SPRING 2014

A thesis
submitted in partial fulfillment
of the requirements
for a baccalaureate degree
in Toxicology
with honors in Biobehavioral Health

Reviewed and approved* by the following:

Melina T. Czymoniewicz-Klippel, Ph.D.
Lecturer and Global Health Minor Coordinator
Thesis Supervisor

Lori A. Francis, Ph.D.
Associate Professor for Biobehavioral Health and
Center for Family Research in Diverse Contexts
Honors Adviser

* Signatures are on file in the Schreyer Honors College.
ABSTRACT

The world is experiencing an epidemiological transition, in which the majority of disease and death is shifting from communicable (e.g. malaria) to non-communicable (e.g. diabetes mellitus) sources. While non-communicable diseases already account for the majority of disease burden in high-income countries, this epidemiological transition is still in its early stages in low-income countries. As a result, low-income countries continue to be burdened with high prevalence of certain communicable diseases; at the same time, the prevalence of non-communicable diseases is rising. Tanzania is one such low-income country that is experiencing a “double burden” of communicable and non-communicable diseases.

As the epidemiological transition occurs in Tanzania, it is important for health professionals, health policy planners, and public health actors to understand the population’s health-seeking behaviors for both communicable and non-communicable diseases. Doing so could help these professionals, planners, and actors to increase the capacity of the health care system to care for this double burden of disease, as well as support public health actors to implement successful prevention and treatment programs. This thesis first discusses the current health care system in Tanzania. It then examines health-seeking behavior for malaria, a communicable disease that has long been a major burden of disease, and diabetes mellitus, a non-communicable disease that is just starting to be a public health problem in Tanzania. The thesis concludes by analyzing prominent themes throughout the literature review and discussing recommendations for reducing the burdens of malaria and diabetes in Tanzania.
TABLE OF CONTENTS

List of Figures .......................................................................................................................... v
List of Tables ............................................................................................................................ vi
Acknowledgements................................................................................................................. vii

Chapter 1 Introduction and Study Rationale................................................................. 1

Introduction ......................................................................................................................... 1
  Sub-Saharan Africa ..................................................................................................... 7
  Tanzania ....................................................................................................................... 9
Study Rationale .............................................................................................................. 11
  Chapter Organization .............................................................................................. 13

Chapter 2 Methods........................................................................................................ 14

  Compiling the Literature Review ............................................................................ 14
  Research Ethics ......................................................................................................... 15
  Collection of Information In-Country ................................................................. 16

Chapter 3 Tanzania’s Health Care System .............................................................. 18

  Structure of the Health Care System .................................................................. 18
    Public and private sectors ................................................................................ 18
    Levels of care .................................................................................................... 20
    Health insurance schemes ............................................................................. 21
  Health Care Professionals .................................................................................... 24
    Sector preference ............................................................................................... 25
    Education and training ...................................................................................... 26
    Internal and external losses of health professionals .................................. 28
  Traditional Medicine ............................................................................................. 29
    Current state of traditional medicine in Tanzania .................................... 30
    Benefits of traditional medicine .................................................................. 32
    Negative consequences of traditional medicine ......................................... 33
    Integrating traditional and modern health care .......................................... 34

Chapter 4 Health-Seeking Behavior for Malaria and Diabetes Mellitus .............. 36

  Malaria ......................................................................................................................... 36
    Influences on health-seeking behavior ......................................................... 36
  Public health programs ......................................................................................... 42
    Modern health care system approach to treatment .................................... 45
    Traditional medicine approach to treatment ............................................. 48
  Diabetes Mellitus ..................................................................................................... 50
LIST OF FIGURES

Figure 1: Top Leading Causes of DALY, by Income Group, 2030. ........................................ 5

Figure 2: Top Leading Causes of Death, by Income Group, 2030. ................................. 6
LIST OF TABLES

Table 1: Top Ten Leading Causes of Disease Burden in 2002 and 2010.......................... 4
Table 2: People/Organizations Contacted While in Tanzania........................................ 17
Table 3: Risks Associated with Traditional Medicine.................................................. 34
ACKNOWLEDGEMENTS

I would like to first thank my thesis supervisor, Dr. Melina Czymoniewicz-Klippel, for providing endless encouragement, support, and guidance throughout the planning and writing processes. Not only did I grow as a writer and critical thinker under her guidance, but I also grew personally as she helped me to better cope with life’s chaos and demands.

I would also like to thank my parents and my brother for showing so much love and support as I have completed my journey through college. Because of their support and their encouragement to take advantage of life’s many opportunities, I have seen many corners of the world and have had many great experiences outside of the classroom. Their love encouraged me to overcome tough obstacles and to work hard for the rewards that follow.
Chapter 1

Introduction and Study Rationale

Introduction

As medicines and medical technologies advance and diets and lifestyles change, the leading causes of disease and death throughout the world continue to shift. Until relatively recently, communicable diseases were responsible for most morbidity and mortality across the globe (Alberti, 2001; Lopez & Mathers, 2006). Now, the world is experiencing an epidemiological transition, in which the burden of disease is shifting from communicable (or infectious) to non-communicable sources. Although this transition is occurring globally, it manifests itself differently in various regions and income groups. Examples of communicable diseases that have historically caused large proportions of mortality are tuberculosis, malaria, and diarrheal diseases. In regards to prevalence, these diseases are now being replaced by non-communicable diseases such as heart disease, diabetes mellitus, and cancer (Alberti, 2001; Lopez & Mathers, 2006). This change in disease burden will require changes in health care systems and policies.

In some parts of the world, especially high-income countries (currently defined as a 2012 gross national income [GNI] per capita of US$12,616 or higher; World Bank, 2013), this epidemiological transition began after World War II, when antibiotics such as penicillin became more widespread (Alberti, 2001). Antibiotics dramatically reduced the burden of communicable diseases and increased life expectancy. With populations living longer, non-communicable diseases, which tend to be slow developing chronic diseases (e.g. cardiovascular disease, chronic pulmonary diseases, and dementias), have had much more opportunity to emerge. Due to
increased medical technology, the availability of antibiotics and vaccines is now increasing worldwide, which has allowed the epidemiological transition to begin in middle-income (2012 GNI per capita between US$1,036 and US$4,085) and low-income (2012 GNI per capita of US$1,035 or less) countries as well. However, these countries, especially low-income countries, continue to be burdened with high prevalence of certain communicable diseases at the same time that the prevalence of non-communicable diseases is rising. Resistance to treatment, amongst other factors, has kept the prevalence of some communicable diseases high (e.g. malaria and tuberculosis), while lifestyle changes (e.g. “Western” diets, smoking, and physical inactivity) have led to an increase in non-communicable diseases (e.g. cardiovascular disease). In particular, high prevalence of malaria and HIV/AIDS have kept the burden of communicable diseases high in low-income countries (Alberti, 2001; Amuna & Zotor, 2008). Continued high prevalence of communicable diseases and rising prevalence of non-communicable diseases in low-income countries has created what has been termed a “double burden of disease” (Amuna & Zotor, 2008).

The Global Burden of Disease (GBD) Study (Murray et al., 2012) calculates the disability-adjusted life-years (DALY) of hundreds diseases for low- and middle-income countries, as well as for high-income countries. DALY is a theoretical measure of the potential years of healthy life lost because of a disease. It is a sum of the years of life lost to premature death (YLL) and the years of life with disability (YLD). Therefore, the higher the DALY, the higher the burden of the disease. The latest GBD study was conducted in 2010 (Murray et al., 2012). This update provided DALYs for nearly 300 diseases and injuries. Data was broken down into 21 world regions (e.g. Eastern sub-Saharan Africa, Asia Pacific, high-income North America). Overall, non-communicable diseases were responsible for the most DALYs in 2010 (54%), followed by communicable/maternal/neonatal/nutritional diseases (35%) and injuries (11%). Lower respiratory infections were found to account for 4.6% of DALYs in 2010. Malaria and HIV/AIDS were both found to account for 3.3%, while tuberculosis accounted for 2.0%.
An earlier version of the GBD study (2002) published DALYs for high-, middle-, and low-income groups (Lopez & Mathers, 2006). The authors found that in low- and middle-income countries, perinatal conditions (e.g. birth asphyxia and birth trauma) had the highest DALY (96.8 million) and were therefore responsible for the highest burden of disease. This was followed by lower respiratory infections (92.2 million), HIV/AIDS (81.8 million), and diarrheal diseases (64.4 million). These were followed by some emerging non-communicable diseases: unipolar depressive disorder (56.5 million), ischemic heart disease (51.6 million), and cerebrovascular disease (43.7 million). Road traffic accidents were eighth on the list (35.2 million), with the top ten rounded out by malaria (34.8 million) and tuberculosis (34.5 million).

In contrast to low- and middle-income countries, the 2002 GBD study found that no communicable diseases were in the top ten leading causes of the burden of disease in high-income countries (Lopez & Mathers, 2006). Unipolar depressive disorder had the highest DALY in this group (10.6 million), followed by ischemic heart disease (7.5 million) and cerebrovascular disease (5.7 million). These three conditions were common to both groups of countries. However, the next several conditions were unique to high-income countries. These conditions were: alcohol-use disorders; Alzheimer’s disease and other dementias; adult-onset hearing loss; chronic obstructive pulmonary disease; trachea, bronchus, and lung cancers; and diabetes mellitus. The final condition in the top ten leading causes of burden of disease in high-income countries was road traffic accidents, which was also common to low- and middle-income countries. For a visual comparison, Table 1 below shows the top ten leading causes of disease burden worldwide for 2002 and 2010 (Lopez & Mathers, 2006; Murray et al., 2012).
Table 1: Top Ten Leading Causes of Disease Burden in 2002 and 2010.

<table>
<thead>
<tr>
<th></th>
<th>Low- and Middle- Income</th>
<th>High-Income</th>
<th>Worldwide</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perinatal conditions</td>
<td>Unipolar depressive disorders</td>
<td>Ischemic heart disease</td>
<td></td>
</tr>
<tr>
<td>Lower respiratory infections</td>
<td>Ischemic heart disease</td>
<td>Lower respiratory infections</td>
<td></td>
</tr>
<tr>
<td>HIV/AIDS</td>
<td>Cerebrovascular disease</td>
<td>Stroke</td>
<td></td>
</tr>
<tr>
<td>Diarrheal diseases</td>
<td>Alcohol-use disorders</td>
<td>Diarrhea</td>
<td></td>
</tr>
<tr>
<td>Unipolar depressive disorders</td>
<td>Alzheimer and other dementias</td>
<td>HIV/AIDS</td>
<td></td>
</tr>
<tr>
<td>Ischemic heart disease</td>
<td>Hearing loss, adult onset</td>
<td>Low back pain</td>
<td></td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>Chronic obstructive pulmonary disease</td>
<td>Malaria</td>
<td></td>
</tr>
<tr>
<td>Road traffic accidents</td>
<td>Trachea, bronchus, and lung cancers</td>
<td>Preterm birth complications</td>
<td></td>
</tr>
<tr>
<td>Malaria</td>
<td>Diabetes mellitus</td>
<td>Chronic obstructive pulmonary disease</td>
<td></td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>Road traffic accidents</td>
<td>Road injury</td>
<td></td>
</tr>
</tbody>
</table>

After the publication of the 2002 GBD study, predicted disease burdens for the year 2030 were calculated (Mathers & Loncar, 2006). The projected causes of disease burden, as again measured by DALY, were also ranked. Globally, HIV/AIDS was predicted to be the leading cause of disease burden, followed by unipolar depressive disorders, ischemic heart disease, and road traffic accidents. The remaining top ten leading causes of disease burden are predicted to be perinatal conditions, cerebrovascular disease, chronic obstructive pulmonary disease, lower respiratory infections, adult-onset hearing loss, and cataracts (Mathers & Loncar, 2006). The majority of causes of disease burden on this projected list are similar to those found in the list of current leading causes of disease burden in high-income countries (Lopez & Mathers, 2006). Lower respiratory infections represent the only communicable disease on the projected list for 2030. Of course, the top ten causes of disease burden differ between income groups. The full table of projected leading causes of disease burden, as measured by DALY, is shown below (Figure 1; Mathers & Loncar, 2006, p. 2027). Global ranks are given in addition to income group ranks.
According to these projections, the majority of DALYs for each income group and worldwide will be quite similar to those in 2002 (Lopez & Mathers, 2006). Communicable diseases and perinatal conditions will continue to be responsible for a large proportion of disease burden in low-income countries. While most of the disease burden in middle-income countries is projected to be due to non-communicable diseases, HIV/AIDS will continue to be one of the leading causes of disease burden. In high-income countries, non-communicable diseases will still be responsible for most disease burden, with cancer-related disease burdens increasing as well.

Mathers & Loncar (2006) also ranked the projected leading causes of death in 2030, both globally and by income level. Although many of the same conditions are common between the

<table>
<thead>
<tr>
<th>Income Group</th>
<th>Rank</th>
<th>Disease or Injury</th>
<th>Percent Total DALYs</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>1</td>
<td>HIV/AIDS</td>
<td>12.1</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Unipolar depressive disorders</td>
<td>5.7</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Ischemic heart disease</td>
<td>4.7</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Road traffic accidents</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Prenatal conditions</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Cardiovascular disease</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>COPD</td>
<td>3.1</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Lower respiratory infections</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Hearing loss, adult onset</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Cataracts</td>
<td>2.5</td>
</tr>
<tr>
<td>High-income countries</td>
<td>1</td>
<td>Unipolar depressive disorders</td>
<td>9.8</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Ischemic heart disease</td>
<td>5.9</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Alzheimer and other dementias</td>
<td>5.8</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Alcohol use disorders</td>
<td>4.7</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Diabetes mellitus</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Cardiovascular disease</td>
<td>4.3</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Hearing loss, adult onset</td>
<td>4.1</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Trachea, bronchi, lung cancer</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Osteoarthritis</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>COPD</td>
<td>2.5</td>
</tr>
<tr>
<td>Middle-income countries</td>
<td>1</td>
<td>HIV/AIDS</td>
<td>9.8</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Unipolar depressive disorders</td>
<td>6.7</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Cardiovascular disease</td>
<td>6.0</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Ischemic heart disease</td>
<td>4.7</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>COPD</td>
<td>4.7</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Road traffic accidents</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Violence</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Vision disorders, age-related</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Hearing loss, adult onset</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Diabetes mellitus</td>
<td>2.6</td>
</tr>
<tr>
<td>Low-income countries</td>
<td>1</td>
<td>HIV/AIDS</td>
<td>14.6</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Prenatal conditions</td>
<td>5.8</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Unipolar depressive disorders</td>
<td>4.7</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Road traffic accidents</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Ischemic heart disease</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Lower respiratory infections</td>
<td>4.4</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Diarrhoeal diseases</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Cardiovascular disease</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Cataracts</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Malaria</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Figure 1: Top Leading Causes of DALY, by Income Group, 2030.
ranked causes of disease burden and ranked causes of death, some differences appear. For example, some cancers are projected to be in the top ten leading causes of death in 2030, but they are not projected to be in the top ten leading causes of disease burden, although the authors did not explain this inconsistency. For the sake of simplicity and clarity, the table of projected causes of death in 2030 is shown below (Figure 2; Mathers & Loncar, 2006, p. 2023).

<table>
<thead>
<tr>
<th>Income Group</th>
<th>Rank</th>
<th>Disease or Injury</th>
<th>Percent of Total Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>1</td>
<td>Ischemic heart disease</td>
<td>13.4</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Cerebrovascular disease</td>
<td>10.6</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>HIV/AIDS</td>
<td>8.9</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>COPD</td>
<td>7.8</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Lower respiratory infections</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Trachea, bronchus, lung cancers</td>
<td>3.1</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Diabetes mellitus</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Road traffic accidents</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Perinatal conditions</td>
<td>2.2</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Stomach cancer</td>
<td>1.9</td>
</tr>
<tr>
<td>High-income countries</td>
<td>1</td>
<td>Ischemic heart disease</td>
<td>15.8</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Cerebrovascular disease</td>
<td>9.0</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Trachea, bronchus, lung cancers</td>
<td>5.1</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Diabetes mellitus</td>
<td>4.8</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>COPD</td>
<td>4.1</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Lower respiratory infections</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Alzheimer and other dementias</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Colon and rectum cancers</td>
<td>3.3</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Stomach cancer</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Prostate cancer</td>
<td>1.8</td>
</tr>
<tr>
<td>Middle-income countries</td>
<td>1</td>
<td>Cerebrovascular disease</td>
<td>14.4</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Ischemic heart disease</td>
<td>12.7</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>COPD</td>
<td>12.0</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>HIV/AIDS</td>
<td>6.2</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Trachea, bronchus, lung cancers</td>
<td>4.3</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Diabetes mellitus</td>
<td>3.7</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Stomach cancer</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Hypertensive heart disease</td>
<td>2.7</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Road traffic accidents</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Liver cancer</td>
<td>2.3</td>
</tr>
<tr>
<td>Low-income countries</td>
<td>1</td>
<td>Ischemic heart disease</td>
<td>13.4</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>HIV/AIDS</td>
<td>13.2</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Cerebrovascular disease</td>
<td>8.3</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>COPD</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Lower respiratory infections</td>
<td>5.1</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Perinatal conditions</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Road traffic accidents</td>
<td>3.7</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Diarrheal diseases</td>
<td>2.3</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Diabetes mellitus</td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Malaria</td>
<td>1.8</td>
</tr>
</tbody>
</table>

Figure 2: Top Leading Causes of Death, by Income Group, 2030.

Many of the diseases and conditions in Figure 2 are also present in Figure 1 for their respective income groups. HIV/AIDS is expected to be one of the world’s leading causes of disease burden as well as death. Ischemic heart disease and cerebrovascular disease are projected
to lead to a high burden of disease as well as large portions of death. Some communicable
diseases, such as malaria and diarrheal diseases, are expected to continue to be heavy burdens and
leading causes of death in low-income countries. However, there are some notable differences
between the two tables. While cancers are not projected to be in the leading causes of disease
burdens globally, some cancers are projected to be leading causes of death in 2030. In middle-
income countries, violence is expected to cause a large burden of disease, but not a large portion
of deaths. Perhaps one of the most notable differences is that, although it is not projected to be
responsible for a large portion of DALYs, diabetes mellitus is expected to be the ninth leading
cause of death in low-income countries in 2030.

Sub-Saharan Africa

In sub-Saharan Africa, a low-income region, communicable diseases continue to cause
the highest burden of disease. Drug resistance keeps prevalence of some communicable diseases
high (e.g. malaria and tuberculosis). In addition, HIV-related illnesses are increasing (Alberti,
2001). According to the 2002 GBD study (Lopez & Mathers, 2006), HIV/AIDS was the leading
cause of burden of disease in the region, with a DALY of 63.4 million years. This was followed
by lower respiratory infections (37.2 million) and malaria (31.6 million). The remaining top ten
leading causes were a mix of communicable diseases and other conditions that have long been
common to low-income countries: e.g. diarrheal diseases, perinatal conditions, maternal
conditions, measles, tuberculosis, road traffic accidents, and protein-energy malnutrition.

Despite the enduring high prevalence of communicable diseases in sub-Saharan Africa,
non-communicable diseases have recently become a major concern as well due to lifestyle
changes (e.g. in diet and physical activity). Even as early as 1990, non-communicable diseases
were responsible for 23% of deaths in sub-Saharan Africa, as determined by the first Global
Burden of Disease study. Furthermore, even though non-communicable diseases cause a higher percentage of deaths in high-income countries, absolute deaths from non-communicable diseases are higher in low-income countries (Alberti, 2001).

Not only are non-communicable diseases creating a large burden of diseases in sub-Saharan Africa, they are also creating a large burden on health care. Non-communicable diseases are sometimes referred to as chronic diseases, because they are long-term diseases. Communicable diseases on the other hand tend to be short-term or acute diseases. In other words, a person with a non-communicable disease will likely require health care for a longer period of time than a person with a communicable disease. For example, malaria is an acute disease that is treated until it is cured in a relatively short time (e.g. days to a couple weeks). Diabetes mellitus, on the other hand, is a chronic disease that managed rather than cured, and so requires long-term treatment and monitoring. According to a study by Setel et al. (2004), an estimated 86% of DALYs in sub-Saharan Africa in 2000 were attributable to diseases that require long-term health care (e.g. stroke). It is important to note, however, that the authors included HIV and tuberculosis in this category because although they are communicable, they are chronic and require long-term health care.

In 2010, the GBD study found that HIV/AIDS was responsible for the most DALYs in eastern sub-Saharan Africa. This was followed by malaria and lower respiratory infections. The remaining top-ten causes of burden of disease were diarrheal diseases, preterm birth complications, protein-energy malnutrition, tuberculosis, sepsis and other infectious disorders of the newborn baby, neonatal encephalopathy, and meningitis (Murray et al., 2012). Non-communicable diseases start to appear in the top 11-20 causes of DALYs in eastern sub-Saharan Africa (e.g. cerebrovascular disease is ranked at 16). Diabetes mellitus is ranked as the 29th leading cause of DALYs for the region in 2010.
In Tanzania, one of the major East African countries, 49% of mortality in 2000 was estimated to be from diseases that require long-term health care (Setel et al., 2004). Although specific diseases were not included in the results, the authors noted stroke and lung cancer as examples of diseases that require long-term care. The authors argue that with a high burden and mortality rate from chronic diseases, health policy and health care need to be able to manage diseases over a long period of time. Currently, much of the health policy and health care is focused on short-term episodic care, since communicable disease have historically held the highest burden of disease – in the past, there has been little need to provide care for non-communicable diseases. In addition, Setel et al. (2004) note that patient education to promote behavior change is an important part of care for chronic diseases. Again, patient education has historically focused on communicable diseases because of their high prevalence. With the rising prevalence of non-communicable diseases, however, differences in short- and long-term health care and management will need to be addressed. Several authors have echoed this stress on patient education and behavior change. Airhihenbuwa & Iwelunmor (2012), for example, especially call for a greater focus on the role of culture in behavior change for the management of non-communicable diseases, such as diabetes mellitus, in Africa. Similarly, Setel et al. (2004) argue, “a greater burden of disease caused by chronic illness implies… the need for a greater emphasis on preventive programs and services” (p. 387). Non-communicable diseases are largely influenced by behavior and lifestyle and tend to be slow-developing, so prevention also needs to be long-term.

Communicable diseases continue to be the leading causes of death in Tanzania. A longitudinal study in rural southern Tanzania (Narh-Bana et al., 2012) found that a large percentage (20.4%) of adult of deaths between 2003 and 2007 were due to HIV/AIDS. Malaria
was the cause of 13.2% of adult deaths during that time. However, non-communicable diseases were found to be a major cause of death as well. In fact, deaths from non-communicable diseases, such as cerebrovascular diseases and epilepsy, have risen rapidly in the study area, increasing from 16% in 2003 to 24% in 2007. With accidents and injuries also causing a large portion of mortality in the region (9%), there is a triple disease burden, which the authors of the study argue will increase if prevention interventions (e.g. lifestyle changes, health education) are not implemented. While mortality from communicable diseases remains high, mortality from non-communicable diseases is expected to continue to increase. In addition, mortality from accidents and injuries has also increased (Narh-Bana et al., 2012).

Malaria is responsible for the largest portion of the burden of disease in sub-Saharan Africa (de Savigny et al., 2004). In Tanzania, malaria is one of the leading causes of death and is the country’s leading cause of morbidity and mortality among children under five (Comoro et al., 2003). A 2003 publication from Tanzania’s Ministry of Health (currently the Ministry of Health and Social Welfare) reported that an estimated 14-18 million cases of malaria are seen each year (MOH, 2003). In addition to causing 13.2% of deaths in the general population (Narh-Bana et al., 2012), malaria is responsible for a tremendous 36% of mortality in children under five years (MOHSW, 2010). Malaria is a disease that results from infection by certain blood parasites called *Plasmodium*. In Africa, *Plasmodium falciparum* is the dominant parasite. It is transmitted into humans through a bite by a parasite-carrying female *Anopheles* mosquito. The most common symptom of malaria is high fever, which can lead to convulsions if not treated. Because the malaria parasites infect red blood cells, anemia can often result. Pregnant women and young children are especially affected by anemia, putting these groups at increased risk of death from malaria (Skolnik, 2012). Although prevention efforts must be long-term, malaria is an acute disease that requires only short-term treatment (i.e. with medication). Yet, malaria can be deadly after only a few days if left untreated (Kamat, 2006).
While still comparatively much less of a burden than malaria, the burden of diabetes mellitus is increasing in Tanzania and other low-income countries. In contrast to malaria, diabetes mellitus (hereafter “diabetes”) is a non-communicable disease that requires long-term care and management. There are two types of diabetes – type I and type II. Diabetes is a disease that is characterized by the insufficient production (type I) or use (type II) of insulin in the body. As a result, glucose cannot be properly transported into cells to be used for energy. Instead, glucose remains in the bloodstream and can lead to dangerously high levels of blood glucose (hyperglycemia). Genetics play a role in type I diabetes, as risk for type I is increased in those with a family history of diabetes. While risk for type II diabetes is also increased in those with a family history of diabetes, type II is also associated with many other risk factors, both biological (e.g. age and ethnicity) and behavioral (e.g. diet and physical activity; International Diabetes Association, 2003). Diabetes requires careful daily and long-term management, patient education regarding diet and lifestyle changes, and proper medication. Diabetics must follow a strict diet, take multiple insulin injections, test blood sugar frequently, and exercise regularly (Skolnik, 2012). Diabetes prevalence is increasing rapidly worldwide, including in Tanzania. This increase in global prevalence is correlated with a rise in obesity (Skolnik, 2012). Approximately 800,000-1,000,000 Tanzanians are estimated that have diabetes (Abbas et al., 2011). Diabetes prevalence is much higher in urban areas (12%) than rural areas (1%). Poor management of diabetes can often lead to complications such as neuropathy and the development of foot ulcers which, if left untreated, will cause enough tissue damage that lower leg amputation is required.

**Study Rationale**

As the epidemiological transition from communicable to non-communicable diseases occurs in Tanzania (Narh-Bana et al., 2012), as well as worldwide (Lopez & Mathers, 2006), it is
important to ensure that health care systems are prepared for this transition. Many factors are
involved in this preparation. A large piece to this puzzle is understanding how a population uses
its health care system for the prevention and treatment of diseases. This thesis is presented as a
situational analysis of health-seeking behavior for malaria and diabetes mellitus in Tanzania,
which represent prevalent communicable and non-communicable diseases, respectively. The aim
of this thesis is to explore how the traditional and modern health care systems influence health-
seeking behavior for these diseases. By doing so, this thesis will add to the current literature of
health-seeking behavior in Tanzania and Sub-Saharan Africa more broadly.

Although several studies have researched influences of health-seeking behavior for malaria in Tanzania (Oberländer & Elverdan, 2000; Comoro et al., 2003; de Savigny et al., 2004;
Manongi et al., 2005; Kamat, 2006; Foster & Vilendrer, 2009), these studies often focus on one
region or district of the country, and their findings have not been compiled to give a complete
picture of the whole country. Additionally, since diabetes mellitus prevalence is still rather low in
Tanzania (Abbas et al., 2011), research on health-seeking behavior for this disease has been rare.
Although more research needs to be done on this topic, this study will compile the findings of the
studies that have been done to this point. These studies, although few, allow preliminary
comparisons and contrasts to be made for health-seeking behaviors and interventions for the two
diseases. Finally, this thesis will add to the current literature that discusses health promotion and
behavior change programs for malaria and diabetes mellitus. In addition to discussing the
illnesses individually, it will be the first study to analyze health-seeking behaviors for the two
illnesses in this context.

By addressing its research objective, this thesis can serve as a reference for medical and
public health professionals looking to understand the epidemiological transition in Tanzania.
Medical doctors could use this document to gather further information about why their patients
make certain decisions regarding disease prevention and treatment. It can also help them to
predict how proposed medical treatments or interventions would fare in practice. Public health professionals could use this study to plan health promotion programs, especially behavior change programs, which aim to improve prevention and treatment of malaria or diabetes.

**Chapter Organization**

The chapters of this thesis have been organized in a way that progresses from broad to specific information. The current chapter provides extensive background information on the global epidemiological transition from infectious to chronic diseases, as well as historical information on malaria and diabetes worldwide and in Tanzania. It also provides a rationale for the thesis. The next chapter, Chapter 2, serves to explain the methodology for organizing, preparing and presenting the thesis, as well as for gathering the data that is presented. The core of the situational analysis is a literature review that is presented in the third and fourth chapters. The third chapter first provides a brief history of Tanzania’s traditional and modern health care practices. It then discusses these health care practices at present and their relation to current health patterns. The fourth chapter overviews the present statuses of malaria and diabetes mellitus in Tanzania, while also providing historical information and projections for the future. It discusses at length the relationships between the diseases and health-seeking behavior, as well as a wide range of factors that influence current behaviors. Finally, the fifth chapter summarizes, analyzes, and concludes the situational analysis, and provides recommendations for future research.
Chapter 2

Methods

This thesis presents a situational analysis. Specifically, it is a review of both peer-reviewed and grey literatures related to health-seeking behavior for malaria and diabetes mellitus in Tanzania. By asking about program documents and publications, grey literature was collected through meetings with contacts in-country in May 2013. In order to gain a solid understanding of Tanzania’s health care system and current public health programs, and to give the researcher a direction as to what to information to seek in-country, drafts of Chapters 3 and 4 of the literature review were composed prior to travelling to Tanzania. Additional information, chapters, and revisions were added later.

Compiling the Literature Review

Several literature searches were performed in order to gather background information and current research findings related to the epidemiological transition, health care systems in Tanzania, and health-seeking behavior for malaria and diabetes in Tanzania. Searches were performed between January 2013 and March 2014. Two search engines were used, PubMed (http://www.ncbi.nlm.nih.gov/pubmed/) and Google Scholar (http://scholar.google.com/). PubMed is a well-known database for health and medical literature, and Google Scholar is a popular database that covers a wide range of disciplines. Various combinations of key words and phrases were used to find relevant literature. Key words and phrases included “Tanzania”, “health care system”, “traditional medicine”, “malaria”, “diabetes”, “epidemiological transition”, “health seeking behavior”, and “sub-Saharan Africa”. Relevance of journal articles was judged by
reading the titles and abstracts, and was determined by whether the article aligned with the focus of each section and the purpose of this thesis. For example, articles that focused on Type I diabetes were not included (only Type II was included in this thesis). Articles that were deemed relevant were downloaded. Further articles were found through the bibliographies of previously saved articles. For the most current information, references were mainly chosen from articles published in the last five years for literature on malaria, and ten years for literature on diabetes and the current health care systems, although exceptions were made in cases when more recent information could not be found. A shorter time frame was used for malaria because of the vast number of relevant articles. Publications from all years were considered for background and historical information.

**Research Ethics**

Ethical approval from an International Review Board (IRB) was not needed for the completion of this thesis. Because no human research (e.g. no recorded interviews) was performed, the chosen research methods do not fit the criteria for research that needs IRB approval. For information about Penn State’s IRB policies, please see http://www.research.psu.edu/orp/humans/policies. Although the researcher met with in-country contacts to collect information, these meetings were informal and were not recorded. Dialogue from these meetings will not be formally analyzed in this thesis. Rather, the purpose of these meetings was to collect grey literature that will be cited and analyzed later in the thesis.

Formal interviews with in-country contacts were initially considered for this thesis. However, major logistical obstacles led to the elimination of those formal interviews. One of these obstacles was the complication of scheduling interviews. The main purpose of the author’s visit to Tanzania was to fulfill a fieldwork requirement for her Global Health minor program.
Although the researcher knew the dates of her visit to Tanzania, she did not know what dates she
would be in Dar es Salaam, where these contacts are located. Therefore, she was not able to
schedule interviews prior to travelling to Tanzania. Another major obstacle was the process of
IRB approval. Although IRB approval from Penn State University was manageable in the
available time frame, IRB approval would have also been needed from Tanzania’s National
Institute for Medical Research (NIMR; http://www.nimr.or.tz). The available time frame did not
allow for this second IRB approval process, especially since consent forms would have needed to
be submitted in both English and Kiswahili. In addition, the researcher was not familiar with
Tanzanian IRB approval process and the timeframe that it would require. Therefore, these formal
interviews were eliminated from the proposed research methods.

Collection of Information In-Country

In addition to performing published literature searches, several documents were collected
from health agencies and institutes in Tanzania, many of which focus their efforts largely on
behavior change as it relates to malaria and/or diabetes mellitus. This in-country document
collection occurred from 20-24 May 2013. The goal of this document collection was to find grey
literature relating to one or more of the following criteria, with a specific focus on Tanzania:

1) Relates to health-seeking behavior of people who have malaria
2) Relates to health-seeking behavior of diabetes mellitus
3) Discusses trends in malaria or diabetes mellitus prevalence
4) Discusses trends in prevention methods for malaria or diabetes mellitus
5) Discusses trends in treatment methods for malaria or diabetes mellitus
6) Discusses roles of modern and traditional medicine in malaria and diabetes mellitus
    health care
Prior to traveling to Tanzania, a list of relevant organizations and professionals was made in order to create a plan for finding and collecting documents once in-country. Relevant organizations and people were found through mentions in current literature, institute directory searches, and web searches. Once in-country, additional contacts were found through initial meetings (i.e. snowball sampling). Table 2 below lists the names and contact information of the people and organizations that were contacted, as well as how the researcher learned about these people/organizations (labeled “Method of Identification”), and what kind of information was collected. A total of twelve pieces of grey literature were collected, including brochures, program activities and results, survey results, a poster, and presentation slides. In addition, in-country contacts referred to eight peer-reviewed journal articles.

Table 2: People/Organizations Contacted While in Tanzania

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Contact Information</th>
<th>Method of Identification</th>
<th>Information Collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emmy Metta</td>
<td>Ifakara Health Institute</td>
<td>E: <a href="mailto:emetta@ihi.or.tz">emetta@ihi.or.tz</a></td>
<td>Ifakara Health Institute directory</td>
<td>Brief details on Ms. Metta’s project on health-seeking behavior for malaria and diabetes mellitus</td>
</tr>
<tr>
<td>Prosper Chaki</td>
<td>Ifakara Health Institute</td>
<td>T: +255 686 997 299 E: <a href="mailto:pchaki@ihi.or.tz">pchaki@ihi.or.tz</a></td>
<td>Introduced by Ifakara Health Institute secretary</td>
<td>Additional contacts at IHI</td>
</tr>
<tr>
<td>Dr. Rashid A. Khatib</td>
<td>Ifakara Health Institute</td>
<td>E: <a href="mailto:rkhatib@ihi.or.tz">rkhatib@ihi.or.tz</a></td>
<td>Introduced by Prosper Chaki</td>
<td>Summary of Dr. Khatib’s malaria research; Suggested published literature</td>
</tr>
<tr>
<td>Angel Dillip</td>
<td>Ifakara Heath Institute</td>
<td>E: <a href="mailto:adillip@ihi.or.tz">adillip@ihi.or.tz</a></td>
<td>Introduced by Prosper Chaki</td>
<td>Findings from Ms. Dillip’s malaria research on health-seeking behavior for malaria</td>
</tr>
<tr>
<td>Dr. Lynn Paxton</td>
<td>Centers for Disease Control - Tanzania</td>
<td>T: +255 222 294 490 E: <a href="mailto:lpaxton@cdc.gov">lpaxton@cdc.gov</a></td>
<td>Centers for Disease Control – Tanzania website</td>
<td>Directed to online publication; Additional contacts</td>
</tr>
<tr>
<td>Karen Kramer</td>
<td>National Malaria Control Programme; Swiss Tropical and Public Health Institute</td>
<td>T: +255 784 717 700 E: <a href="mailto:karen.kramer@natnets.org">karen.kramer@natnets.org</a></td>
<td>Referred to by Dr. Lynn Paxton and Karen Kramer</td>
<td>Hard-copy of Tanzania HIV/AIDS and Malaria Indicator Survey 2011-2012; Information on trends in malaria treatment and behavior; Additional contacts</td>
</tr>
<tr>
<td>Rob Ainslie</td>
<td>Johns Hopkins University Center for Communication Programs Tanzania</td>
<td>T: +255 222 600 784 E: <a href="mailto:rainslie@jhuccp.org">rainslie@jhuccp.org</a></td>
<td>Referred to by Dr. Lynn Paxton</td>
<td>Information about JHU CCP’s COMMIT project and malaria behavior change; Presentation slides about COMMIT’s work</td>
</tr>
<tr>
<td>Beatrice Minja</td>
<td>Tanzania National Malaria Movement (TANAM)</td>
<td>T: +255 789 181 695</td>
<td>Referred to by Karen Kramer</td>
<td>Information on TANAM’s work with malaria behavior change; Brochures that are distributed at health clinics</td>
</tr>
</tbody>
</table>
Chapter 3

Tanzania’s Health Care System

One essential component of analyzing health-seeking behavior is understanding a country’s health care system. This chapter will provide an overview of Tanzania’s health care system, including modern and traditional health care. The chapter will include information such as the structure of the public and private sectors, the methods that are used to finance health care, education and distribution of health care workers, and socioeconomic inequities that exist. All of these factors impact the way in which Tanzanians use the health care system, i.e. impact their health-seeking behavior. The next chapter will extend on the present chapter by discussing the health care system in relation to malaria and diabetes.

Structure of the Health Care System

Public and private sectors

Tanzania’s health care system has both a public and private sector. Although private for-profit facilities were eliminated in 1980 during the period of socialization policies, they were re-legalized a decade later. Soon after, the Tanzanian government introduced user fees at its public health facilities. This was done at the urging of the International Monetary Fund (IMF) and the World Bank (Benson, 2001), which provide much donor funding for Tanzania’s health care budget and thus had a strong influence on the government’s decisions (Shiner, 2003). Along with insisting on user fees in public facilities, the IMF and World Bank encouraged Tanzania to promote private health care facilities. These changes were part of global structural adjustment
policies that were required if a government hoped to secure loans from the World Bank and IMF (Benson, 2001). As a result, many private health facilities were soon constructed throughout Tanzania, but mainly in urban areas.

This expansion of the private sector has been typical of low- and middle-income countries recently (i.e. since the 1990s; Kumaranayake et al., 2000). However, the effectiveness of private facilities in Tanzania has been questioned (Benson, 2001; Shiner, 2003). Private health care facilities tend to be concentrated in urban areas, where residents already have more choice in health care facilities compared to rural populations. That is, while private facilities could be effective in increasing access to care in rural populations, urban populations who already have access to multiple facilities are the ones who receive the additional care options from private facilities. This creates inequities in access to healthcare for rural and urban populations, which will be discussed later in this chapter.

In 1993, right before the introduction of user fees in public facilities, Benson (2001) studied the impact of private facilities in the Arumeru and Arusha Districts of Tanzania. In these districts, 50 new health facilities were built between 1986 and 1993, with only 6 of these being public. He found that although private facilities greatly outnumbered public, especially in urbanized areas, those few public facilities met more of the local population’s needs than the many private facilities. Private facilities were typically built in areas where the surrounding population already had access to another facility, while public facilities were typically built in areas that did not have an existing facility. Benson found that urban residents have several health facility options, with a mix of private and public, while rural residents often have only one outdated public clinic that is accessible. For the purpose of his study, Benson defined “accessible” as being within a five-kilometer distance of home. Benson related this finding to the “Inverse Care Law”: “the best health facilities almost always end up in places with the least need for these facilities” (Hart, 1971, p. 412).
Levels of care

The public health care system is divided into three main levels of care, which the Ministry of Health and Social Welfare (MOHSW) has outlined (2008). The lowest level, Level I, is at the district level. At this level, primary health care is offered through dispensaries that target about three to five villages averaging 10,000 people each. However, the MOHSW is planning to expand this level of care by providing a dispensary for every village. This will be done through the Primary Health Services Development Program (PHSDP), which will be funded by MOHSW and require the addition of 5162 dispensaries by 2017. Dispensaries can refer patients to health centres, which serve about 50,000 people and provide in-patient care. The highest scale within Level I is district hospitals, which serve about 250,000 people. District hospitals are located in 105 of the 126 districts in Tanzania. In the 21 districts without government hospitals, faith based organization (FBO) hospitals are used as proxies for district hospitals. Through the PHSDP, the MOHSW also plans to add 2075 health centres and 8 district hospitals by 2017.

Level II of the public sector is the regional level. This level consists of regional hospitals, which serve about one million people each. Regional hospitals offer expanded and more specialized services than district hospitals, such as increased clinical and nursing care, surgeries, and increased diagnostic capabilities (WHO, 2004). Finally, Level III of the public sector consists of referral and specialized hospitals. There are only four referral and four specialized hospitals throughout Tanzania. The referral hospitals are Muhimbili National Hospital in the eastern part of Tanzania, Kilimanjaro Christian Medical Centre (KCMC) in the north, Bugando Hospital in the west, and Mbeya Hospital in the south (MOHSW, n.d.). These specialized hospitals provide care for psychiatry, tuberculosis, orthopedics, and cancer, with each of the four hospitals focusing on one of these specialties. Although there are only four public specialized hospitals, some private and FBO hospitals throughout the country offer specialized care as well (MOHSW, 2008).
Health insurance schemes

The Tanzanian health care system is financed through a variety of sources, including user fees, taxation, donors (e.g. bilateral and multilateral agencies), and various insurance schemes. In 2010/2011, health care expenditure accounted for 12% of total government expenditure. This money came from both taxation and donor support (Bultman et al., 2012). In 2006, approximately 23% of health care financing came from user fees (out-of-pocket, point-of-care costs). Despite the variety of insurance schemes available, only 18.1% of Tanzanians were covered by insurance in 2011, with coverage increasing with wealth. However, this is a major improvement from 2008, when only 8.5% of Tanzanians were covered by insurance (Bultman et al., 2012). In order to continue expanding health insurance coverage across the population, the MOHSW has set a goal of 30% coverage by 2015 (Bultman et al., 2012; Kuwawenaruwa & Borghi, 2012), although the Ministry’s actions for expanding coverage are still in the early planning stage (Bultman et al., 2012).

Although there are a variety of public and private health insurance schemes in Tanzania, there are two main schemes that cover the majority of the insured population. The first is the National Health Insurance Fund (NHIF), which currently insures an estimated 5-7% of the population (Bultman et al., 2012; Kuwawenaruwa & Borghi, 2012). Coverage has been expanding since its creation in 2001, with an average membership growth rate of 11.3% per annum. Insurance through the NHIF is mandatory for all public servants, which includes occupations such as civil servants and emergency service workers (e.g. paramedics). Employees and employers each contribute to paying 6% of the employee’s gross salary to the NHIF. While the NHIF includes a wide range of benefits, an important exclusion is services provided by MOHSW’s disease control programs, although it is unclear why this exclusion has been made
This could have profound implications on these employees’ ability to access treatment for communicable diseases such as malaria, which will be discussed later.

The second major health insurance scheme is the Community Health Fund (CHF), which currently insures an estimated 8-10% of the population (Bultman et al., 2012; Kuwawenaruwa & Borghi, 2012). The CHF began in 1996 with a pilot in Igunga district (Mtei & Mulligan, 2007), and is now available in 108 of 133 districts in Tanzania (Bultman et al., 2012). While the CHF operates mainly in rural districts, an urban cousin, called the Tiba Kwa Kadi (TIKA), began operating in 2009 in Dar es Salaam (Kuwawenaruwa & Borghi, 2012). Communities with CHF/TIKA schemes decide on the annual per-person membership fee in that community, which is typically TZS 5,000-20,000 (US$3.11-$12.45; Bultman et al., 2012; Kuwawenaruwa & Borghi, 2012). This is done using community councils and is based on the community budget, since CHF/TIKA are community funds. The membership fee provides member households with primary level health care. Unlike the NIHF, the CHF/TIKA insurance scheme has been experiencing negative membership growth. At its peak in 1999, CHF membership was 23%. The drop in membership is thought to be due to a variety of factors, including but not limited to inability to pay the membership fee, relatively low cost of out-of-pocket user fees in some districts, perceived poor quality of health services, and lack of education about health insurance (Mtei & Mulligan, 2007).

In addition to the NIHF and CHF/TIKA health insurance schemes, a few other schemes together cover about 1% of the population. One of these is the National Social Security Fund’s (NSSF’s) Social Health Insurance Benefit (SHIB) scheme. While all private sector employees must participate in the NSSF, NSSF members can choose whether to participate in the SHIB. Currently, only about 10% of private sector employees are members of SHIB. The SHIB covers outpatient and inpatient care, but only at select facilities. In some districts, there is a shortage of approved facilities, which may contribute to the scheme’s low membership. Low membership is
also thought to be due to alternative health benefits offered by employers, as well as the widespread belief that SHIB membership will decrease an employee’s pension (Bultman et al., 2012).

In addition to the previously discussed nation-wide health insurance schemes, small-scale schemes called micro-insurance are also available. Micro-insurance is a relatively new concept (the first scheme was started in the late 1990s), so membership is still low. It is provided by nongovernment sources such as religious groups or private sponsors/insurers and schemes tend to be community-level programs (hence the term “micro”). Membership is voluntary, and benefits vary depending on the specific scheme. Similar to micro-insurance, for-profit private insurance is also available, but membership is low. Low membership in micro-insurance and private insurance schemes is thought to be due to some of the same reasons behind low membership in the NIHF, CHF/TIKA, and SHIB; recurring themes are poor quality of health care, inability or unwillingness to pay membership fees, and a lack of knowledge of health insurance (Bultman et al., 2012).

Despite the variety of health insurance schemes available, there are clear membership disparities between classes. While an estimated 13.5-15% of the richest wealth group is covered by health insurance, only 2-4% of the poorest wealth group is covered. Similarly, the variety of health insurance schemes increases with wealth (Kuwawenaruwa & Borghi, 2012). The poorest and second poorest of five wealth groups belong only to the CHF. While the middle and second richest wealth groups belong to the NIHF and SHIB as well, private insurance appears to be available only to the wealthiest Tanzanians (Kuwawenaruwa & Borghi, 2012). In addition, there are inequities in terms of need for and benefits of health care. The wealthiest 20% of the population represents about 19% of health care needs, but receives about 23% of health care benefits, giving a +4-point differential between benefits and needs. The poorest 20% of the population has an estimated 22% of health care needs, but they receive only about 12% of
benefits, giving a -10-point differential. Interestingly, there is a sharp contrast between the poorest and second poorest wealth groups. The second poorest wealth group represents 20% of health care needs but receives about 24% of benefits, giving a +4-point differential (Mtei et al., 2012). These differentials show that while the wealthiest and second poorest wealth groups receive more benefits than they need, the poorest Tanzanians face the greatest barriers in accessing needed healthcare.

**Health Care Professionals**

There are various types of health professionals in Tanzania. Medical doctors have five years of medical training, including coursework and clinical work. Clinical officers (COs) have three years of training in medicine and community health. Assistant medical officers (AMOs) are a level above COs and a level below medical doctors, with two years of additional clinical training beyond that of COs. The rest of the health professional pool is comprised mostly of pharmacists, dentists, nurses, and midwives. Certified health professionals complete their training at universities throughout Tanzania. According to Kaaya et al. (2012), there is a disproportionate number of health professionals of varying specialties in each district, with 39 nurses and midwives, only three or four physicians, and not even one pharmacist or dentist for every 100,000 Tanzanians. By contrast, the United States has 810 nurses, 240 physicians, 80 pharmacists, and 60 dentists for every 100 Americans (MUHAS & UCSF, 2011).

The MOHSW has acknowledged significant shortages in the health workforce in both the public and private sectors. According a report by the United Republic of Tanzania (2008), the lowest shortage in the public sector (48%) is in referral or specialized hospitals. The highest shortage in the public sector (74%) is in training institutions, which are medical facilities (i.e. hospitals) that carry out training and education of health professional students. The opposite trend
is seen in the private sector, with the lowest shortage (62%) being in training institutions and the highest shortage (88%) being in non-training hospitals. From looking at the lowest shortages in each sector, it could be strongly argued that there is a severe shortage of health workers in all types of facilities in both the public and private health sectors. One reason for these shortages is thought to be the migration of health professionals from Tanzania to more developed countries. This migration is a problem throughout most of sub-Saharan Africa. After receiving their education and training, many health professionals choose to migrate to countries such as the United Kingdom, Canada, or the United States (Eastwood et al., 2005). This migration, referred to as a “brain drain”, will be further discussed later in the chapter.

**Sector preference**

In addition to the severe shortages of health workers across Tanzania, there are often disparities at the district level. This is often caused by worker preference for either the public or private sector. In rural districts especially, it has been found that most health care workers tend to prefer the public sector (Songstad et al., 2012). This is likely a major contributing factor to the higher shortages of health workers in the private sector compared to the public sector (United Republic of Tanzania, 2008). In a study conducted by Songstad et al. (2012), focus groups comprised of nurses, COs, and AMOs revealed some of the most common reasons for public sector preference in one rural district. The most influential factor was the better pension scheme that is offered by the public sector. A better pension scheme provided a sense of long-term financial security for public sector health professionals. For these workers, this factor seemed to outweigh any negatives to working in the public sector (e.g. shortage of medical equipment/supplies and poor infrastructure); workers in the private sector acknowledged this as well. Other reasons for public sector preference were better health worker rights and more respect
compared to the private sector. For instance, one public sector nurse claimed that workers in the private sector could be fired for being sick for a long period of time, while public sector workers would still have a job after they had recovered. Another driving factor for public sector preference is a lighter workload, along with more lenient working hours. Private facilities are much busier and so workers do not get a break, while public facilities face less demand and so are more laid back for workers. The relaxed and slow pace of the public facilities is more appealing.

However, there are several benefits for working in the private sector as well, even though these benefits did not seem to be enough motivation for most health workers in rural districts. One benefit of the private sector is that there are more opportunities for employer-funded advanced education. The government is not able to provide such funding for public sector employees. Another benefit found is that there is a better quality of housing for health care workers in the private sector. Health care workers in the public sector have claimed that their government-funded staff quarters are generally of poor quality (Songstad et al., 2012). Finally, private sector facilities typically have better medical equipment and infrastructure than public facilities, and so can offer a better quality of care. Despite this better quality of care, most rural workers still tend to prefer the public sector. This creates an even larger disparity of health professionals, since most patients prefer private facilities while most workers prefer public ones. In other words, private facilities have a high demand for services but few workers to meet this demand, while public facilities have a lower demand but more workers (Songstad et al., 2012).

**Education and training**

As previously mentioned, there is an extreme shortage of health professionals in Tanzania. As a result, many health professionals work beyond their level of training in order to compensate for a lack of supervision by a professional with higher training. However, there has
been an increased effort in recent years to expand medical education in order to minimize the current shortage. At present, there are eight universities in Tanzania that train health professionals, six of which train medical students to become physicians. Three of the six physician-training universities are located in Dar es Salaam, with one each located in Moshi, Mwanza, and Dodoma (Kaaya et al., 2012). Until 1997, only one of these universities (Muhimbili University of Health and Allied Sciences, or MUHAS) was training health professionals. Kaaya et al. (2012) estimate that only about 50 medical students were admitted each year until additional universities began training. In 1999, when there were four medical universities, 184 medical students were admitted. Based on the most recently available data, 756 medical students were admitted in 2009 when all six universities had started their medical training programs. This shows tremendous improvements in efforts to produce physicians in order to improve health care in Tanzania. However, other health professional programs are not admitting nearly as many students annually. Kaaya et al. estimate that 120 pharmacy students, 20 dental, 130 nursing, and 29 public health (specifically environmental health) students matriculate annually.

In addition to increasing the number of matriculating medical students, medical universities in Tanzania have made efforts recently to update and improve their curriculum and training activities. This is especially the case for MUHAS, which is trains the largest number of health professional students (Kaaya et al., 2012). One of the many international partnerships that MUHAS has formed is a partnership with the University of California San Francisco. This partnership was formed in order to facilitate curriculum innovation and faculty development at MUHAS (Kaaya et al., 2012). In order to comply with new government requirements, MUHAS introduced competency-based curricula in 2011 (MUHAS & UCSF, 2011). This new curricula emphasizes skills such as professionalism, clinical skills, and relationships with patients and colleagues. For example, in order to improve MUHAS medical students’ surgical skills, a “surgical skills laboratory” course was created. This course allows students to use real surgical
tools on a simulation of the body made of PVC and foam. Another goal of the MUHAS-UCSF partnership is to increase the number of practicing health professionals, especially physicians. Currently, there are not enough practicing professionals to adequately train and supervise recent medical graduates. This creates a burden on the health care system, and leads to many new graduates seeking employment in administrative positions or overseas. Through the MUHAS-UCSF partnership, a tool called ICAD (Increasingly Clinically Active Doctors in Tanzania; UCSF, 2014) has been developed to analyze the impact and costs of policies that would increase the number of practicing health professionals (MUHAS & UCSF, 2011).

**Internal and external losses of health professionals**

Even though the number of health professional students is increasing, there are both internal (i.e. domestic) and external (i.e. international) losses of graduates, which keep the number of practicing professionals quite low. Kaaya et al. (2012) attribute these losses to two main factors: 1) there are long delays in assigning recent graduates to their placements, and 2) the potential salaries, benefits, and workplace conditions (especially in public facilities) are often considered unattractive. Both of these factors cause graduates to seek alternative employment, often in administrative positions (e.g. within NGOs) or overseas.

A recent report from Sikika, a Tanzanian health NGO, and the Medical Association of Tanzania (MAT), discusses findings from a study that tracked health professional graduates. The study found that 39.6% of tracked graduates have abandoned medical practice to pursue other opportunities (Sikika & MAT, 2013), such as those described by Kaaya et al. (2012). Another 41.6% of graduates are working in urban areas, with about a third of graduates practicing in Dar es Salaam, leaving only a small proportion of medical graduates who are practice medicine in rural Tanzania. In addition, 8.2% of graduates were found to have left Tanzania, creating an
external “brain drain”. Furthermore, 38.8% of tracked graduates did not have a work placement at the time of the study. Throughout all levels of the health care system, the MOHSW estimated that in 2006 there were 65% and 85.9% shortages of health professionals in the public and private sectors, respectively (MOHSW, 2008). These data show the severity of the losses of medical graduates in Tanzania and the causes of the extreme shortage of practicing health professionals. In order to retain more medical graduates, the concerns described by Kaaya et al. (2012; see above paragraph) will need to be addressed.

Tanzania and other sub-Saharan African countries are amongst the countries that are most disadvantaged by the so-called “brain drain” in which health professionals that are trained in one country (e.g. Tanzania) leave to find work abroad, usually in higher income countries, due to the prospect of better pay and working conditions. Eastwood et al. (2005) describe the “merry-go-round” of health professional migration out of sub-Saharan Africa: “Tanzanian, Kenyan, or Nigerian doctors moved to South Africa, South African doctors moved to the UK, British doctors moved to Canada and the USA, and Canadian doctors migrated to the USA, producing a circular movement around the globe” (p. 1894). However, this migration is quite unidirectional, leaving Tanzania and other sub-Saharan African countries with extreme shortages of health professionals. Those concerns described by Kaaya et al. (2012) will need to be addressed in order to motivate health professionals to stay in Tanzania. For example, the MOHSW might need to find funding to increase health professionals’ salaries.

Traditional Medicine

Kayombo et al. (2012) define traditional medicine (TM) as “health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral based medicines, spiritual therapies, manual techniques and exercise, applied singularly or in combination to treat, diagnose
and prevent illnesses or maintain well-being” (p. 1). Traditional medicine has long been used in Tanzania and throughout Africa; it existed well before the introduction of modern health care. During African colonization (from the 1880s until independence in 1961; Stangeland et al., 2008), modern, or Western, health care was introduced, and both forms of care were used. However, the two systems remained distinct and separated. In Tanzania, British colonizers even forbade cooperation between TM practitioners (TMPs) and Western physicians. Throughout Africa, TM was often associated with witchcraft and supernatural forces. Consequently, colonial powers often banned or discredited TM (Stangeland et al., 2008).

After gaining independence, many African countries embraced TM as a way to regain African identity and culture (Stangeland et al., 2008). Recently, WHO (2002) has estimated that up to 80% of Africans use TM to fulfill a variety of health care needs, such as HIV/AIDS, cancer, and fungal infections (Stangeland et al., 2008). However, WHO acknowledges that precise data on TM usage is lacking. In Tanzania, it has been estimated that 60-70% of the population seeks health care from TM practitioners (Kayombo et al., 2012). Although the task of determining precisely who, when, where, why, and how Tanzanians use TM is complex, many researchers have contributed to answering some of those questions. Often, research compares a population’s use of TM to their use of modern medicine (see below).

**Current state of traditional medicine in Tanzania**

Over the past several years, there has been much research into the development and safety of traditional medicines. The Institute of Traditional Medicine (ITM), founded in Dar es Salaam in 1991 as a unit of MUHAS, is one entity conducting such research. It hopes to maintain consistency and safety with herbal medicine and biological testing by producing raw materials to be used in herbal medicines. Specifically, ITM is focused on the development of antiviral,
anticancer, antiprotozoan, and antimalarial medicines (Stangeland et al., 2008). Recently, WHO has been introducing efforts to regulate TM and advocate further development of herbal medicines so that TM can be used to expand health care coverage worldwide (Kayombo et al., 2012). WHO’s African Regional Office (AFRO) has identified priority health issues for developing medicines in Africa (Stangeland et al., 2008). These priority issues are HIV/AIDS, hypertension, sickle cell anemia, malaria, and diabetes mellitus. The latter two diseases will be discussed extensively later.

The WHO’s estimation that up to 80% of the African population uses TM is supported in the high prevalence of TM practitioners (about 1 per 500 people) compared to conventional medical practitioners (about 1 per 40,000 people; WHO, 2002). These ratios are similar in Tanzania, at 1:350-450 for TM practitioners and 1:33,000 for conventional practitioners (Stangeland et al., 2008). WHO argues that in many poorer populations, such as those in sub-Saharan Africa, TM may be the only affordable health care option. Additionally, as WHO is quick to point out (WHO, 2002), TM also has a strong position within widespread traditional belief systems. Its cultural and historical significance is so important that even conventional medical practitioners frequently use TM to treat their own illnesses.

TM plays a role in not only healing biological illnesses, but also improving mental health through the spiritual component of TM. Kayombo et al. (2012) found that half of the 33 health center or dispensary managers they interviewed admitted to using TM to treat a variety of illnesses. Although not necessarily reflective of their own experiences with TM, the managers spoke positively of TM practitioners’ treatment of HIV/AIDS and mental illnesses (e.g. Schizophrenia). When asked about patients, these managers noted that TM is widely used even in populations living near conventional health facilities. In the specific case of HIV/AIDS, a variety of plants have been found to contain compounds that have powerful immunostimulant effects that interfere with the HIV life cycle and prevent opportunistic infections (Moshi, 2005).
**Benefits of traditional medicine**

Traditional medicine has two main benefits that are commonly discussed in the literature. The first is that TM stems from and incorporates cultural belief systems (Kayombo et al., 2012; Moshi, 2005; WHO, 2002). Kayombo et al. (2012) argue that health has both biological and cultural components, and the cultural basis of TM contributes to improved biological health by providing holistic care. The second benefit, and arguably one of the most powerful reasons for TM’s continued wide use, is that TM is more affordable than modern medicine. Often, TM is the only affordable method of health care (Moshi, 2005; WHO, 2002). The affordability of TM has led to observed increases in its use, with recent estimates of 629 million people worldwide who use TM. In fact, the WHO has argued that TM is one of the most effective methods to providing access to basic health care for the entire world population because of its low cost (Kayombo et al., 2012; WHO, 2002).

While TM is generally very inexpensive, it has been found to provide effective treatments for a wide range of illnesses, both communicable and non-communicable. In fact, these effective TM treatments have often been used in the development of pharmaceuticals that are used in modern health care. Pharmaceutical companies isolate the active compound from the TM treatment (usually a plant) and create a new drug with that active compound (Moshi, 2005). Moshi (2005) discusses a variety of pharmaceuticals that were developed from TM: anticancer, antimalarial, anti-asthma, anti-diabetic, anti-HIV, antibacterial, and antifungal drugs. For example, cinchona bark had long been used in South America for the treatment of malaria before quinine was isolated from the bark. This isolated quinine has been used to synthesize quinine analogs such as chloroquine that have been widely distributed by formal health care systems for the treatment of malaria (Moshi, 2005).
Despite the widespread use of TM and its aforementioned benefits, negative implications of TM have certainly been observed as well. One major implication is that initial treatment efforts with TM can delay the treatment of an illness with modern medicine. In the case of life-threatening illnesses, delays in seeking conventional treatment can lead to death, when it is likely that a patient would have survived, or at least lived longer or more comfortably, had he or she not first pursued treatment with TM. Such was the case in a study by Blanke et al. (2008). In this study, the authors recorded the outcomes of hospital treatment for children under five years of age presenting with symptoms of “enema syndrome”, including respiratory distress, hypotension, abdominal distension, and even loss of consciousness. Before seeking hospital treatment, TM treatment was used for 41.4% of children. The authors found that children initially treated with TM were significantly more likely to die than children who bypassed TM (20.5% vs. 8.5%). Children initially treated with TM arrived at the hospital, on average, later after the onset of symptoms than children not treated with TM (five vs. three days). This delay alone could not account for the increased mortality; the study showed that a combination of delay in treatment and the use of possibly toxic TM treatments led to increased mortality. From this the authors proposed that, although their study did not prove that TM treatment is toxic, it indicated that TM could be a marker for harmful health-seeking behavior. In other words, the TM treatments may not be harmful on their own, but the behaviors and practices involved with TM delay effective treatment.

In their study of health care utilization in 33 districts in Tanzania, Kayombo et al. (2012) found several health-related risks of TM. The authors categorized these risks as either 1) related to patient handling and diagnosis, or 2) related to practice and treatment. In addition, the health workers that were interviewed in their study listed several ethical issues associated with TM, such
as the use of harmful practices or minimally effective doses. These health risks and ethical issues are summarized below (Table 3). The points in the table were listed by Kayombo et al. and have been arranged into tabular format here for ease of reading.

<table>
<thead>
<tr>
<th>Table 3: Risks Associated with Traditional Medicine</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Risks related to patient handling and diagnosis</strong></td>
</tr>
<tr>
<td>1. Delays in proper treatment for accident victims</td>
</tr>
<tr>
<td>2. Child fevers and malaria confused with superstitions associated with witchcraft</td>
</tr>
<tr>
<td>3. Diagnosis is based only on symptoms, with no laboratory support to confirm</td>
</tr>
<tr>
<td>4. Minimal scientific health knowledge leads TM practitioners to misadvise patients</td>
</tr>
<tr>
<td>5. Herbal purgatives and emetics can lead to dehydration</td>
</tr>
</tbody>
</table>

**Integrating traditional and modern health care**

While TM has cultural significance and tends to be more affordable than modern medicine, the formal health care system focuses on modern medicine. Scientific research and clinical trials overwhelmingly study the effectiveness of modern treatments (e.g. synthetically produced pharmaceuticals), so those are the treatments that tend to be approved and promoted in the health care system. However, some countries including Tanzania have been working to integrate traditional medicine into the modern health care system (Stangeland et al., 2008). In 2005, the Traditional and Alternative Medicine Act went into effect in Tanzania. This Act formally established the Ministry of Health and Social Welfare’s authority to regulate TM. It is intended to integrate TM into the modern health care system, particularly by encouraging
cooperation between modern health professionals and traditional healers. It also provides legal protection for traditional healers against piracy of their treatments (Stangeland et al., 2008).

Around the time that the Traditional and Alternative Medicine Act went into effect, Kayombo et al. (2012) found that there was a lot of interest from modern health professionals in Tanzania in collaborating with traditional healers and providing training in order to relieve the problems and ethical issues that exist with TM (see Table 3 above). Specifically, health professionals suggested relieving ethical concerns by 1) training traditional healers to provide them with knowledge and skills for identifying serious health problems that would require urgent treatment; 2) creating awareness of TM ethical issues among traditional healers, modern health professionals, and communities; 3) developing additional policies and legislation to regulate ethical issues of TM; and 4) establishing pricing systems and prescription guidelines for traditional treatments (Kayombo et al., 2012). The Traditional and Alternative Medicine Act intends for the MOHSW to address these concerns and alleviate them by providing training and legislation for traditional healers and their practices. In addition, there is interest among educators to integrate TM history and awareness into school curriculums (Kira and Komba (2012). Educators have suggested that doing so might help to promote scientific research and development of TM treatments.
Chapter 4

Health-Seeking Behavior for Malaria and Diabetes Mellitus

Malaria

Tanzania’s Ministry of Health and Social Welfare (MOHSW) has estimated that 90% of its 40 million residents are at risk for malaria (MOHSW, 2010). As a result of this widespread risk, an estimated 14-18 million clinical cases of malaria and 100-125,000 subsequent deaths are seen in Tanzania each year (MOH, 2003). Pregnant women and children under five years have been identified as the most vulnerable populations, with about 36% of Tanzania’s under-five mortality due to malaria (MOHSW, 2010). Pregnant women and children are particularly burdened by the anemia that results from malaria. In addition, these population groups have reduced immunity to malaria parasites. Children’s immune systems are still developing, and pregnancy reduces the acquired immunity that women with previous malaria infections had developed (MOH, 2003).

Influences on health-seeking behavior

Socio-cultural factors

Cultural factors can have a major impact on how Tanzanians pursue health care for malaria. One clear example of this is the traditional beliefs behind the cause of convulsions in
severe malaria (outlined above). Cases of mild malaria are considered to come from a Western disease, and therefore Western (i.e. biomedical) treatment is sought (Comoro et al., 2003). However, the convulsions that are characteristic of severe malaria are sometimes thought to have spiritual causes, and therefore traditional medicine is sought (Oberländer & Elverdan, 2000; Comoro et al., 2003; Foster & Vilendrer, 2009; de Savigny et al., 2004). Although it is not often known why or how someone becomes possessed with an evil spirit, specific explanations have sometimes been offered. One such explanation is that a spirit can be picked up from being in the hot sun near large stones or trees (Oberländer & Elverdan, 2000).

Household power dynamics also play a significant role in treatment decisions (Oberländer & Elverdan, 2000; Montgomery et al., 2006). In some of Tanzania’s ethnic groups, such as the Bondei in the northeast, the father of the household makes the ultimate decision on if and how to pursue treatment (Oberländer & Elverdan, 2000). Therefore, although women are usually the caretakers, they must first get permission from men before pursuing treatment for perceived malaria. Montgomery et al. (2006) also found that, even though symptoms of malaria are typically first recognized by women, women have limited decision-making power in the household and therefore appropriate treatment may be delayed or otherwise hindered. They also often have very little control of a household’s financial resources. Instead, male members of a household decide when and what type of treatment to seek, and how much money can be used to procure treatment. In addition, mothers are often viewed as uneducated, ignorant, lazy, neglectful, and/or deceptive by healthcare workers, so necessary care is not always provided in a timely manner (Montgomery et al., 2006).

Contrary to Montgomery et al.’s (2006) findings, in some areas of Tanzania, such as in the Kibaha district, elder generations of females have a strong influence on the health-seeking behavior of younger females for their sick children. In the Kibaha district, some young mothers have been found to want to take their children with suspected severe malaria to the hospital for
treatment. However, the mothers’ mothers-in-law or grandmothers forbid them, claiming that the hospitals will kill the children and the young mothers will be responsible for their deaths. Therefore, the young mothers feel as if they have no choice but to take their children to traditional healers, the accepted form of treatment among elder females (Comoro et al., 2003).

**Health education/literacy factors**

The health-seeking process for malaria in Tanzania is impacted by an inconsistent understanding of the symptoms associated with malaria. The lack of association between convulsions and severe malaria has already been discussed. However, some studies have also found a lack of understanding of the symptoms of mild malaria. For instance, Kamat (2006) found that, contrary to the common blame on user fees in delaying treatment for malaria, many mothers actually delayed treatment for their children’s malaria because they thought that their children only had a fever and nothing more. It is only after about two days that these mothers realized that the illness might be something more serious than fever.

Women are often the targets of public health actors’ health education interventions because they are thought to be the first to recognize and manage illnesses. However, Montgomery et al. (2006) argue that this approach is misguided; since decisions to seek treatment are usually made by male household members, educating the women is not terribly effective. In fact, the authors argue that health education interventions may actually disempower women, rather than empowering them as intended. They believe, “Women may internalize the role of ‘the uneducated’ and lose faith in their own knowledge. We found some instances of women becoming dependent on the medical profession to direct their behaviour” (Montgomery et al., 2006, p. 1665). Therefore, Montgomery et al. (2006) have called for health education to be directed toward entire communities, including men, in order to improve health-seeking behavior.
Economic factors

It is estimated that Tanzania spends USD $2.14 per person per year on malaria services. This is out of a total of $11.37 per person per year spent on health (de Savigny et al., 2004). Citizens pay about three-quarters of health expenditures, with the rest paid for by the government and donors. Due to this imbalance, poorer Tanzanians face a higher burden of treatment cost than wealthier Tanzanians. However, a study comparing modern and traditional treatment paths for severe malaria in the Rufiji district in southern Tanzania (de Savigney et al., 2004) found that treatment-seeking paths were the same for the poorest and wealthiest households. Across economic groups, caretakers tend to bypass modern treatment in favor of traditional treatment whenever convulsions are occurring. Although the authors did not suggest a reason for this finding, it suggests that non-economic factors, such as socio-cultural or health education/literacy factors, may have a bigger influence on health-seeking behavior, a hypothesis echoed by Kamat (2006).

Despite de Savigney et al.’s (2004) finding that economic factors do not strongly influence health-seeking behavior, other studies have found otherwise. Muela et al. (2000) found that in Ifakara, people are often willing, but not able, to pay for biomedical care. However, they can afford similarly expensive traditional care. The authors suggest that this paradox is likely due to traditional healers’ acceptance of alternatives to cash payments, such as food or work, as well as a community’s willingness to contribute to traditional care payment. In contrast, the burden of biomedical care costs fall mainly on the patient. Similarly, Sabot et al. (2009) found that the high costs of artemisinin-based combination therapies (ACTs) tend to prevent poorer Tanzanians from purchasing them. The study’s researchers bought ACTs from the manufacturer, Novartis, and sold them to a wholesaler in Dar es Salaam for 88% below the price offered to public buyers. The wholesaler was then instructed to sell the drugs to drug shops in the study districts (Moswa and
The researchers found that by subsidizing the ACTs, consumer prices were reduced and the populations’ use of the drugs increased significantly.

**Geographic factors**

According to de Savigny et al. (2004), 90% of Tanzanians live within one hour of a government-run health facility. However, this is not always a primary health care facility. As a result, patients and caretakers in rural districts sometimes bypass the standard referral process and instead travel directly to a district or regional hospital to seek treatment (Manongi et al., 2005). Caretakers sometimes bypass primary care facilities simply because a district or regional hospital is closer. Other times, it is because caretakers lack faith in the treatment received at primary care facilities or because primary care facilities do not have proper diagnostic tools (Manongi et al., 2005). Along with poorer access to primary health care facilities, rural areas have been found to have poorer access to malaria medications. In a recent study of access to ACTs, the medications were significantly more available to individuals in urban areas than in rural areas (Sabot et al., 2009). This is possibly due to the higher number of drug dispensaries in populated areas, which creates competition and subsequently higher demand for those shops to carry ACTs.

**Quality of care factors**

Finally, individuals’ perceptions of the quality of care influences health-seeking behavior for malaria. For example, as previously discussed, severe malaria is often treated with traditional medicine because it is believed that anti-malarial injections given by modern health care providers will kill the patient (Foster & Vilendrer, 2009; Reid, 2010; Comoro et al., 2003).
Despite the use of biomedical care for mild malaria treatment, caretakers do not always trust the quality of care provided by some health facilities. Caretakers are especially skeptical of primary health care facilities, and often bypass them to go directly to a district or regional hospital. The skepticism stems from a lack of laboratory services for diagnosis, a subsequent lack of appropriate treatment, and/or past experiences with ineffective anti-malarials prescribed by primary care providers (Manongi et al., 2005). Some caretakers have even been found to opt out of at-home treatment for their children’s malaria, including sponging to reduce fever, in order for their children’s symptoms to progress so that it becomes clear that they have malaria. These caretakers do this because they believe that, if they reduce their children’s fever, health care workers will not recognize that the children have malaria, and will subsequently not provide appropriate treatment (Kamat, 2006).

Miscommunication between health care providers and caretakers has also been shown to deter timely and appropriate malaria treatment. In a study by Kamat (2006), only about one-third of mothers were told by a doctor or nurse that their children had malaria. Many other mothers were simply told that their children had fever. All of these mothers’ malaria-inflicted children were given anti-malaria treatment, but the majority of mothers remained oblivious to their children’s malaria diagnosis. Kamat argues that, if communication is improved so that mothers are made aware that their children have malaria, more timely and appropriate treatment may be sought. Currently, some health care providers do not explain well enough to caretakers that their children’s symptoms are related to malaria and should be treated quickly. As a result, caretakers continue to prolong what Kamat (2006) calls the “wait and watch” period (p. 2952) and therefore delay proper treatment for malaria.
Public health programs

In an effort to reduce the prevalence of malaria, there has been a push for the increased distribution and use of insecticide-treated nets (ITNs). This push has come from governmental (MOHSW) and non-governmental programs alike. Two ITN promotion projects that reduced the burden of malaria in the late 1990s were the Kilombero Net (KINET) project and the Social Marketing for ITNs (SMITN) project (Mastandrea, 2009). KINET was operated in the Kilombero Valley by Ifakara Health Institute and the Swiss Tropical Institute, while SMITN was operated by Population Services International. Both of these projects promoted social marketing of ITNs and especially focused their efforts on increasing ITN accessibility for pregnant women because of their reduced immunity to malaria. KINET was a major contributor to later ITN programs because it showed an association between bed net use and a reduction in malaria morbidity and mortality. The program found that regular use of ITNs resulted in a 27% reduction in child mortality and a 60% decrease in child anemia, as well as reduced malaria in pregnant women. SMITN, now re-named SMARTNET, was innovative in that it developed subsidized insecticide re-treatment kits (Mastandrea, 2009).

SMARTNET later became a component of a government-sponsored ITN program – the national ITN strategy (NATNETS). This strategy was started by MOHSW in 2000 and has become a multi-donor, multi-partner effort. Major donors include the Global Fund (GF) to Fight AIDS, Tuberculosis and Malaria, President’s Malaria Initiative (PMI), World Bank, and Swiss Agency for Development and Cooperation, along with other smaller donors (NATNETS, 2012). The GF has funded vouchers for pregnant women to cover costs of ACTs and rapid diagnostic tests. The PMI has funded vouchers for infants, behavior change communication programs, and indoor insecticide spraying. The World Bank has provided substantial funding for Tanzania’s health sector, particularly for the purchase and spraying of ITNs. The Swiss Agency has provided
managerial and technical support for the NATNETS program. NATNETS also has several implementing partners and private partners (NATNETS, 2012).

There are three major components of NATNETS: 1) an ITN cell, which is the coordinating unit for supporting national ITN accessibility; 2) SMARTNET, which is responsible for scaling up the supply of ITNs; and 3) the Tanzanian national ITN voucher scheme (TNVS), which specifically targets pregnant women for subsidized nets (Magesa et al., 2005). When NATNETS was developed, its goal was to reach 60% ITN coverage of high-risk populations i.e. pregnant women and children under five years, by 2005. Reasons for this specific target are unclear. As of 2010, NATNETS found that 64% of households had at least one ITN in use (NATNETS, 2012). While reaching this goal, the program faced a few challenges in the way. One major challenge was that there was a major shortage in the supply of ITNs after program workers underestimated the number of households that would request a net. Another challenge was disagreements over the type of nets that should be distributed. The MOHSW wanted a more durable, but more expensive, type of net, but major donors such as the GF, PMI, and World Bank did not allow for it because of financial constraints (Bonner et al., 2011).

Another governmental malaria program is the Urban Malaria Control Programme (UMCP) in Dar es Salaam, which began in 2007 (Fillinger et al., 2008). Under UMCP, community members are hired to work in larval surveillance and larvicide application. Unlike ITNs, which are used to prevent mosquito-to-human transmission of malaria, UMCP aims to prevent transmission by destroying the parasitic host. The program includes monitoring and surveillance of *Anopheles* habitats and mosquito densities using remotely sensed imagery. After only one year, there was a 96.5% reduction in *Anopheles* larval habitat abundance in the 15 pilot intervention wards in Dar es Salaam. There was also a 31% reduction in transmission by *Anopheles gambiae s.l.*, the primary malaria vector (Fillinger et al., 2008). Despite the success of the program, information about UMCP’s activities since 2008 could not be found.
One non-governmental malaria program is the ACCESS Programme, which began in 2003 and is funded by the Novartis Foundation for Sustainable Development (Hetzel et al., 2007). The program is implemented in the Kilombero and Ulanga districts in southeast Tanzania. It has three main intervention areas: 1) behavior change for health care seeking, 2) improved quality of care at health facilities, and 3) improved case management in drug shops. Similar to other malaria programs, ACCESS is targeting pregnant women and children under five years of age.

Specific strategies for creating behavior change that are used in the ACCESS program are education of community leaders, social marketing, and campaigns set in maternal and child health clinics. Behavior change is promoted through messages about recommended medications, sources of treatment, prevention methods, and symptoms of severe malaria. These messages are shared largely through road shows that target poor rural populations. The road shows use entertainment, such as comedies and cinema shows, to draw large audiences. Radio spots are used in remote villages where the road show cannot travel (Hetzel et al., 2007).

The ACCESS program’s intervention area of improving quality of care focuses on three main factors: correct diagnosis of malaria through improved laboratory diagnosis, “rational” prescription of drugs such as anti-malarials and antipyretics (i.e. only after malaria has been diagnosed), and appropriate advice on malaria prevention and prescribed treatments. To improve quality of care, ACCESS provides refresher training for health care staff (e.g. clinical staff and lab technicians), as well as rapid diagnostic tests for a few dispensaries previously lacking in diagnostic tools (Hetzel et al., 2007).

Finally, ACCESS’s main strategy for improving case management in drug shops is to support the introduction of Accredited Drug Dispensing Outlets (ADDO), implemented by the Tanzania Food and Drugs Authority (TFDA) and Management Sciences for Health (MSH). Unlike regular drug shops, ADDOs are allowed to sell a limited list of medicines that are normally only available with a prescription. The ADDO project aims to change the behavior, or
rather the education, of drug shop owners and staff in order to increase quality of services. Behavior change is planned through education, incentives, and “regulatory coercion” of drug shop owners.

**Modern health care system approach to treatment**

In Tanzania, especially in rural areas, it is common for people to seek treatment for suspected malaria from dispensaries or general stores, rather than at primary health care (PHC) facilities. This is thought to be due to a wide variety of factors relating to PHC facilities, including poor access to facilities, poor quality of care, shortage of skilled workers and/or essential medications, and long waiting times (Hetzel et al., 2008). Full-scale pharmacies can sell all prescription medications, provided they are supervised by pharmacists. Drug stores may only legally sell over-the-counter (OTC) medications, and they are headed by someone with basic medical training. This training requirement is usually interpreted as at least four years of training as a pharmacy assistant or nurse (Goodman et al., 2007). General stores are not authorized to sell even OTC medications, although they often do. Due to a lack of legal enforcement, drugs stores and general stores often illegally sell some prescription medications, including anti-malarials (Hetzel et al., 2008). However, studies have found that drug store and general store employees generally have inadequate knowledge of the proper treatment of malaria (Hetzel et al., 2008; Minzi & Haule, 2008). Workers at these facilities frequently provide an outdated anti-malarial (e.g. chloroquine) and/or do not know the correct dosing requirements for the given drugs. Chloroquine and sulphadoxine-pyrimethamine (SP) are anti-malarials that were once recognized as the standard of malaria treatment. Due to parasitic resistance of those drugs in Tanzania, artemisinin-based combination therapy (ACT) is now the recommended anti-malarial (Minzi & Haule, 2008). However, pharmacies have been found to continue to stock chloroquine and SP
after they have been deemed ineffective, so patients continue to take treatments to which malaria parasites have already developed resistance. In addition, few drug-dispensing workers know the correct dosing of the new ACT medications. One study found that about one-third of general store owners refer patients with suspected malaria to a higher level of health care, despite having medications in stock (Hetzel et al., 2008). This indicates that, while they do supply the medications, many shop owners recognize and acknowledge their lack of expertise and recommend that customers seek more appropriate treatment.

At the PHC level, there has been a major push by global health actors, especially the WHO, for the use of malaria rapid diagnostic tests (RDTs) in order to improve health care for suspected malaria. Before the introduction of RDTs, and still commonly today, malaria was diagnosed largely on clinical symptoms. Generally, any patient presenting with a fever was prescribed anti-malarials, which led to over-diagnosis and over-treatment. This is thought to have contributed to parasitic drug resistance, prevented the proper diagnosis of other illnesses, and resulted in high wasteful costs for inappropriate treatment (Mubi et al., 2011). RDTs have been introduced as an alternative to microscopy, which is slow and expensive, and is subsequently not readily available. RDTs use blood samples to quickly (i.e. within a few minutes; Mubi et al., 2011) detect specific proteins or enzymes found in malaria parasites (Ishengoma et al., 2011). A recent study (Mubi et al., 2011) compared the prevalence of malaria diagnosis by community health workers who alternated weekly between using RDTs and using clinical symptoms to make a diagnosis of malaria. The patients who were seeing community health workers all presented with fever. It was found that nearly all (96.5%) fever patients seen during clinical symptom-based diagnosis weeks were prescribed ACT medications, while only 53.2% of patients seen during RDT diagnosis weeks were treated with ACT. This is because only 50.3% of patients tested with RDTs were found to be positive (Mubi et al., 2011). These data suggest that half of patients presenting with fever were misdiagnosed with malaria when clinical symptoms were used solely
for diagnosis. Clearly, if this percentage of misdiagnosis is widespread throughout Tanzania, there may be a tremendous level of unnecessary spending and a short-lived effectiveness of the new ACT treatment.

When a patient does have malaria, it is important to receive early diagnosis and treatment to minimize the severity of the illness. However, as mentioned previously, there are several issues with PHC facilities that discourage patients from seeking the appropriate treatment. In order to increase the availability of diagnostics and treatment, efforts have been made by public health professionals to train non-health professionals, referred to as community-owned resource persons (CORPs) in the use of RDTs (Rutta et al., 2012). These CORPs are health workers that receive only minimal training, in this case in carrying out RDTs. Other training includes early diagnosis and treatment with anti-malarials, morbidity questionnaires, and finger prick blood collection. Community members were selected by the researchers to become CORPs based on “specified criteria” (not outlined in the publication) as well as at least primary or secondary education and a “good relationship” with the community (Rutta et al., 2012). Despite the lack of overall medical training, these CORPs have been found to be successful in diagnosing and providing treatment or referrals for malaria, while allowing the misdiagnosis of malaria to be further reduced. Over the course of the study period, malaria incidence decreased by about 66% (Rutta et al., 2012). The success of this study suggests that RDTs can become easily available and accessible even in rural communities, with only a small amount of training needed for CORPs. With the current shortage of trained health professionals in Tanzania, the use of community members for health care could have a significant impact on health care availability for malaria.
Traditional medicine approach to treatment

Mild or uncomplicated malaria is characterized by symptoms such as fever, vomiting, loss of appetite, and diarrhea (Comoro et al., 2003). In Tanzania, this type of malaria is almost always treated with pharmaceuticals and/or modern health care, and is rarely treated by traditional medicine (Comoro et al., 2003; Foster & Vilendrer, 2009; de Savigny et al., 2004). However, traditional medicine is commonly used to treat severe malaria, which is very often accompanied by convulsions. Several researchers have studied health-seeking behaviors for severe malaria in children (Comoro et al., 2003; Foster & Vilendrer, 2009; Oberländer & Elverdan, 2000; de Savigny et al., 2004), and most have found traditional medicine to be a major route of treatment.

The common preference for traditional medicine in the treatment of severe malaria appears to stem from longstanding cultural beliefs. In Tanzania, convulsions are often associated with spiritual, rather than biomedical causes (Comoro et al., 2003; Foster & Vilendrer, 2009; de Savigny et al., 2004). Severe malaria is often referred to as degedege, which is a name given to the spirit of the bird. It is thought that this spirit, sometimes called Shetani (Comoro et al., 2003), which is considered to be bad luck, causes the convulsions that are associated with severe malaria (Oberländer & Elverdan, 2000). As a result of this belief, children with degedege convulsions are taken to traditional healers or are given traditional medicines at home (Comoro et al., 2003; Foster & Vilendrer, 2009). This is especially common in rural areas of Tanzania, while people in urban and peri-urban areas tend to more often believe the biomedical explanation of convulsions (Comoro et al., 2003). Traditional treatment often involves the use of herbal medicines, although non-herbal treatments have also been reported. Two common non-herbal treatments are urinating on the convulsing child, as well as exposing them to elephant dung fumes (Comoro et al., 2003; Foster & Vilendrer, 2009). Elephant dung fumes are often used because it is believed that the bad
Another common cultural belief associated with convulsions is that an injection (i.e. of anti-malarial medicine) will paralyze and kill the convulsing child (Foster & Vilendrer, 2009; Reid, 2010; Comoro et al., 2003). Therefore, children with severe malaria are often not given injections of anti-malarials that could potentially cure them. This belief that injections kill convulsing children seems to have been passed down from generation to generation (Comoro et al., 2003). However, it has been found that there is some truth behind this belief. Children receiving injections, especially in rural clinics, are often injected with needles that are contaminated with bacteria, even if the clinic uses sterilization practices. These bacteria may lead to a bloodstream infection, which when paired with severe malaria can kill the child (Reid, 2010). Therefore, there is scientific evidence that, to some degree, supports this fear of injections for convulsing children.

Although traditional medicine is often involved in the treatment of severe malaria, or degedege, it is common to combine traditional and modern health care for the treatment of both uncomplicated and severe malaria. Caretakers of children with suspected or confirmed malaria often seek treatment using either traditional or modern health care, and then switch to the other if the first did not seem to be effective. There does not seem to be a clear trend on the amount of time a caretaker uses one form of health care before switching to the other. Oberländer & Elverdan (2000) describe malaria treatment in Tanzania as a “stepped process in which the sequence continuously moves from explanation to therapy and on to evaluation, and, if healing fails, the process is repeated” (p. 1354). Clearly, modern and traditional medicines both play major roles in the treatment of malaria for many Tanzanians; it is difficult to determine which treatment method is more significant.
Oberländer & Elverdan (2000) also describe various cases in which either traditional medicine or modern medicine was successful in treating malaria, as well as a case in which both types of medicines failed. Traditional medicine has been found to cure confirmed severe malaria even after modern medicine failed. In one specific case reported by Oberländer & Elverdan (2000), a woman was cured of severe malaria by receiving traditional treatments and undergoing exorcism. Initially, the woman was treated with intravenous quinine and blood transfusions at a hospital after a high concentration of malaria parasites were found in her blood. Despite this treatment, her convulsions continued after treatment, so she visited a traditional healer who gave her some treatment (not specified by the authors). She started to feel a bit better but was not yet cured, so she visited a second traditional healer who determined that an evil spirit was the cause of her illness. After the healer performed an exorcism, the woman was cured. The researchers do not provide any details about the methods used for the exorcism, and it is unknown which method of treatment actually cured the woman.

Diabetes Mellitus

Influences on health-seeking behavior

Socio-cultural factors

Studies on Tanzanians’ socio-cultural influences in health-seeking behavior for diabetes are quite limited in number; one study that does fulfill this purpose comes from Kolling et al. (2010). One consistent finding is that, although diabetes is a disease of the individual, those individuals’ families frequently play an active role in managing the disease. Family members
often provide care through buying medicines, cooking healthy foods, and escorting the individual with diabetes to health care services (Kolling et al., 2010). The strong social support provided by families likely has a very positive effect on the management of an individuals’ diabetes.

Although families often contribute to the care of individual with diabetes, they can also sometimes be the reason that an individual does not receive proper care or medication to manage the disease. Kolling et al. (2010) noted multiple cases when diabetes patients chose to use their resources to help treat another family member’s illness instead of their own. For example, one woman with diabetes had a daughter who was sick. The woman chose to buy medicine for her daughter instead of herself. Elsewhere in sub-Saharan Africa, researchers have found that proper diabetes management can be hindered when diabetics do not cook their own meals. For example, in one study in Senegal, diabetes patients stated that other family members who are responsible for the cooking often do not prepare meals that follow a diabetes-friendly diet (e.g. meals include a lot of rice; BeLue et al., 2013). In these situations, diabetes patients do not properly manage their diabetes and are more likely to have a poorer outcome. Improper diabetes management can lead to high blood sugar levels and complications such as neuropathy and foot ulcers (Bakker et al., 2006; Abbas et al., 2011).

Health education/literacy factors

Health education and literacy factors have been shown to play a role in diabetes management in Tanzania, especially in relation to traditional medicine. Moshi and Mbwambo (2002) found that traditional healers in a rural area of Tanzania (Kilosa district) could not identify diabetes. Although they could recognize specific symptoms, the traditional healers could not relate those collective symptoms to a single disease. Therefore, patients who visit these healers with diabetes-like symptoms are likely not properly managing their diabetes since they are
managing the effects rather than the cause of the disease, and are not even aware that they have the disease.

Moshi and Mbwambo (2002) and Kolling et al. (2010) both found that some of the traditional medicines used to treat diabetes-like symptoms are actually toxic to patients. These medicines, such as aloe vera (Kolling et al., 2010), are likely doing patients more harm than good. Increased health education and literacy for both the traditional healers and the patients could eliminate the use of these drugs. Moshi and Mbwambo (2002) recommended that traditional healers be educated on the toxic effects of some of their treatments so that they can better manage their patients’ diabetes-like symptoms without causing toxicity.

In their study, Kolling et al. (2010) also found that patients were often told that TM could cure their diabetes. It is unclear whether the traditional healers really believed this to be true, or if they used this claim as a tactic to generate business. Although major short-term improvements are sometimes seen in diabetes patients using TM, the claim that TM can cure diabetes has not been verified long-term. Still, some patients choose TM over biomedical treatments because they believe that TM will provide a quick cure, while biomedical treatments would be lifelong burdens (Kolling et al., 2010).

**Economic factors**

Economic factors also have a major influence on Tanzanians’ health-seeking behavior for diabetes. In a comparison of anti-diabetic drugs in Tanzania’s public and private health sectors, Justin-Temu et al. (2009) found that about four times as many diabetes patients attended public clinics compared to those that attended private clinics. This is largely due to the cost differences of services and treatments. Justin-Temu et al. (2009) found that the mean price for one vial of animal insulin was about US$0.55 in public clinics and US$5.45 in private clinics. The authors
argued that this cost difference may be due to differences in the socioeconomic status of the patients at each type of clinic (i.e. private clinics can raise the cost of drugs because their clients tend to be of higher socioeconomic status). Despite the lower drug costs, about 26% of patients attending public clinics could not afford the drugs, while this number was about 10% for patients attending private clinics (Justin-Temu et al., 2009).

Kolling et al. (2010) also described economic factors in their study of health-seeking behavior for diabetes. These economic factors are again strongly related to the role of the family in health-seeking behavior. Sometimes, family members help to pay for a diabetic’s medications, therefore improving the outcome for that person with diabetes. In addition, patients are sometimes able to get money for medications from friends. One patient in Kolling et al.’s (2010) study described how he sometimes visits the business where he used to work to ask former co-workers for money. Even with strong social support groups, diabetes patients sometimes chose to pay for other family members’ medications instead of their own when there is not enough money in the family to pay for everyone’s medications. Such was the case of the woman with the sick daughter (described on p. 51).

The high long-term costs of biomedical treatments sometimes cause patients to opt for lower-cost traditional treatments instead. Sometimes, patients are diagnosed with diabetes at a biomedical health clinic, and then they go to traditional healers for treatment. This is especially the case for those who are told, or who believe, that TM can cure diabetes, as previously described. The combination of lower costs and shorter treatment duration is a big incentive for those of lower socioeconomic classes to opt for TM instead of biomedical care (Kolling et al., 2010).
Quality of care factors

Justin-Temu et al. (2009) found that many patients, especially those who visit public clinics, cannot afford anti-diabetic drugs. There is also a difference in the availability of drugs between public and private clinics. Justin-Temu et al. (2009) and Kolling et al. (2010) found that public facilities were stocked less oral hypoglycemic drugs than private facilities. Therefore patients that visit public clinics have less choice in their treatment options because of availability and affordability factors. As a result, some patients may only manage their diabetes sporadically, based on when the drugs that they need are available. Some patients, such as one described by Kolling et al. (2010), can spend an entire day traveling from clinic to clinic in search of anti-diabetic drugs, sometimes with no success. This inconsistent treatment method will likely lead to poorer health outcomes compared to those patients that are able to access treatment consistently; blood sugar levels are difficult to properly maintain with inconsistent treatment and complications such as neuropathy and foot ulcers are more likely to result. The inconsistent availability of drugs is another factor that pushes some patients to choose TM, which is widely available, over biomedical care (Kolling et al., 2010).

Public health programs

Public health programs for diabetes in Tanzania have largely focused on improving clinical care. This includes diagnosis, referrals for higher-level (e.g. district, regional, or national level) care, nutrition education, and patient education for disease management. There are several on-going diabetes projects in Tanzania, carried out by a wide range of actors such as the World Diabetes Foundation and the International Diabetes Foundation, as well as local actors such as MUHAS. However, very little about diabetes research and care can be found in published
literature. One project, called the “Essential NCD health intervention project” and piloted in 1999, aimed to improve clinical guidelines, quality of care evaluation, health policy, and prevention of diabetes and other NCDs in Tanzania and Cameroon (Unwin et al., 1999). The authors found that prior to the project, primary care and diagnostic tools (e.g. blood glucose measurement tools) for diabetes were lacking in Tanzania. This is because in Tanzania and other countries of sub-Saharan Africa, the health system is already overburdened from the demand caused by communicable diseases. In addition, the WHO has noted a lack of cost-effective methods for disease detection and management for chronic diseases such as diabetes. Follow-up publications for Unwin et al.’s (1999) study could not be found.

Another project, the Step by Step Diabetic Foot Project, focused specifically on educating health professionals to identify diabetic patients at high risk for foot ulcers, a common complication of diabetes that can lead to amputation (Bakker et al., 2006; Abbas et al., 2011). This project is a collaboration between the International Diabetes Federation Consultative Section, the International Working Group on the Diabetic Food, the Diabetic Food Society of India, and MUHAS. Over the course of the project, which was implemented from 2004-2007, nearly 12,000 diabetic patients were screened at 15 health facilities in 14 regions across Tanzania. The number of patients with foot ulcers and/or amputations increased as more cases were identified, which the authors attributed to better diagnosis by health professionals, rather than poor patient education in prevention. An unpublished follow-up study found that, four years after the start of the project, the amputation rate had been reduced by about 50%. The reason behind this reversed trend is unclear, although the follow-up study suggests that it may be related to increased patient education and continued provider training and education (A step ahead of Step-by-Step WDF07-291, n.d.).

Many additional unpublished projects, run by collaborations between the World Diabetes Foundation and various in-country partners, also focus largely on improving clinical care.
Together, these projects have established roughly 200 new diabetes clinics across Tanzania, and over 20 clinics specifically for diabetic foot care. Nearly 1000 health professionals (physicians, clinical officers, nurses, and others) have been trained in diabetes care and management. While many of these projects also included public education in diabetes prevention, this activity was often last on a long list of project goals. Most public awareness and prevention methods were television and radio programs, as well as leaflets of information. The impact of these activities has not been reported.

**Modern health care system approach to treatment**

With diabetes prevalence rising quickly and the recognition that the disease affects all income groups, Tanzania is considered to be one of the leaders in diabetes care in sub-Saharan Africa (Kolling et al., 2010). Access to and quality of modern health care for diabetes management has increased over recent years. As discussed previously, the Tanzania Diabetes Association, Ministry of Health and Social Welfare (MOHSW), and partners such as the World Diabetes Foundation have together established many diabetes clinics across the country (Kolling et al., 2010).

However, despite these new clinics, there are still many issues that are faced by diabetic patients. Many of these issues are similar to those faced by anyone trying to access the modern health care system. With increased health education for the public and improved medical treatment, modern health care facilities have seen an increase in the number of patients over the last few years. However, there remains to be a severe shortage of health care professionals that are trained in diabetes care. This means that a limited number of workers must try to see a large number of patients, which may reduce the quality of care that the patients receive. In addition,
most diabetes clinics are in urban areas, leaving much of the rural population with poor access to these clinics (Kolling et al., 2010).

Even in urban areas, access to medications can be difficult. Expensive medications and a nationwide shortage of insulin, seemingly due to cost issues, have resulted in many patients not being able to take medication regularly (Kolling et al., 2010). Justin-Temu et al. (2009) compared availability and affordability of diabetes medications in the public and private health sectors in Dar es Salaam. They found that, although oral hypoglycemic medications were available in all seven of the study facilities, more variety was available in the private facilities. Public facilities did, however, have the two drugs (chlorpropamide and tolbutamide) that are present on the National Essential Drugs List. Private facilities also had both animal and human insulin, whereas public facilities had only animal insulin (Justin-Temu et al., 2009), although no clinically relevant differences have been found between the two types of insulin (Richter & Neises, 2005). Due to limited availability, all of these medications were much more (up to ten-times) expensive in private facilities, but the authors found affordability to be a problem even in public facilities.

**Traditional medicine approach to treatment**

Traditional medicine has been used to treat diabetes and diabetes-like symptoms (e.g. hypertension, high blood sugar) in both urban and rural areas of Tanzania (Moshi & Mbwambo, 2002; Kolling et al., 2010). However, the situations in which TM is used in these two settings are very different. A study of health-seeking behavior for diabetes in Dar es Salaam, Tanzania’s largest city, showed that patients preferred biomedical care to treat diabetes, which is recognized as having biomedical rather than spiritual causes (Kolling et al., 2010). However, diabetes patients sometimes seek TM treatment because biomedical treatments are either unavailable or unaffordable. When Kolling et al. (2010) interviewed a group of diabetes patients, one specific
TM treatment that they mentioned consistently was aloe vera. Apparently, traditional healers had told these patients that aloe vera could actually cure their diabetes. However, one patient who was interviewed was told by a physician that aloe vera could be poisonous and result in kidney failure. This patient then stopped taking the aloe vera and decided to opt for biomedical care instead.

Aside from affordability and availability concerns with biomedical treatments, Kolling et al. (2010) found that TM was often used in urban diabetes patients because of their belief that herbal treatments could cure their diabetes. While biomedical treatments are life-long regimens, patients are sometimes told of TM treatments that would only need to be taken temporarily in order to cure diabetes. This was the case for at least one of the study’s interviewed patients, who was told by an acquaintance that an herbal treatment containing aloe vera would cure her diabetes.

Another study, conducted in rural eastern Tanzania (Kilosa district, in Morogoro region), focused on traditional healers’ knowledge of diabetes (Moshi & Mbwambo, 2002). Unlike in Dar es Salaam, where traditional healers encourage patients to receive a diabetes diagnosis by biomedical care before starting TM treatment (Kolling et al., 2010), the traditional healers in Kilosa district had very little knowledge of diabetes. In fact, none of the 65 traditional healers who were interviewed could unequivocally relate the symptoms that they were treating to diabetes. Specifically, the symptoms that were focused on were polyuria, polydipsia, and excessive thirst and sweating. However, one-third of the traditional healers did recognize and treat one or more of these symptoms individually – it seems that they were just unaware that these symptoms were collectively characteristic of a specific illness (Moshi & Mbwambo, 2002). As a result of this lack of awareness, traditional healers would not be able to diagnose diabetes, and treatments for one particular symptom (e.g. hypertension) may not relieve other symptoms (e.g. hyperglycemia).
The traditional healers in Kilosa district identified several plants that they have used to treat diabetes symptoms, as well as complications of diabetes (e.g. hypertension; Moshi & Mbwambo, 2002). The researchers of the study, who work at the Institute of Traditional Medicine at MUHAS, recognized some plants that have previously been shown to have effects that would benefit diabetes patients, such as improving oral glucose tolerance (e.g. *Albizia versicolor*, *Kigelia Africana*, and *Securinega virosa*) and lowering blood sugar (e.g. *Cassia auriculata* and *Ricinus communis*), cholesterol (e.g. *Albizia anthelmintica*), and blood pressure (e.g. *Securidaca longipedunculata*, *Lannea schimperi*, and *Deinbollia borbonica*). However, some of these treatments (e.g. *A. versicolor* and *S. virosa*) have also been found to be toxic in animal lab studies. Therefore, the researchers recommended that traditional healers’ knowledge be reviewed in order to eliminate the use of toxic plants, although they did not give a specific plan for this process (Moshi & Mbwambo, 2002).
Chapter 5
Discussion and Conclusion

Discussion

Brief summary of previous chapters

Chapter 1 introduced the concept of the epidemiological transition, which describes a global shift in the burden of disease from communicable diseases, such as malaria, to non-communicable diseases, such as diabetes. Low-income countries such as Tanzania continue to have a high burden of disease from communicable diseases, while the burden from non-communicable diseases is increasing as diet and lifestyle changes take place. With this “double burden” of disease, it is important to understand Tanzanians’ health-seeking behaviors so that the country’s health care system can be adequately prepared to respond to the health care needs of the population. For reasons previously explained (see p. 10-12), this thesis has used malaria and diabetes to represent communicable and non-communicable diseases, respectively.

In Chapter 2, the methodology of the thesis was outlined. The thesis has been written in the form of a situational analysis, which includes an overview of Tanzania’s health care system and a literature review of health-seeking behavior for malaria and diabetes in Tanzania. Grey literature related to prevention, treatment, and/or health-seeking behavior for malaria or diabetes, which was collected in-country, has been incorporated into this analysis.

An overview of the health care system in Tanzania was presented in Chapter 3. This overview includes an analysis of both the modern system and traditional medicine. In regards to the modern health care system, details such as levels of health care, health insurance schemes,
and the health professional workforce were examined. The history and current state of traditional medicine was also reviewed, with benefits and drawbacks of traditional medicine being discussed.

Finally, Chapter 4 represents the core of this thesis by analyzing Tanzanians’ health-seeking behavior for malaria and diabetes. For each disease, the following items were discussed: prevalence, treatment methods (both modern and traditional), past and current public health programs (e.g. patient education, behavior change, health professional training), and influences on health-seeking behavior. This last item is especially important for anyone looking to improve the prevention and treatment of malaria and diabetes in Tanzania. In order to be effective, health programs should to be designed and implemented in a way that is tailored to the needs of the target population.

Themes emerging from the analysis

Combining modern and traditional health care

One of the most important themes emerging from this analysis is that Tanzanians continue to use both modern and traditional health care, sometimes simultaneously while at other times in complement of each other. This is certainly not unique to Tanzania. Studies have noted similar combination care in other parts of sub-Saharan Africa, such as Zimbabwe (Cavender, 1991) and Burkina Faso (Beiersmann et al., 2007), as well as in other regions of the world, such as Taiwan (Chi, 1994). Although this combined use of health care in Tanzania has been well documented (Oberländer & Elverdan, 2000; Stangeland et al., 2008; Kayombo et al., 2012), there are no clear-cut “rules” that determine when and why the two types of health care are used. As described in Chapter 4, mild malaria is usually seen as a biological disease and so is treated with
modern health care, while severe malaria is often seen as having a spiritual cause and is therefore treated with traditional medicine. Diabetes is usually seen as a biological or biomedical disease, and so modern health care is oftentimes the first choice of treatment. However, traditional medicine is used when modern medicines are either unavailable or unaffordable, or when patients believe that traditional medicine can fully cure their diabetes with short-term treatment (Kolling et al., 2010).

Since both modern and traditional health care are still widely used, and effectively so, it is important going forward to include both systems in public health programs or health policy planning. Integration of these two systems has been shown to be effective elsewhere, such as with the integration of traditional Chinese medicine and modern health care to treat mental illness in China (Tan et al., 2013). Some Chinese medical practitioners receive special training in traditional Chinese medicine, which allows them to use treatment methods such as acupuncture and herbal medicines to treat mental illnesses after they have been clinically diagnosed (Tan et al., 2013).

Tanzania’s MOHSW has started to encourage the integration and collaboration between modern and traditional health care with the Traditional and Alternative Medicine Act of 2005 (Stangeland et al., 2008). The Act gave the MOHSW authority to oversee traditional medicine and also offered protection for traditional healers against piracy of their treatments. However, most public health programs still focus only on the modern health care system. For example, programs that function to train health professionals in diagnosing and treating malaria or diabetes should include training for both modern health care professionals as well as traditional healers. Up until this point, most training programs have focused on engaging modern health care professionals only. In Chapter 3, some proposed steps for integrating modern and traditional medicines were outlined, as discussed in Kayombo et al. (2012). Some of these steps include training traditional healers to identify health conditions that require urgent care, addressing and
regulating ethical concerns of traditional medicine (e.g. use of sub-doses, unsanitary practices), and creating prescription guidelines for traditional treatments (Kayombo et al., 2012).

**Education and training of traditional healers**

Another theme that emerged in this thesis was traditional healers’ lack of knowledge of severe malaria and diabetes. Medical research has shown malaria to be caused by parasites in the blood, and convulsions to be a distinctive sign of severe malaria. However, traditional healers in Tanzania continue to believe and teach that convulsions are caused by spirits and that modern medical treatments (e.g. anti-malarial injections) will kill rather than cure the patient (Comoro et al., 2003; Foster & Vilendrer, 2009; Reid, 2010). As previously discussed (see p. 40-49), this belief frequently leads in improper treatment, and patients often die because they did not receive the anti-malarials that could have saved their lives. This belief was perhaps accurate in the past, when dirty/contaminated needles were used for injections. However, use of sterilized needles has significantly improved in Tanzania, and anti-malarial injections are now regarded as life-saving (Reid, 2010).

In the case of diabetes, researchers (Moshi & Mbwambo, 2002) have shown that some traditional healers are able to recognize individual symptoms of diabetes (e.g. hyperglycemia, hypertension, polyuria), but they are not able to relate the symptoms to a single disease. Further, these traditional healers prescribe herbal treatments for individual symptoms, but the cause of those symptoms is not managed using this treatment method. A study conducted in Dar es Salaam with diabetes patients and their families, health professionals, and traditional healers (Kolling et al., 2010) found that some traditional healers have knowledge of diabetes, but they either again prescribe treatments that only treat specific symptoms, or they make claims that their treatments can completely cure diabetes (Kolling et al., 2012). This misinformation sometimes leads patients
to forgo effective modern medicines in favor of traditional medicines that have not been shown to have the long-term effects that traditional healers and others claim. Traditional healers have also been found to prescribe some herbal treatments, especially in the case of diabetes symptoms, that are known to be toxic to laboratory animals (Moshi & Mbwambo, 2002).

As suggested by Kayombo et al. (2012), traditional healers should be educated about the toxicity of these drugs, so that they can prescribe or identify safer alternatives. For example, researchers from the Institute of Traditional Medicine (ITM) at MUHAS could provide annual or bi-annual training and education for traditional healers at district hospitals. In addition, researchers from ITM could distribute education materials (e.g. booklets, pamphlets) to those healers who cannot travel to the district hospitals.

**Expanding the health care workforce**

A third theme that has been observed throughout this thesis is that there is a need to both train and retain more health care professionals in Tanzania. As discussed in Chapter 3, in Tanzania there is a severe shortage of all health care professionals, including physicians and nurses, leaving many health care clinics understaffed and/or unsupervised by someone with the proper level of training. In addition, even with increasing enrollment in medical training programs, for various reasons (again discussed in Chapter 3) many graduates find employment in non-clinical settings, outside of Tanzania, or in different professions altogether.

Chapter 4 discussed training programs for both malaria (i.e. in the use of RDTs) and diabetes (i.e. in the identification of foot ulcers). These programs show that diagnosis and subsequent treatment of the two diseases both improved greatly after health professionals received training in diagnosis of these two conditions. Currently, it would be unlikely for these training programs to be effective on a large scale because the number of health professionals (e.g.
physicians) in Tanzania is too low. This suggests that the quality of health care in Tanzania would improve dramatically if the number of trained health professionals, who are able to accurately diagnose the diseases, increased. Therefore, the MOHSW should introduce more incentives for medical graduates so that they are not lost to non-clinical or international jobs. In addition, the Ministry should increase incentives for health professionals to work in the public sector and in rural areas, where most Tanzanians receive their health care. With little incentive or motivation for health professionals, the quality of health care decreases (e.g. though decreased concern for patient safety), as demonstrated in a study in Ghana (Alhassan et al., 2013). In Morogoro Region, Tanzania, researchers found that community health workers have an intrinsic desire to volunteer and provide support for the ill. Government support is provided in the forms of stipends, training, and supervision. However, motivation is still low because of inadequate pay and poor availability of medical supplies (Greenspan et al., 2013).

**Accessibility and affordability of health care**

Similarities in accessibility and affordability of care have been seen for malaria and diabetes. For both diseases, the ideal types of medications are frequently unavailable, especially in rural Tanzania. As discussed in Chapter 4, ACTs are sometimes not stocked in dispensaries, and caregivers instead can only purchase outdated malaria medications, such as chloroquine, which are ineffective because malaria parasites in Tanzania (and elsewhere worldwide) have already developed resistance to them. Occasionally, inaccessibility and/or unaffordability of proper malaria medications leads caregivers to seek out traditional care instead of biomedical care. Because traditional healers tend to identify evil spirits as the cause of malaria, especially severe malaria (see Chapter 4), their treatments are rarely effective and patients die from a lack of proper care.
Likewise, the highest standards of diabetes medications are often unavailable. This is especially true for insulin, with human insulin only being available in some private facilities, and at a high cost. Public facilities and other private facilities only offer animal insulin, which is still too expensive for many Tanzanians. In rural areas, diabetes drugs are even scarcer, and patients often seek treatment from traditional healers to address individual symptoms rather than managing the source of the disease. Often, as seen in Chapter 4, patients that have already been diagnosed with diabetes often receive biomedical treatment inconsistently because drugs are unavailable or unaffordable. When patients only receive treatment once in a while, their diabetes is not being managed effectively and thus they are likely to have poorer health outcomes, as seen in a study by Cramer et al. (2007).

Therefore, increasing the availability and decreasing the costs of diabetes drugs would lead to better health outcomes for diabetes patients (Cramer et al., 2007). Changes in Tanzanian health policy and oversight (e.g. improved enforcement of the National Essential Drugs List by the MOHSW) are needed to ensure that health care facilities have enough diabetic drugs in stock to meet patients’ demands.

**Role of men in children’s health care**

As discussed in Chapter 4, men often play a major decision-making role in the treatment of children’s malaria in Tanzania. Although women are almost always the caregivers (e.g. taking children to the health center, administering medication), men typically make the ultimate decision of when and where to seek care. This is because men hold the financial power in a household, so women must seek their permission for medical expenses (Oberländer & Elverdan, 2000; Montgomery et al., 2006). Despite this powerful role that men play, public health programs generally focus on addressing the female caregivers (e.g. through health literacy/education
programs). It is certainly important to work with women so that they are able to recognize the symptoms of malaria and know how to seek proper treatment. However, men’s health literacy needs to be similarly addressed so that they can make prompt decisions when female caregivers suggest that treatment be sought for their children’s illnesses or when they notice signs of illness themselves. This would minimize the delay in proper treatment and therefore increase the likelihood that a child will survive. Public health programs, such as those discussed for malaria in Chapter 4, currently target females because they are the caregivers. Because men do not appear on the surface to play a large role in child health care, there is a lack of male-focused public health literature, except for diseases such as HIV/AIDS where men have a physiological role in the spread of the disease.

**Lack of prevention efforts for diabetes**

Prevention efforts for malaria are much stronger than those for diabetes in Tanzania, likely due to the chronic nature of diabetes and its relatively recent emergence as a public health problem in the country. This is explained in Chapter 4; several of the reviewed malaria public health programs focusing on prevention (e.g. ITNs, caregiver education), while virtually no published reports on diabetes prevention could be found. Although there may be diabetes prevention programs in Tanzania that have not yet been published, published diabetes public health programs aim at improving diagnosis, treatment, and patient education for those who have already been diagnosed.

Although factors such as diagnosis and treatment are important to address, programs should also include a great deal of effort at preventing diabetes. Lifestyle changes such as regular moderate or intense physical activity and a low-fat, high-fiber diet have been shown to significantly reduce the risk of diabetes (e.g. one study found a 36% reduction in risk with these
lifestyle changes in Finland; Lindström et al., 2006). Although this particular study took place in Finland, similar results were seen in studies in China and the US (Lindström et al., 2013). With decreased incidence and prevalence of diabetes in Tanzania, the burden that diabetes puts on the population and the health care system would decrease as well. Furthermore, with fewer Tanzanians having diabetes, those that do have the disease will need increased access to proper treatment should we want their long-term health outcomes to improve.

Although primary prevention efforts in Tanzania seem to be strong for acute, communicable diseases such as malaria, prevention of chronic non-communicable diseases, including diabetes, seems to be weak. Along with a lack of prevention programs for diabetes, researchers have called for significant improvements in prevention of hypertension, which, like diabetes, is also not generally addressed until the condition is diagnosed (Edwards et al., 2000). Behavior change programs that aim to promote health diets and physical activity could be effective prevention programs for diabetes and other related non-communicable diseases (e.g. hypertension) in Tanzania, as they have been elsewhere (Lindström et al., 2006).

**Conclusion**

One thing that has been made quite clear throughout this thesis is the urgent need to strengthen Tanzania’s health care system, especially in two areas: education and retention of health care professionals, and collaboration between biomedical and traditional healers. Severe shortages in health care professionals hinder the proper and timely treatment of illnesses, and can cause patients to seek inappropriate care that is ultimately ineffective. In addition, there is a high burden on the health care professionals that are present, which decreases the quality of care that patients receive.
Throughout this thesis, both similarities and differences could be seen in health-seeking behavior for malaria and diabetes. Some similarities include the use of both biomedical and traditional treatments, the frequent inaccessibility and/or unaffordability of medications, and the importance of family and friends in accessing treatment. However, several differences also exist, stemming from the major characteristic differences between the two diseases. These differences include strength of prevention efforts, patient understanding of the disease origin, and adherence to treatment. Malaria is an acute communicable disease that has been a major cause of mortality in Tanzania for centuries. Diabetes is a chronic non-communicable disease that has just recently emerged as a significant burden of disease in Tanzania. Because of the different natures of these diseases, health-seeking behaviors for malaria and diabetes are also different, and so these diseases each present their unique needs for public health programs.
**BIBLIOGRAPHY**


Kamat, V.R. (2006). “I thought it was only ordinary fever!”: Cultural knowledge and the micropolitics of therapy seeking for childhood febrile illness in Tanzania. Social Science & Medicine, 62, 2945-2959.


Kuwawenaruwa, A. & Borghi, J. (2012). Health insurance cover is increasing among the Tanzanian population but wealthier groups are more likely to benefit. *Ifakara Health Institute Spotlight*, 11, 1-4.


ACADEMIC VITA

Cara Nordberg
caranordberg@gmail.com

Education:
The Pennsylvania State University – University Park, PA
Schreyer Honors College
College of Agricultural Sciences
Major: Bachelor of Science in Toxicology
    Minor: Global Health
    Minor: Environmental Resource Management

Work Experience:
Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry – Atlanta, GA
Collegiate Leaders in Environmental Health Internship Program
June 2012 – August 2012
    ATSDR Division of Toxicology and Human Health Sciences, Environmental Toxicology Branch, Computational Toxicology Lab
    - Built databases of toxicity threshold data for more than 200 chemicals
    - Assisted in the development of a model to predict unknown toxicity thresholds
    - Performed statistical analysis on the databases using SAS program
    - Attended presentations and field trips relating to various environmental health topics
    - Contributed to a publication based on the toxicity threshold model (in progress)
    - Gave oral presentations to other interns and CDC/ATSDR professionals

Nordberg, C. Computational Toxicology: Modeling of Inhalation Exposure Limits for Emergency Response. CDC/ATSDR CLEH Internship Program, Atlanta, GA. August 2012.

Nordberg, C. Aquatic Pesticide Exposure and its Associated Health Effects: Endocrine Disruption. CDC/ATSDR CLEH Internship Program, Atlanta, GA. July 2012.
    - Awarded Best Undergraduate Presentation
**International Study:**
Muhimbili University of Health and Allied Sciences – Dar es Salaam, Tanzania
May-June 2013
PSU Global Health minor program
- Shadowed health professionals in local health clinics and hospitals
- Teamed with MUHAS medical students to conduct community surveys
- Reported on one community’s prevention and treatment of malaria
- Met with local NGOs and research agencies to discuss prevention and treatment of malaria in Tanzania

University of Leeds – Leeds, United Kingdom
January-May 2012
Direct exchange program with PSU
- Studied full-time during the Spring 2012 semester
- Learned about British culture and history through university-sponsored daytrips
- Joined a university student organization

China Study Tour – Beijing, China
May 2010
PSU Department of Agricultural Economics and Rural Sociology
- Short-term Study Tour
- Toured various agricultural businesses

**Research Experience:**
The Pennsylvania State University – University Park, PA
Kordas Laboratory – Nutrition, Metals, and Development
August 2012 – December 2012
- Performed hair digestions for the analysis of heavy metal concentrations
- Attended weekly laboratory meetings, where I both listened to and gave presentations on research in the area of metal toxicity and its behavioral effects in children

The Pennsylvania State University – University Park, PA
Forensic Chemistry Research Group
April 2010 – May 2011
- Studied the migration of phthalates from polyethylene terephthalate plastics
- Ran samples on a GC-MS
- Developed and adjusted analysis methods
Presentations:
Oral Presentations:
Nordberg, C. Computational Toxicology: Modeling of Inhalation Exposure Limits for Emergency Response. CDC/ATSDR CLEH Internship Program, Atlanta, GA. August 2012.

Nordberg, C. Aquatic Pesticide Exposure and its Associated Health Effects: Endocrine Disruption. CDC/ATSDR CLEH Internship Program, Atlanta, GA. July 2012.
- Awarded Best Undergraduate Presentation

Poster Presentations:
- Awarded 2nd Place in the Undergraduate Poster Session
