UNIVERSITY OF AGDER

Master Thesis

Investigating the relationship between poverty and disease

The case of Guinea Worm in the Savelugu-Nanton District of the Northern Region of Ghana.

Abukari Abdul-Basit Tampuli

Supervisor
Dr Gregory Breetzke

This Master's Thesis is carried out as a part of the education at the University of Agder and is therefore approved as a part of this education. However, this does not imply that the University answers for the methods that are used or the conclusions that are drawn.

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Abstract

The relationship between poverty and disease is complex and is often difficult to explore. The situation is exacerbated when investigating different aspects of this relationship and including concepts such as sustainable development into the equation. Varying methods have also been employed in past research when examining this relationship. Quantitative methods often give a vivid but superficial picture to the relationship, whilst a qualititative method often leads to difficulties in extrapolating this relationship to other contexts. In the research, I employed a mixed research strategy employing both quantitative and qualitative methods. Initially I estimated – based on the data I obtained - the average number of weeks lost to farming by people infected with Guinea Worm, the average number of weeks it takes to heal, and the average number of active weeks of farming lost. In the research, I found that a person within the targeted district loses approximately 107 weeks of his or her 'active' life to Guinea Worm. This translates into roughly 2 years of inactivity in the person's lifetime. These 107 weeks lost to Guinea Worm is equivalent to approximately 9 farming seasons which ultimately means 9 years of economic inactivity in the Savelugu-Nanton District per person. Using qualitative methods, I discussed related issues with students and teachers in the district and found that Guinea Worm results in high rates of absenteeism in schools which impacts negatively on broader education in the region. Further investigations revealed that people in the district have lower life expectancies when compared nationally, which is a worrying statistic for a country that is already plagued with low life expectancies.

Dedication

This dissertation is dedicated to my beloved father, Freshman, a great visionary and my mentor. May you rest in perfect peace.

Acknowledgment

The completion of this thesis marks a destination I set out for two years ago. In order not to fall victim to the saying that people are often caught up in their destination that they forget to appreciate the journey that brought them there, especially the goodness of the people they meet on the way, I hereby acknowledge the following personalities.

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Declaration by candidate

I hereby declare that the thesis:

Investigating the relationship between poverty and disease:
The case of Guinea Worm in the Savelugu-Nanton District of the Northern Region of Ghana.

has not been submitted to any other universities than the University of Agder for any type of academic degree.

Tamale, 15th December, 2010

Abukari Abdul-Basit Tampuli **Date**

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Abbreviations

AIDS	Acquired immune deficiency syndrome
CDCP	Center for Disease Control and Prevention
CFLI	Canada Fund for local initiative
CIA	Central Intelligence Agency
DFID	Department for International Development
FCUBE	Free Compulsory Universal Basic Education
GDP	Gross Domestic Product
COCOBOD	Ghana Cocoa Board
GHS	Ghana Health Service
GLSS	Ghana Living Standards Survey
GPRS	Ghana Poverty Reduction Strategy
GSS	Ghana Statistical Service
GWEP	Guinea Worm Eradication Program
HDI	Human Development Index
HIV	Human immunodeficiency virus
IFPRI	International Food Policy Research Institute

IMR	Infant mortality rate
ITFC	Integrated Tamale Fruit Company
ITTU	Intermediate Technology Transfer Unit
LRED	Local and Regional Economic Development
MDGs	Millennium Development Goals
MOH	Ministry of Health
NGO	Non Governmental Organisation
OECD	Organisation for Economic Cooperation and Development
UN	United Nations
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNEP	United Nations Environment Program
UNICEF	United Nations Children's Fund
VIP	Ventilated Improved Pit latrine
WHO	World Health Organization
WVG	World Vision Ghana

Chapter 1: Introduction

1.1 Background to the study

There is an old adage that says 'healthy people make a healthy nation'. I would like to add that a healthy human being also has the potential for accelerated growth and development. The opposite is also true as 'unhealthy people' make an unhealthy nation, i.e. a nation vulnerable to disease. Regardless of the reciprocity of this relationship, it is dutifully acknowledged that diseases impair one or more parts of the body making an individual less productive if not totally incapacitated for either a short or long period of time. Every country faces the risk of getting a disease outbreak whether viral or bacterial, but the chances of contracting a disease depends very much on how equipped the country is economically to counteract such incidence. People in developing countries stand a very high chance of being infected with diseases that would otherwise have been prevented if their countries had the necessary public health structures put in place.

According to the United Nations (UN) (2001, p. 2) 'poverty may be defined as a human condition characterized by sustained or chronic deprivation of the resources, capabilities, choices, security and power necessary for the enjoyment of an adequate standard of living and other civil, cultural, economic, political and social rights.' According to this definition, poverty is a multidimensional phenomenon. It is therefore prudent that I make my stand clear as to what dimensions I am considering when I define what poverty means to me. The Ghana Poverty Reduction Strategy (GPRS) (2003-2005) (2003) which represents comprehensive policies, strategies, programs, and projects to support growth, poverty reduction and human development in Ghana, has recognized the fact that aside from poverty being multidimensional, it is also interactive. The GPRS broadly defines poverty as an unacceptable physiological condition that is coupled with social deprivation, and identifies many dimensions and manifestations it may take the form of. In the Savelugu-Nanton District - where the current research is focused - the aim of the paper will give preference to the following manifestations of poverty.

- Low capacities through lack of education, vocational skills, entrepreneurial abilities, poor health and poor quality of life
- Exposure to shocks due to limited use of technology to stem effects of droughts, floods, army worms, crop pests, crop diseases, and environmental degradation

I chose these dimensions because they are visible in that one can observe their manifestations in any area. Infrastructure for education for example gives an explanation to the situation in the many districts in Ghana. Pupils sit in pavilions and under trees, which means a significant reduction in school-going days especially during the raining season. The student teacher ratio is another visible observation. According to official statistics, nationwide enrolment in Ghana has been increasing since the government's free compulsory basic education (FCUBE) introduced in 1995 and launched in 1996, but there are regional disparities. The Northern region has for example, always been behind the rest of the country in terms of its enrolment rate. In 2008, the Ghana Living Standards Survey (GLLS, 2008, p. 12) report by the Ghana Statistical Service (GSS) had the Northern Region recording the lowest school attendance rate of 54.7 percent while other regions like the central regions are recorded at 96.9 percent.

The increase in enrolment in any area is however ambiguous when the educational sector in the area is bedeviled with high dropout rates, low performance at the transition level (from junior high to senior high and from senior high to tertiary levels), low retention of teaching staff posted and a huge gender disparity in enrolment and academic performance. According to ghanadistrict (2010), the Savelugu-Nanton district has an agriculture-based economy that employs roughly 97 percent of the labor force, the majority of whom produce staple crops on a subsistence level. This explains why the second definition of poverty is relevant as most people in the Savelugu-Nanton district are farmers using limited technology and not engaging in best practices.

Poverty cannot be talked about without its measurement. Just as there are numerous approaches and dimensions to poverty so too are there many ways of measuring it. Poverty can be measured either directly or indirectly, relatively or absolutely; or it can also be measured using either income-based or deprivation-based methods (Strengmann-Kuhn, 2000). Regardless of the measurement method selected, most literature regarding the Savelugu-Nanton district classifies it as poor both in absolute *and* relative terms. It is beyond the scope of this study to measure poverty in the district but to emphasize the fact that the majority of people in the region live below the poverty line.

According to the International Food Policy Research Institute (IFPRI) (2008), Ghana's poverty is predominantly rural, with the northern sector being the most poor. The poverty in the three northern regions of the country has been responsible for Ghana's high overall poverty levels. Ghana's national poverty rate has fallen from 51.7 percent in 1991/92 to 39.5 percent in 1998/99 and then to 28.5 percent in 2005/06, for a total decline of 23.3 percentage points over those 14 years. However, the poverty rate continues to be high in the Northern Zone (60 percent), whereas it had dropped to 20 percent nationwide. The GPRS (2003) has the exact figure at 70 percent poverty rate in the Northern Zone; in other words, seven out of ten people living in the Northern Zone are currently poor. The report also added that food crop farmers in the country have the highest incidence of poverty. They constitute fifty-nine percent (59%) of the poor in Ghana. In 2005 the Overseas Development Institute (ODI), (2005) prepared a revised report for the Department for International Development (DFID) Ghana which was on the economic growth of northern Ghana. In this report, it is stated that the occupational structure of northern Ghana is radically moving out of agriculture, over half the population of the population are still farmers who neither produce enough nor earn enough to assure basic food requirements. Those who are not farming engage in hunting or the distribution of farm products by way of trading. The African Development Bank (ADB) (2005, p. 10) summarize the above in the following statement:

> *''The lingering poverty in the Northern savannah region is explained by the fact that subsistence agriculture is the major economic occupation and the two main staple food crops-millet and sorghum-*

provide a return to family labour lower than the market wage rate owing to high labour requirements relative to the output price''

The prevalence of certain diseases in this region is of concern since the area is already poor and has a doctor-patient ratio of 1: 92,000. The national doctor-patient ratio in Ghana has recently improved from 1:14,731 to 1:13,683 (Annual Report, Ghana Health Service (GHS), 2007). In both instances i.e. poverty and health, the Savelugu-Nanton region is at a disadvantage implying a bleak future in terms of development.

According to the GHS (2005), the eradication and elimination of diseases in Ghana is of major concern – diseases such as Guinea Worm, leprosy, trachoma, Tuberculosis, and HIV/AIDS are prevalent and prevention and treatment measures for these diseases are scarce. Among all of these diseases, Guinea Worm in particular is of major concern. The disease is a major concern for a number of reasons: -

- First, Guinea Worm incapacitates individuals who would otherwise would have been farming, trading, or going to school (Carter Center, 2009). It incapacitates the individual totally for the period of which they are infected. In most cases, the removal of the worm from the body marks the end of the disease until another worm emerges. The worm itself can emerge from any part of the body once the larva is taken inside the body through an orifice, mostly through drinking water. Those infected are unable to work for that period which represents a loss in productivity and the fact that the region experiences a single maxima rainfall only every 5 months (with very few irrigation facilities) worsens the situation. This implies that when that period is over, the farmer has to wait for the next year's rains; a farmer may not be able to produce in a certain year if he or she is infected within that year.
- Second, Ghana is rated second (behind war-torn Sudan) in the world in terms of Guinea Worm prevalence. According to the Center for Disease Control and Prevention CDC (2009), Ghana reported 35% of the 9,585 global infections reported in 2007 with Sudan taking the lead with 61%. The regional distribution is however, skewed toward with the Northern Region recording over 90 % out of the total infections in Ghana. The Savelugu-Nanton District recorded the highest prevalence rates in Ghana (GHS, 2005).

1.2 Statement of problem

Research related to the achievement of the Millennium Development Goals (MDGs) is currently topical in developmental literature worldwide as time is running out on most countries achieving them. There is therefore a need to be made more fully aware of all variables that interact directly or indirectly with the set of MDGs. Issues such as poverty and health are central to almost all MDGs and can be seen as an integration of MDGs 1, 4, 5 and 6 of the United Nations. Within this context, Guinea Worm has in integral role to play in the achievement of a number of MDGs in Ghana since its eradication will improve health and by implication improve the productivity and schools attendance of individuals who have previously contracted the disease.

The Northern region of Ghana, which has the highest prevalence rate of Guinea Worm, is not only the poorest region in the country; it is by implication also lagging behind the rest of the country in terms of its development. Regarding health, which is the main concern of this research, the GPRS (2003) has this to say under its Health-Based Indicators of Poverty, ‘‘…there are deep geographical disparities. Infant and under five mortality in the three Northern regions are generally higher than in the South. In comparison with the Greater Accra Region, they are twice and three times as high respectively.’’ The incidence of diarrhea in Northern Ghana for example, is 31%, which they describe as unacceptably high, compared with the national average figure of 18%. According to the GHS (2004), the national maternal mortality rate is estimated to be 214 per 100 0000, while that of Northern region showing over 800 deaths per 100,000 live births.

Almost all the health-base indicators that are improving in Ghana are either stagnant or worsening in the Northern regions. In terms of poverty and development, the World Bank (2008, p. 12) referred to the Northern regions as ‘‘a historically poor area’’ and that the region has largely been left out in terms of the growth and development process the country has achieved in the last 15 years. The region typically espouses Intergenerational Transfer of Poverty, which is described by the United Nations Development Program (UNDP) in its Human Development Report (2007, p. 17) as a situation resulting from a prolonged deprivation spanning throughout the lifetime of individuals or groups. The report in reference to this

concept says ‘‘this is typical of situations of chronic poverty in most parts of the Northern regions of Ghana which have the highest incidence of poverty’’

My interest in health and development has warranted my choice of health as one of the important variables that affect development. There are so many factors responsible for limiting a country’s ability to fully exploiting its human resources and health of the population stands tall among them. A sick person struggles to contribute to the economy of a country and rather places strain on its functioning; this is especially the case when the disease or the illness incapacitates those infected; such is the case with Guinea Worm.

1.3 Research objectives and questions

The main objective of this study is to investigate the relationship between poverty and the prevalence of Guinea Worm in the Northern region of Ghana. More specifically, I aim to determine the extent to which the poverty situation in the district can be explained by the prevalence of Guinea Worm.

Secondary research questions include the following:

- What is the average number of working days lost because of Guinea Worm infection?
- Why is the disease still prevalent in the Northern region despite numerous strategies aimed at eradicating it?
- What is the effect of Guinea Worm on education?

These questions encompass the definition of poverty I employed since they take into account loss of education, the loss of farm working days and traditional believes that are still impeding the eradication process of Guinea Worm in the country.

1.4 Importance of the study

The study aims to use both qualitative and descriptive quantitative methods to investigate the relationship between poverty and Guinea Worm prevalence in Ghana. The study aims to not only add to the existing literature on the topic but also add both qualitative and quantitative components to these results within a Ghanaian context. The cost of Guinea Worm to the economy and the impact the disease has on education are also investigated. It is anticipated that the results of the study may give impetus to policy makers' attention towards the disease

The area under investigation is the Savelugu-Nanton District (see Figure 2.2). This district is one of eighteen administrative districts in the Northern Region of Ghana. The District shares boundaries with Tolon/Kumbugu District to the west, Tamale Municipality to the south and the Yendi District to the southeast. It has a total land area is 1790.70 sq. km. It has 149 local communities. Like all other districts in the Northern Region, it has high levels of poverty, high illiteracy rates, and a high prevalence of Guinea Worm.

1.5 Thesis Outline

The thesis is made up six chapters. Chapter one introduces the background to the research and subsequently gives an overview of the health and developmental challenges of the Northern region. The second chapter describes the social, economic and cultural characteristics of the district. Chapter three is the literature review. Chapter four explains the methodology used in the study while chapter five contains the analysis as well as provides findings. In chapter six some conclusions are drawn with recommendations.

Chapter 2: Area of Study

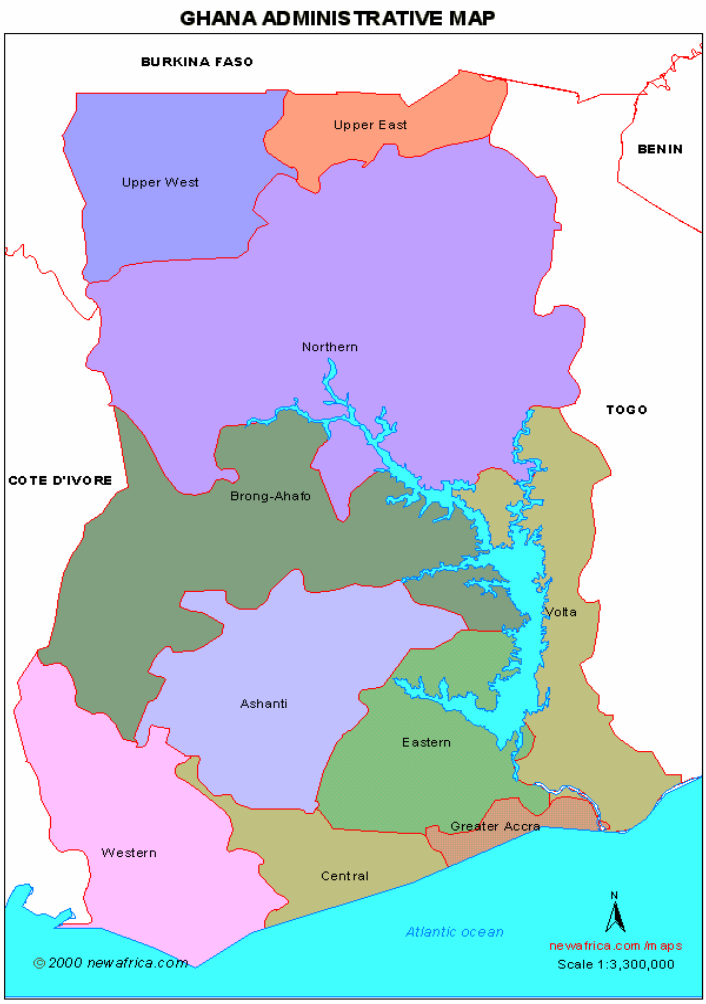


Figure 2.1: Administrative map of Ghana

Figure 2.2: Map of the district in the map of the Northern region of Ghana

2.1 Demographic and administrative demarcations

The population of the Savelugu-Nanton district was 91,415 at the time of the 2000 population census. With an estimated annual growth rate of 3%, the projected population in the Savelugu-Nanton district in 2010 is estimated to be around 122,575. This demography is divided into 49% male and 51% female populations. With a total land area of 1790.7 sq. km, the estimated population density is roughly 61 persons per sq. km. There are 149 communities in the Savelugu-Nanton District. These communities are administratively demarcated into one urban/town Council (Savelugu-Nanton, the district capital) and five Area Councils, namely, Nanton, Diare, Pong-Tamale, Moglaa and Tampion. The other 143 communities can be described as rural. Nearly 80% of the population resides in these rural communities and 20% are located in the few urban towns.

2.2 Micro-economy

The Savelugu-Nanton district like other districts in the Northern Region has an agrarian economy with about 97 percent of the labour force engaged in the cultivation of staple food at the subsistence level. Even though cash crops like sheanut, soya beans, cotton and cashew are farmed in the district, farmers do not typically farm these crops since there is no ready and immediate consumer market and farmers often lack the resources and expertise to farm them. Farmers generally prefer crops like maize, beans, rice, and other grains, which they can directly consume. Processing of these produce are generally traditional, which does not allow the produce to be preserved for a long period. A farmer may produce enough for the family for a whole year, but the foodstuffs themselves cannot be stored for a year, forcing the farmer to dispose of them. Unlike the Southern part of Ghana, which has significant year round rainfall, allowing all year round cultivation, the North has a single maxima rain fall allowing the people who depend solely on the one rainfall event to farm once a year. Irrigation, which should ideally be an alternative to rainfall, is underdeveloped in the region.

Industrially, the district is underdeveloped. Agro-processing industries are the main industrial activities in the district. These consist of sheanut processing, groundnuts processing, cotton ginnery, and rice processing. Their existence is also based on the subsistence needs of the farmers. Groundnut processing for example produces groundnut paste and oil both used for cooking. The combined need for the traditional clothing of the people known as 'fugu', bed mattresses, and pillows, which are made locally gives rise to the processing of cotton. Rice processing is an inseparable part of its production, since rice harvested from the farm cannot be eaten unless processed. It is little wonder that all but the sheanut industry currently utilises traditional small-scale methods. Out of the numerous sheanut-processing industries in the district, only the Shebu industry uses modern technology to produce at a large scale for export purposes. It must be emphasised that all these industries have the capacity to produce in a large scale using modern technologies and can equally compete on the international market; it's just that they have not been exploited yet. The Local and Regional Economic Development (LRED, 2009) in Ghana has notes that the percentage of people involved in the industrial sector in district is 3%. Since most of them are on the farm, the highly subsistence industrial sector need few hands. There has been some effort by external support agencies such as Non Governmental Organization (NGOs), The United Nations Development Programme (UNDP), The United Nations Children's Fund (UNICEF), Canada Fund for local initiative (CFLI), World Vision Ghana (WVG), Intermediate Technology Transfer Unit (ITTU), Ventilated Improved Pit latrine (VIP) and individual countries, to upgrade technologies, especially for women in the processing of sheanut, groundnuts, rice, cotton ginnery, and soap manufacturing. This support has brought hope to those sectors. It has been widely observed that governments in the past have neglected the economic prospects of the North. An obvious example of this fact is the sheanut industry, which is specific only to the North. It is named the "cocoa of the north" just as the cocoa to the South, but there is a whole institution called Ghana Cocoa Board (COCOBOD) that sees to the improvement in production and marketing of cocoa. Upon several concerns and pressure, the only consideration given to the sector is charging the COCOBOD to oversee the industry, which is secondary to their activities, which partly explains why things are not changing. Sheabutter, one of the products of sheanut is equally an international commodity since its benefit especially to the cosmetics industry has been known. The American Shea Butter Institute (ASBI)

lists 21 benefits of sheabutter including traditional, medicinal, and industrial uses. In fact, sheanut processors in the Savelugu-Nanton district have been calling on the government to help them dispose of their harvest after they have used what they want domestically. The institute further mentioned that there is no substitute for it in terms of its natural importance rendering it a scarce commodity translating into high international market prices. An organic mango production company, Integrated Tamale Fruit Company (ITFC) is one of the companies trying to help the locals exploit the resources they are underutilizing with their traditional methods of production. It offers direct benefits to local farmers involved. Until their emergence in the district mango production was not common though there were mangoes grown in the wild; the people did not see the need to expand production since it is not a staple food they can directly rely on. The company employs 250 employees and works with over 1,300 small- scale out grower mango farmers with an expected profit of US$1 million per year by 2010 (ITFC, 2007). The Savelugu-Nanton district has the potential for economic independence as seen from the cases of mongo and sheanuts.

Commerce and trade is another vital occupation in the district, but the percentage of people involved are predominantly women and the number of people employed is very small. As a result of the single rainfall event that enables farming for only a short period, most farmers sit idly throughout waiting for the next rainfall event while others attempt to distribute the previously harvested produce within the district and in some cases the neighboring ones of which Tamale Metropolis is the largest market. This trading of foodstuffs becomes necessary because of the slight difference in soil nutrient that allows varying crops to be supported very well in some communities; with a number of communities within the region identified by the crop that grows very well on their soil. The youth, especially the girls then move to the South which is economically active throughout the year to be head porters known in Ghana as ‘’kaayaaye’’.

According to the Local and Regional Economic Development (LRED, 2009), the service sector constitutes less than 1% of Savelugu-Nanton’s economy. This has been blamed on its proximity to the regional capital, which is 20km away. This is seen by many to be both a blessing and a curse to the district’s development in the sense that, on one hand, the metropolis offers a ready market for some of their goods and gives

them access to adequate health care as well as educational facilities since the Savelugu-Nanton district has only two low performing Senior High Schools and no tertiary level education. On the other hand, it is easy for producers to send their products to the Tamale market, thus retarding the development of the local market. Professionals and technocrats working in the district prefer to live in Tamale. This contributes to the low patronage of the local social infrastructure and the slow development of the sector. In addition, the two important professionals the district need, namely teachers and health professionals refuse postings to the Savelugu-Nanton district based on the inadequate social and economic infrastructure there. Even those who accept postings to the district live in Tamale and commute to the district everyday which reduces the number of man-hours they should have worked if they were residing in the district itself. According to the Annual Report of GHS on Northern region in 2005, it is stated that among their challenges they face are healthcare professionals who refuse to accept postings in the Northern region. Healthcare professionals typically blame poor administrative systems, and inadequate resources for their decision not to move to these regions. Education and all other services sector suffer the same fate. Also worth mentioning is the fact that there are several other economic activities that employ a number of people in the district. These economic activities include sand winning, fishing mostly along the Black Volta, hair dressing saloons, chop bars, pito brewers, and cobblers. Lastly, it is important to note that there are great tourism potentials in the district with sites like the Saa-Kpuli slave market, and the Former Seat of the Dagbon kingdom and the Oxbow Lake at Zonchangni.

LRED's 2009 publication entitled ''Doing Business in Savelugu-Nanton District'' aimed at selling the opportunities to potential investors. They summarized those opportunities on page 3 as follows:

''Savelugu-Nanton District offers attractive opportunities for investors, due to its proximity to the Tamale Airport and vast natural resources such as rich soils, arable land, and natural economic trees. Dams and the White Volta are suitable for irrigation. Cattle breeding, production of Shea butter and tourism are some of the areas for promising investments''

The farming practices used are bush burning, the felling of trees for farmlands and as fuel, and improper maintenance of farmlands among others. About 92 percent of residents in the district use firewood for cooking (ITFC, 2007). The obvious effect of this is the gradual desertification of the district. The erratic rainfall pattern in the past decade has also been linked to the desertification of the region in recent years. This makes it difficult for farmers to plan their farming activities. According to the FAO (2008, p. 46):

> *''Ghana's total land area of 238539 km2 is at risk of desertification, which claims about 20 000 ha of the country's land annually. The most severely affected areas are the Northern and upper regions of the country''*

In addition, there are numerous pollutants in the water features in the country which reduce fish production and encourage the breeding of vectors such as insects and weeds that give rise to water related diseases of which Guinea Worm and River Blindness are the most prominent.

2.3 Infrastructure

Infrastructure development is synonymous with economic development. Sound infrastructure is able to propel the economy of any city or country. ''Good infrastructure helps to raise productivity and lower costs in the directly productive activities of the economy, but it has to be expanded fast enough to meet the demand for infrastructure in the early stage of development.'' (KIM, 2006, p. 1) This then means that the improvement of economic activities will inevitably require the expansion of infrastructure.

2.3.1 Electricity

A high percentage of the Savelugu-Nanton District has no access to electricity. Out of the 149 communities, only 17 are hooked to the national grid (ghanadistricts, 2010). Those who have electricity are on the single phase, which cannot support the

establishment and operation of micro-scale industries such as grinding mills, and other electricity-influenced ventures. Of course, the socio-economic implications of a lack of efficient electricity supply cannot be overemphasized. Economic development has been intrinsically coupled to electricity use, and that its absence is usually associated with poverty and a reduced quality of life (Weinberg, 2001).

2.3.2 Water and sanitation

The lack of drinking water is another problem in the Savelugu-Nanton district. It is estimated that about 45% of the people lack access to save drinking water, which comprises sources like treated water, boreholes, and hand dug wells (ghanadistricts, 2010). This partially explains the prevalence of Guinea Worm in the district. Those water sources that are suitable to drink from are also spread over a few communities. The treated water for instance are found in only six communities out of the 149, namely Savelugu-Nanton, Janjori-Kukuo, Kanshegu, Duko, Diare and Sahakpalugu. Table 2.1 below indicates the distribution in terms of the various urban/area councils in the district.

Table 2.1: Existing sources of water supply for communities in the Savelugu-Nanton District

URBAN/AREA COUNCIL	HAND DUG WELLS WITH PUMP	BORE HOLES	PIPEBORNE WATER
Diare	5	35	2
Moglaa	0	23	3
Nanton	15	63	0
Pong-Tamale	6	9	1
Savelugu	5	15	1
Tampion	13	35	0
TOTAL	44	179	6

Source: Savelugu Nanton District-DWST/ Field inventories

There are numerous other water sources that are considered unsafe for drinking but are relied upon by members of the district. There are six dams, of which two have filtration galleries, and 85 dugouts. These sources are open and do not have the required maintenance resulting in these sources harboring insects, weeds and bacteria lava. People compete with livestock for water sources resulting in water pollution and subsequent drying up of the dams after the rains. For most part of the year, they drink any water they come across and those who attempt to obtain cleaner water spend most of their time searching in vain. In communities in the Northern region, fetching water for domestic use is conventionally the duty of the women and children whose learning hours are lost through this.

Sanitation is also problematic in that less than 20% of the population in the district has access to safe excreta disposal. Its breakdown includes VIP toilets, septic tank, and Communal Kumasi Ventilated Improve Pit (KVIP). Approximately 16,106 residents representing 15.2% of the population had access to save excreta disposal as at December 2005 (see Table 2.2 below)

Table 2.2: Summary of indicators on water and sanitation

	Water and Sanitation	2003	2004	2005
1	% population served with safe water sources (coverage)	21.1	41.6	45
	% Population served with boreholes	11	31	34
	% Population served with wells fitted with hand pumps (hand dug wells)	0.1	0.6	1
	% Population served with other safe source (treated Piped water)	10	10	10
	Total population served with safe water source	21,074.00	42,796.00	47,682.00
2	% of population using safe excreta disposal facility	12	14	15.2
	% Population with VIP	3	4	5.2
	% Population with KVIP (Coverage as at 31/07/06 was 3%)			
	% Population with other safe source (Aqua Privy)	9	10	10
	Total population with safe excreta disposal	11,985.00	14,403.00	16,106.00

Source: Savelugu Nanton District-DWST/ Field inventories

2.3.3 Healthcare centres

The healthcare centre at Savelugu-Nanton is the only major and relatively developed health centre with good medical staff. The pressure on the healthcare centre is so great that most individuals go straight to Tamale for attention. However, there are community clinics at some few communities like Nanton, Diare (two centers), Pong-Tamale, Janjori-Kukuo, Zoggu and Moglaa. Table 2.3 below provides an explanation of the situation in these health clinics. Out of the nine health centres, only two have water, Savelugu-Nanton hospital, and Diare health center. Diare has to rely on a generator for electricity. The figures on the availability of ambulance, hospital beds, theatres, and toilet facilities are dire to say the least.

Table 2.3: Hospital facilities and core medical staff in the Savelugu-Nanton District

NAME OF HEALTH FACILITY	WATER	ELECTRICITY	AMBULANCE	THEATRE	NO. OF BEDS	NO. OF WARDS	TOILET
Savelugu Ho	Yes	Yes	1	1	23	4	4
Nanton Centre	No	Yes	-	-	4	2	2
Diare Centre	Yes	Generator	-	-	2	1	2
Pong- T Health Centr	No	Yes	-	-	2	1	1
Tampion Post	Yes	Yes	-	-	-	-	-
Moglaa Post	No	Yes	-	-	2	-	2
Janjorikukuo Clinic	No	Yes	-	-	4	1	2
Zoggu Clinic	No	Yes	-	-	3	1	2
Pigu Compound	No	Yes	-	-	-	-	-

Source: Savelugu Nanton District Field Inventory

2.3.4 Schools

The quality of education is often related to the quality of educational infrastructure. The Savelugu-Nanton district has high enrolment rates at the lower levels accompanied with high dropout rates as school levels progress. Aside from a high student-teacher ratio, most of the students cannot be monitored as they sit under trees and pavilions. As observed from Table 2.4 below, the lower levels of education in the district lack adequate infrastructure. Almost half of the students in both pre-school and primary school learn under trees, pavilions, and sheds. The obvious implication of this is that learning is not effective in the rainy season as the threat of rain sees schools closing for the day.

Table 2.4: Educational infrastructure in the Savelugu-Nanton District

Level	Total Number of Classrooms	Classes made of cement	Others (Under trees, Shed, Pavilion etc)	Classroom Occupancy ratio	TLM	
					Core Text Books	Other Text Books
Pre-School Level	70	23 (32.9%)	47	1:96	0.0 *(0.0)	0.0 *(0.0)
Primary Level	476	265 (55.7%)	211	1:39	1.0 *(1.0)	0.3 *(0.2)
JSS	64	38 (59.4%)	26	1:51	1.5 *(1.7)	0.7 *(1.4)

Source: GES, SNDA, 2005
*** National rate**

2.3.5 Roads and transport

The economic and social impact of roads on communities cannot be overemphasized. Roads provide physical linkages between the major components of the economy; communities to health centers, communities to markets, farmlands to markets and communities to schools. In the Savelugu-Nanton district, most of the settlements are linked to the capital city and to other important cities. Some communities are interconnected with feeder roads to main cities whilst other farmlands and some of the villages are situated far from the feeder roads and have poor access. According to ghanadistricts (2010), over 50% of the roads in Ghana are seasonally inaccessible except through bicycles. As a result, almost every household must have access to a bicycle. In addition, more than 90% of the farmlands are not located on the main Tamale-Bolgatanga road and the part of the year where the feeder roads connecting the other villages are needed most i.e. raining season for farm activities as well as harvesting and transportation of produce, they are not accessible. It must be noted the situation does not only retard the economic development but also limits access to other social facilities like education and health.

2.4 Health situation

In addition to the poor infrastructural development in the health sector in the district, the disease situation is equally dire. Though malaria remains the number one disease for OPD cases, other diseases remain a threat to human life and economic survival. The diseases prevalent in the district include malaria, typhoid, anemia, diarrhea diseases, hypertension, pneumonia, other ARI (Acute Respiratory Infection), skin diseases and ulcers, rheumatism, trachoma, River Blindness and Guinea Worm. The inadequate health infrastructure has made it difficult for health personnel to have accurate records on some of these diseases even though they are present in the district; HIV/AIDS is a typical example of such a disease. Among the list of diseases, both malaria and Guinea Worm have received the most attention with healthcare professionals attempting to educate the people on water treatment before drinking and encouraging them to sleep in bed nets (especially pregnant women). Other assistance provided by professionals include the provision of drugs like chloroquine and fansidar, and the provision of water filters especially piped water filters, and attempting to increase access to potable water. Diare is the most endemic Guinea Worm community in Ghana, making the district first in terms of prevalence. Studies show that children are more vulnerable to the disease.

Chapter 3: Literature Review

3.1 The reality of sustainable development

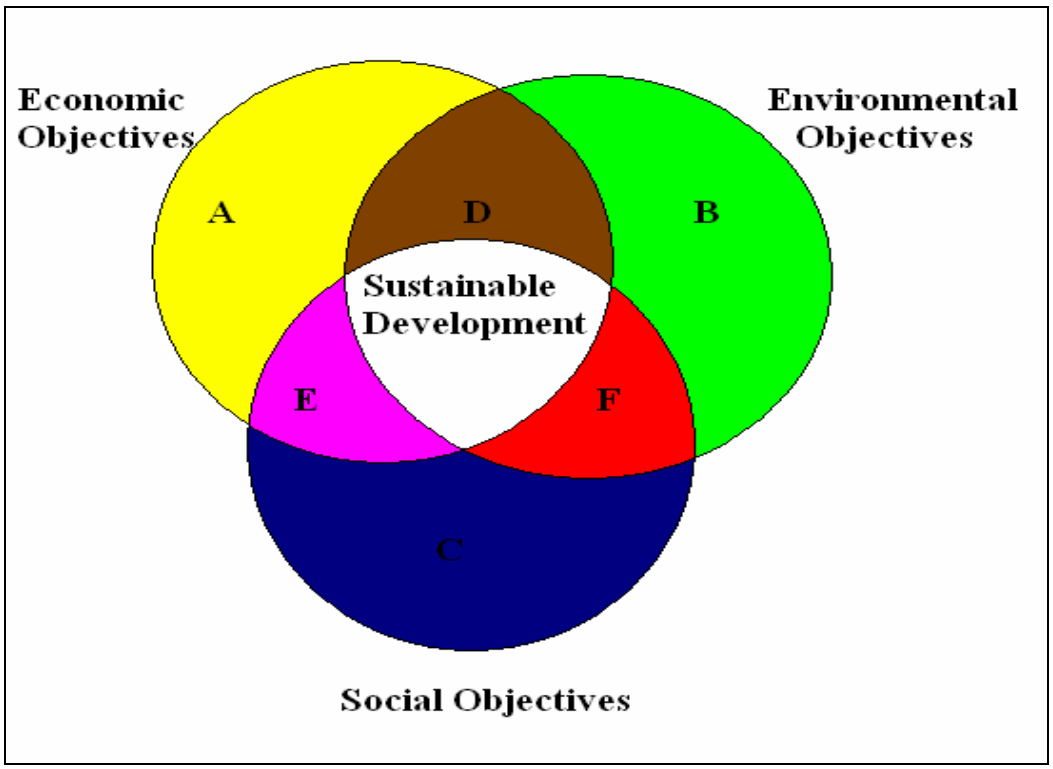
This research is concerned with two components of development - poverty and health. However, the issue of sustainability has become so integrated with development that the two terms are often used interchangeably. According to Todaro (1994) development is a multidimensional process that involves 'major changes in social structures, popular attitudes and national institutions, as well as the acceleration of economic growth, the reduction of inequality and the eradication of poverty.'' Though there are a lot definitions for sustainable development, the most widely used and accepted was initiated in a report by the United Nations World Commission on Environment and Development (WCED) in 1987 under the chairmanship of the then Prime Minister of Norway, Brundtland, from whom the report got its name 'The Brundtland Report'. It stated that economic and social development is sustainable if it "meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland 1987, p. 45). As mentioned, this definition is the most widely used although it was not the first attempt to incorporate sustainability into development issues. Dalal (1994) notes that the issue of sustainability started in the days of Malthus (Malthusian Population Theory) where he predicted the destruction of humanity if its population was not controlled. There were many publications alluding to the fact that the prevailing development trend must be checked to ensure sustainability. According to Dalal (1994, p. 1), it was until seven years before the famous Bruntland report that The World Conservation Strategy (WCS) made a first actual attempt to define sustainable development in the following words:

"For development to be sustainable, it must take account of social and ecological factors, as well as economic ones; of the living and non-living resource base; and of the long-term as well as the short-term advantages and disadvantages of alternative action"

This definition was criticized for being ecologically biased and not encapsulating the whole essence of sustainable development. Mitlin (1992) defined sustainable development by saying that it should involve two components; the meaning of development (i.e. what are the main goals of development: economic growth, basic needs, rights, etc.); and the conditions necessary for sustainability. Criticizing a definition is one thing and executing what is entailed in the adopted definition is another thing. The United Nation and international scholars have widely adopted the Bruntland report's definition of sustainable development and so I will use their definition as well despite many differing opinions.

According to Tatyana and Sheram (2000), the main components or objectives of sustainable development under which countless dimensions can be drawn are economic, social, and environmental factors. Sustainable development then stands at the intersection of all three factors and must be balanced as well, because they are interdependent.' Dalal (1994) explained the balancing factor in sustainability as entailing an integration of the three objectives if possible. In a case where it is impossible trade-offs must be made which involves making hard choices and compromise. Development will then be all compassing and balanced by ensuring that it is socially desirable (i.e. fulfilling people's cultural, material and spiritual needs in equitable ways.), economically viable (i.e. paying for itself, with costs not exceeding income) and ecologically sustainable (maintaining the long-term viability of supporting ecosystems). Figure 3.1 below shows the interaction of the components of sustainable development according to Tatyana and Sheram (2000) with little modification in terms of color and alphabets insertion for clear understanding for the purpose of this review.

Figure 3.1: Objectives of Sustainable Development



A number of theories of development have emerged over the years but many lack the ability to balance economic objectives with environmental and social objectives. For example, the result of restoring vegetation without considering the economic and social ramifications is futile; operating in sector B of Figure 3.1. Some economic theories or models maintain that the limited resources available should be channeled to the exploitation of resources so that when the economy is satisfied economically, the rest will trickledown. In ‘‘Beyond Economic Growth’’ Tatyana and Sheram (2000, p. 8) state that, “history offers a number of examples where economic growth was not followed by similar progress in human development. Instead growth was achieved at the cost of greater inequality, higher unemployment, weakened democracy, loss of cultural identity, or over consumption of natural resources needed by future generations.” Economic growth often signifies the fulfillment of the economic objectives at the detriment of the social and environmental objectives. Aside from historical evidence supporting the unsustainability of ‘stand-alone’ economic development, theoretical evidence also, contradict this mode of thinking.

Indeed, the environmental and social costs associated with economic development are often so great that they outweigh the perceived benefits of economic growth. This is because the costs are external and accounting for them is very difficult. In such a situation, the ultimate welfare of the people is negative but this is only seen years after such economic development has taken place.

Another reason why economic growth alone does not constitute sustainable development is that economic growth depends on the natural and social environment. Economic growth depends on the support from these sectors. For example, social and human development will be required to provide ‘‘higher qualified workers capable of technological and managerial innovations along with opportunities for their efficient use: more and better jobs, better conditions for new businesses to grow, and greater democracy at all levels of decision making’’ (Tatyana and Sheram, 2000, p. 8).

There is evidence that the relationship between economic development and human development has not always been positive. The former is popularly measured by per capita income while the latter by the Human Development Index (HDI). It has been observed that the world ranking in HDI does not always match with per-capita income ranking. Estonia for example is ranked 44th in HDI but is ranked 63 in terms of its per capita income. The same trend is observed in the case of Romania ranked 60th in terms of human development but is 89th in terms of income. Another trend observed from these data is the fact that there are a number of cases where there are higher HDI in lower income countries. Thailand and Colombia are classical examples of this. There are also examples where lower HDI scores are prevalent in high-income countries.

What this means is that for the sustainability of the economy, humans and the natural environment must be healthy enough to provide the needed support. This therefore provides a clear understanding as to why a country that embarks on its development agenda by focusing on the economic objectives fails to be sustainable. The United Nations in its Human Development Report (1996, p. 1) states in its opening sentence that; “human development is the end-economic growth a means.” It however acknowledges the fact that it requires a proper policy implementation from the government sector to realize this. In this case, human and environment concerns are

long-run goals that will automatically follow after economic growth has taken place. There is absolutely no automatic link between economic growth and human development. Dalal (1994) has also noted that there is no necessary link between economic growth and improvement in the environment. This means that there is no guarantee that economic development will trickle down on the other two developmental objectives – environment and humans/social development

Even when there is a deliberate attempt to define and implement sustainable development, it seems the ghost of economic growth of the past is still haunting every sustainable development effort. The famous Brundtland report that many see as the cornerstone for the publicity of sustainable development has in itself been criticized for not acknowledging the delicate balance between economic, social and environmental factors. This is observed in the vision of the report to achieve fast economic growth, free market access of developing countries to that of developed countries, lower interest rate for debts, and a high technology transfer. The signing of the Kyoto protocol is a clear example in which the global community could not reach a compromise because others see economic growth as the ultimate prize in a country's development.

From Figure 3.1, it can be understood that operating within any sector of the Venn diagram other then the portion that harmonizes the three objectives will result in growth that is short-lived in some respect. Tatyana and Sheram (2000, p. 8) state succinctly that: "Only development that manages to balance these three groups of objectives can be sustained for long and conversely, ignoring one of the aspects can threaten economic growth as well as the entire development process."

3.2 Variation and strategies

It can be observed from the above discussion that sustainable development does not have a universal definition or application. It is important to be aware of the fact that in the pursuit of its sustainability agenda, each country should pay attention to balancing environmental, social, and economic objectives. As a result, countries will differ in terms of the strategies they use to achieve sustainable development. This will inevitably lead to a certain sector leading development such as social objectives, whiles others will have economic-led development all depending on their unique circumstances. The Sudan, for example, where establishing peace is the main obstacle to development, will have to put peace and security first in their quest for sustainable development. Theoretically, this could be achieved by either harmonizing the social setting or by improving the economic situation in the country. Other countries rely on economic-led development. Ghana is an example of a country striking a balance between the three objectives but the economic objective still leads overall growth. ‘‘Ghana’s overall development strategy relies on the private sector as the engine of growth, driven by increasing domestic and foreign investment’’ (OECD, 2006, p. 6). This is especially important now that Ghana is producing oil that will mean potentially more investment in that sector.

Other countries choose to develop their human capital. Human development is vital for sustainable development, because it considers the long-term conditions for humanity’s survival (Tatyana and Sheram, 2000). Even though the environment and sustainable development were the key topics at the Earth Summit (Rio Conference), the importance of human beings in sustainable development was acknowledged by having human development first out of the 27 principles listed at the summit. “Human beings are at the center of concern for sustainable development. They are entitled to a healthy and productive life in harmony with nature” (UNEP, 2010). Finally, human development is most often required in a country where a particular disease is endemic and causes partially or totally incapacitation of its people. An example of such a disease is Guinea Worm, which directly retards the growth in the eyes of any ordinary observer. A person has the tendency of being infected every year because there is no immunity to it; it is seasonal and there is no vaccine or drug.

As noted earlier, balancing social, economic, and environmental objectives is an integral part of sustainable development. It is not only the neglect of the objectives that will lead to stunted development but also the inability of the country or the region to get the right balance between the objectives. The UNDP (1996) has identified four patterns, which countries can use to achieve sustainable development considering the various economic and human/social objectives. They acknowledged that sustainability cannot be talked about in a lopsided development as discussed earlier, but only when an attempt is made to combine the objectives. The first three patterns combine the two objectives and in each case some succeeded and others failed implying that sustainability is guaranteed only when the objectives are integrated in a balanced manner. There are countries that embarked on a slow economic development with a fast human development. Republic of Korea in the 1960s, China, and Indonesia in the 1970s succeeded with this pattern while Cameroon and Sierra Leon ended up in a deteriorating economic and human development in the 1980s. Brazil and Egypt in the 1980s embarked on a fast economic growth accompanied with slow human development, the result of which was failure after a decade. A mutually reinforcing economic growth and human development is yet another pattern, which other countries took which according to UNDP sustained development for a minimum of three decades. The last pattern, which sways away from sustainable development, is a situation of mutually stifling economic growth and human development. As Dalal (1994, p. 4) states: ‘‘there is no blueprint for sustainable development. It needs to be defined to meet and respect the particular needs and circumstances of individual countries, societies and cultures’’ Depending on these differences what is of concern to a country or an organization will not be the same for the other though all are having the same goal.

3.3 Guinea Worm

3.3.1 History of the Guinea Worm

Guinea Worn is known as the disease of the poor; and is generally confined to developing countries. As is so often the case in these countries, the disease attracted a lot of superstition and little effort was initially made to tackle it. “A lack of understanding of its preventable causes has shrouded it in myth; poor people have accepted it as God's will or punishment, another horrible fact of life like high infant mortality or the vagaries of the rains” (Yohalem, 1990, p. 1). The oldest mention of the disease is thought to originate in 1530 BCE where Guinea Worm was associated with the 'fiery serpent' mentioned in the Old Testament (Numbers 21:4-9). The story reads, “….And the Lord sent fiery serpents among the people, and they bit the people; and much people of Israel died...” Further evidence of its existence is also documented by various authors in the field of philosophy and physics of ancient India, Greece and the Middle East (WHO, 2009b). Notable among the European authors were Galan, Agatharchdis who lived in 140 BC and Plutarch, though there is no evidence of the disease in their homelands; all their writings were pointing to its prevalence along the Red Sea (Karam and Tayeh, 2006)

According to Cairncross et al (2002) there are several Egyptian texts pointing to the second millennium BC as the period in which Guinea Worm was prevalent. There is also evidence that calcified dead male worms have been found in 3000-year-old Egyptian mummies. This was established in the Manchester Egyptian Mummy Project were scientists found a calcified male Guinea Worm in the abdominal wall of a female mummy, which the team nicknamed the “Pharaoh Worm” (Morrow) Gallardo S. R et al (2005). Overall, the disease has been documented in Algeria, Egypt, the Gambia, Guinea Conakry, Iraq, Brazil, and the West Indies but in almost all of these countries, Guinea Worm is no longer prevalent because of determined eradication efforts (Greenaway, 2004).

The Arabian peninsula during the medieval period was also once considered to be an endemic region especially in their holy city of Medina, where it was called ‘Medina vein’ from which the current name ‘‘Dracunculus medinensis’’ is derived. It was at this time the first detailed description of the worm and the disease was given by the

famous Persian/Arab physicians Ibn Sina (Avicenna) and Ar-Razi in the tenth century AD (Karam and Tayeh, 2006). According to Merrill (2008) it is believed that Guinea Worm is the potential origin of the Staff of Life (Rod of Asclepius, see Figure 3.2), used as the symbol for medicine. The rod signifies the most effective and widely used method of treatment by wrapping the worm on a stick.

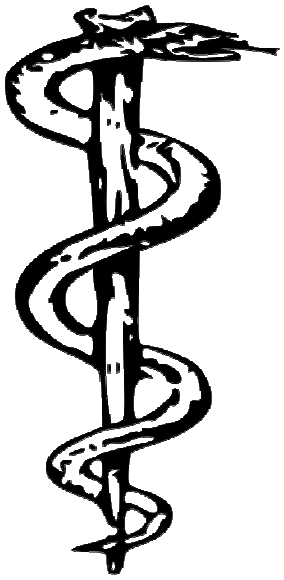


Figure 3.2: The Rod of Asclepius

Over time, global awareness of the disease has increased and scientists have attempted to unravel the mystery behind its existence and mode of transmission. Some proposed that it was an exposed nerve whiles others say it was a dead tissue. It was Carolus Linnaeus, a Swedish naturalist, who settled the controversy by suggesting that it was in fact worms that caused the human body's deformity (Cox 2002). At this stage in time, no one could talk of treating it since it was not even known what type of sickness it was. After its identification as a worm, much attention was drawn to its life and how it gets into the human body. European travelers in the early seventeenth century could now comfortably give it a new name 'Guinea Worm' after they discovered that it was prevalent along the Gulf of Guinea (WHO, 2010a). The first medical doctor from West Africa to be trained in Europe, James Africanus Horton wrote extensively on Guinea Worm, but with its transmission still in a mystery, he thought it was transmitted through the soles of the feet (Cairncross et al 2002).

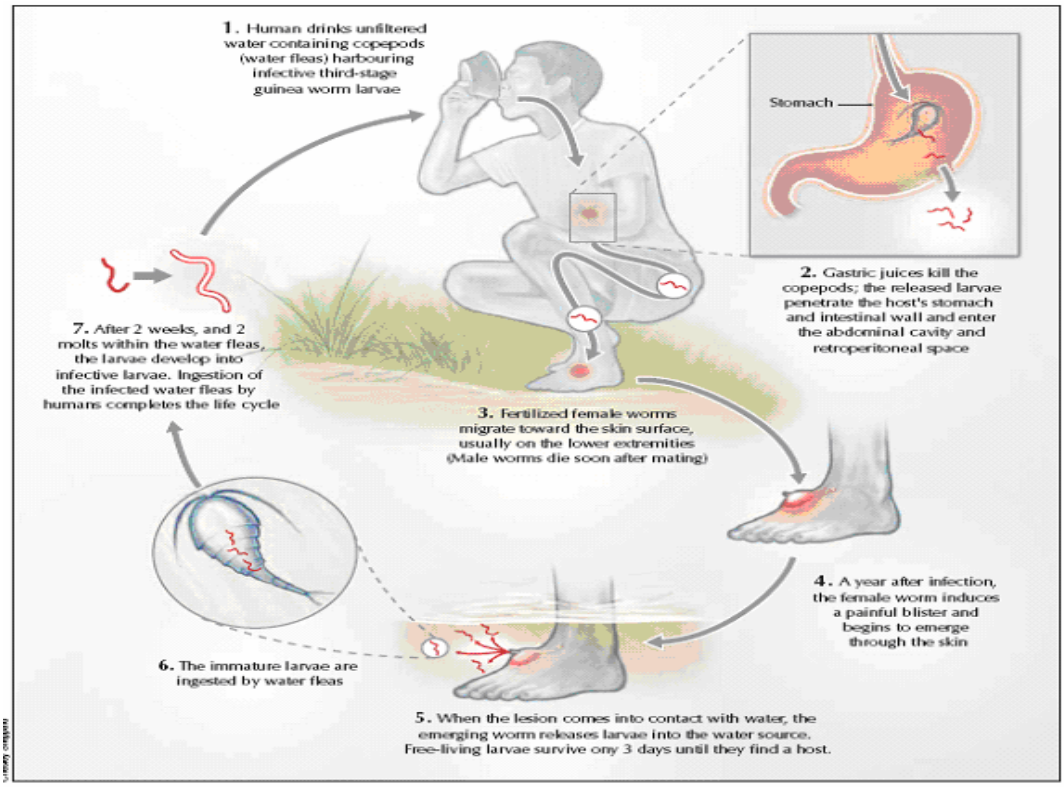
A groundbreaking discovery was made in 1870 by a Russian biologist Fedchenko, which has been described as one of the turning points in the history of tropical medicines as well as parasitology. He found out that the Cyclops (a water flea) is the intermediate host in dracunculiasis transmission-the worms that are brought forth by the female worm after being immersed in water are eaten up by the freshwater fleas in the water who are then ingested by human beings (WHO 2008). Concerning the anatomy of the worm, credit is given to Henry Charlton Bastian for being the first to give an accurate account (Karam and Tayeh, 2006). Robert Thomas Leiper in 1905 and Dyneshvar Atmaran Turkhud in 1913 established a complete life cycle of the worm by experimentation in a laboratory. This they did by inducing experimental infections in animals and humans, which also gave strong endorsement to the work of Fedchenk (Karam and Tayeh, 2006).

3.3.2 Disease life cycle

According to Cairncross et al (2002), the worm called Dracunculus medinensis is caused by a single species belonging to the nematode super family Dracunculoidea of the order Spirurida. It is the largest of the tissue nematode parasites affecting humans. This mature female worm makes a blister under the portion of the skin it lies with its anterior end. The complete life cycle, which takes approximately a year, starts with the introduction of the lava into stagnant water, which humans use as drinking water? The contact of the blister with water induces the blister to burst there by exposing its anterior end. The immersion of the infected part into the water is the most common way by which the lava gets into the water. At some point in time when the morphology of the disease was not known, people quench the burning sensation accompanied with the blister by immersing the infected part of the body into water, which then prompts the blister to burst and causes the release of the larvae by the female worm. The mature female Dracunculus medinensis is one of the longest nematodes and could measure up to a meter (100cm) in length. It releases the lava as long as it lives by contracting its vulva located interiorly and posterior, i.e. all over the body (Karam and Tayeh, 2006). It has the capacity to release from 1 to 3 million larvae in its lifetime which remain viable in the water for up to 7 days. The number of

larvae released at each contraction decreases gradually day by day (Cairncross et al 2002). Figure 3.3 represents the complete life circle. It starts the cycle with the drinking of the infected water while my explanation starts with stage 4 from the diagram.

Figure 3.3: The Life Cycle of Guinea Worm



Source: Greenaway, (2004, p. 496)

As explained earlier, the survival and development of the larvae after the seven days requires an intermediate host, usually the water flea (copepods) measuring from 1 to 2 millimeters. These are predatory species and they ingest the larvae as soon as they find it in the water. This is illustrated in the sixth stage in the diagram. In the body cavity of the water flea, it develops into an infective third stage after molting twice for 14 days at a temperature of 26°C (Cairncross et al., 2002).

For further development, a human being ingests the copepod containing the infective larva by drinking the water that contains it. Upon reaching the stomach, the gastric juice, which is a digestive acid, reacts to the water, and kill the copepod as a result

liberating the infective larva to have direct contact with the stomach walls. Either they penetrate the stomach walls or those that are moved to the small intestines also penetrate the intestinal wall to the peritoneal cavity and then migrate to the connective tissues of the abdomen wall and thoracic cavity all in 15 days (Greenaway, 2004). They remain at this place and develop into sexually mature male and female by molting twice. They mate in 100 days time and the male worm dies after a few months. The female then continues its migration and development through the body towards the surface of the skin of the lower limbs (fingers and legs) and can potentially emerge out of any part of the body. This journey normally takes ten months by which it is fully grown and developed with the distended uterus being filled with millions of first stage larva (Karam and Tayeh, 2006). It informs its readiness to emerge by forming a blister awaiting a contact with water to start the cycle again.

3.3.3 Epidemiology

The distribution of the Guinea Worm is based on two factors - unsafe drinking water; and the temperature of the region. Examples of unsafe drinking water sources include ponds, hafirs, dams, and step wells (mostly used in India). The continuous flowing pattern of rivers and streams makes it difficult for the survival of both the released larva and the intermediate host (copepods) since they require some time to develop (Karam and Tayeh, 2006). The second condition, namely temperature, is a result of the stage at which the larva morphs inside the copepods and this requires a temperature of 26°C (Cairncross et al., 2002). Generally speaking this temperature can only be found in the tropics and that is why Guinea Worm is classified by the WHO as a tropical disease. An examination of the epidemiological map of Guinea Worm in Figure 3.4 indicates this pattern.

Within the three endemic countries in Africa: Sudan, Ghana and Mali, the prevalence of Guinea Worm is skewed towards the poorer regions of those countries. For example, in Southern Sudan, Northern Ghana, and Eastern Mali (Hopkins et al, 2008). In Ghana 95% of the cases are located among the Dagomba ethnic group, which is the group that dominates the Savelu-Nanton District. According to Karam and Tayeh

(2006), the disease typically affects these rural communities even though some occurrences in urban towns are possible. The researchers however stressed that occurrences in urban areas are more likely to be imported, i.e. contracted elsewhere. The case of imported infection makes it difficult to establish a relationship between infected drinking water and the presence of the disease due to the long incubation period.

In the 1980s the Center for Disease Control and Prevention (CDC) started a worldwide initiative to eradicate Guinea Worm but the initiative was relatively ineffective until a partnership was formed between the CDC and the former U.S. president Jimmy Carter, the United Nations Children's Fund (UNICEF) Executive Board, and the African Regional Committee of the World Health Organization (WHO). The efforts of this partnership led to a significant reduction of cases of the disease (Cairncross et al 2002). The initiative also adopted as a sub-goal, the International Drinking Water Supply and Sanitation Decade (1981–1990), which has been led since 1986 by The Carter Center (Hopkins et al, 2008). As seen from the map (Figure 3.4) which shows where Guinea Worm was and is currently found, there were 20 endemic countries as at 1986 which has since been reduced to 4 (all in Africa); Ghana, Sudan, Mali and Ethiopia. The rest of the countries are either certified free of transmission (India, Pakistan, Senegal, Yemen) or are in the pre-certification stage (Cameroon, Central African Republic, Chad, Kenya, Uganda).

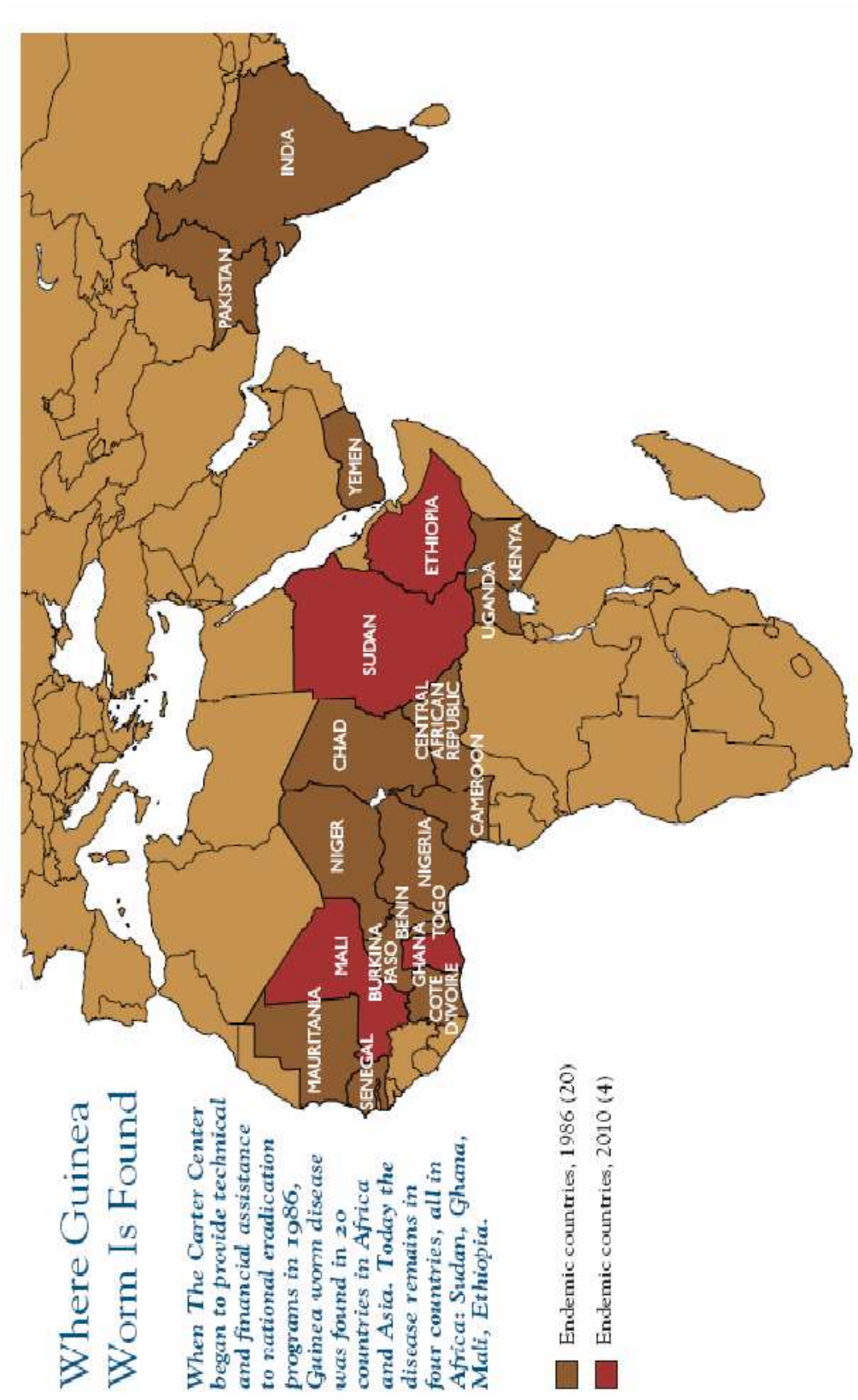


Figure 3.4: Guinea Worm Map-2010

Source: Carter Center (2010)

3.3.4 Clinical features and treatment

The outward manifestation of Guinea Worm is seen from the period of the blister on the outer skin to the healing of the ulcer. Almost all of the developments on the body of the host occur beneath the surface of the skin. When the worm emerges on to the surface just beneath the skin, it releases some of the larvae at that portion where the body of the host automatically reacts to it resulting in the formation of a blister. The formation is associated with a burning sensation restricted to the portion of the blister. According to Karam and Tayeh (2006) typical symptoms with the blister include, erythema, urticarial rash, intense pruritus, nausea, vomiting, diarrhea, dyspnoea, giddiness and syncope. This can continue for some time until the blister bursts, reducing some of the pain. Contact with cold water can induce the rupture of the blister. As explained earlier, every part of the human body is a potential site for the emergence of the worm, however more than 90% of worms emerges from the lower extremities, usually below the knees (Greenaway, 2004). An average of 1 to 3 blisters can emerge simultaneously, but as many as 40 have been documented to emerge from a given person in a season (Barry, 2007). Upon the rupture, the worm exposes it anterior end and immediately discharges its larva and some fluid. As explained earlier the uterus filled with larvae is all over the body hence the part that comes out of the body dries up after discharging its content. The process is repeated until the whole worm is out of the body. It has been acknowledged that some worms do not make it to the surface and therefore die and calcify anywhere within the body of the host. They can cause permanent disability and deformities if they end up in one of the joint especially the knee. In very few occasions, the worm finds its way to the aberrant locations such as the pancreas, lung, periorbital tissue, testes, pericardium, and the spinal cord causing severe damage to the host (Greenaway, 2004).

There may be additional complications involved with the disease such as bacterial and tetanus infection if proper nursing techniques are not employed in extracting the worm from the host. This is a very common occurrence in rural communities where nursing services are sorely lacking. According to Cairncross et al (2002), 28% of patients in Ghana had pain 12 to 18 months after the emergence of worms while 0.5% had permanent physical impairment in the form of “locked” knees or other joints. There is no immunity to its infections and the probable case is that a person can be

infected every year as long as he or she continues the exercise of drinking contaminated drinking water. The current treatment for the disease involves carefully winding the worm around a stick everyday as it emerges. Modern medicine has just found a way administering drugs that will ease the pains associated with extraction but here is no known cure or vaccination. ‘‘The use of niridazole (25 mg per kg body weight daily for 10 days), thiabendazole (50 mg per kg body weight daily for three days), or metronidazle (400 mg for an adult daily for 10 to 20 days) can help in lessening the intense tissue reaction, making extraction easier, and can relieve the pain’’ (Karam and Tayeh 2006, p. 378). Surgical extraction prior to the emergence of the worm is possible and has been practiced in India; it is however not encouraged at an intervention level considering the high risk of spreading more infectious diseases especially HIV.

3.3.5 The socio-economic effects of Guinea Worm

The detrimental effects of Guinea Worm are felt in all spheres of life. As mentioned previously the disease rarely kills but incapacitates the host for months. Permanent disability is also very small (less than 1%) however between 58 to 76% of patients are unable to leave their beds for approximately a month during and after the emergence of the worm (Adeyeba and Kale, 1991; Cairncross et al 2002). This peak period of inactivity often coincides with periods of the year when labor is required in rural communities especially among farmers during sowing or harvesting their crops. It is estimated that infected people lose 100 days of work per year and that infected children are absent from school for 25% of the school year (Cairncross et al 2002). A survey of 87 households in southern Nigeria estimated an annual loss of income in 3 rice-growing states at US$20 million, and for the people of Dogon in Mali “the disease of the empty granary’’ is the other term for the Guinea Worm disease (Greenaway 2004, p. 497). The seasonality of its infection implies that a whole household or community can be incapacitated at the same time making it impossible for members to substitute for one another in agricultural as well as other responsibilities. The fact that 28% of the patients are still not fit to undertake daily activities for 12 to 18 months even after infection exacerbates the problems (Greenaway, 2004).

Regarding the nutritional state of children, a study in the Sudan by Cairncross (1996) found that in households where more than half the adult members had suffered from dracunculiasis in the previous year, the children under 6 years old were nearly three times more likely to be malnourished. These children obviously cannot attend school just as their parents cannot attend to laborious tasks on the farm. Absenteeism increases in peak season and schools are normally closed down when there is an outbreak in a particular year. School may also close when there is a teacher who is infected. Cairncross et al (2002) mentions that on average, schools in endemic areas close down at the peak of infection even when there is no outbreak.

In 1997, the World Bank estimated that the economic rate of return on the investment will increase by 29% per year in affected countries if Guinea Worm was eradicated. This estimate is based on very conservative estimates of the average amount of time infected workers are unable to work (Greenaway, 2004). However, others consider this estimate as been pessimistic and undervalued with the explanation that the eradication campaign by the World Bank should not be viewed as mitigating the direct and measurable impact on production but also the perpetual stream of benefits at no ongoing cost (Cairncross et al., 2002).

3.3.6 Methods of eradication

Following the discovery that a worm carries the disease, and the subsequent discovery that the worm cannot survive on its own without the help of the intermediate host, the eradication of Guinea Worm has primarily revolved around breaking the life cycle of the disease. Muller (1979) notes that the nature of the Guinea Worm life cycle should make it relatively easy to eradicate. The copepods are not a mobile vector like a mosquito, and the carrier state in both the copepods and human hosts is of limited duration. Diagnosis is easy and unambiguous as well as cheap and effective measures are available to prevent transmission. The disease has a limited geographical distribution, and even within these areas, it is found only in certain communities. Its markedly seasonal distribution also permits a more intensive focus on its prevention in seasonal campaigns. Lastly, as discussed above, transmission from animals to people is practically unknown.

The eradication of Guinea Worm has focused on breaking the disease life cycle through the following intervention methods (Cairncross et al., 2002):

1. Provision of a safe water supply,
2. Filtration of one's drinking water to remove copepods,
3. Searching for patients with active cases and proper management of cases,
4. Ensuring that patients avoid contact with ponds.
5. Killing or removing copepods in ponds.

Points 1 and 4 are perhaps the most effective means by which to break the transmission. Indeed, the provision of safe drinking water makes it virtually impossible for the copepods to enter the human system even if all the ponds are infected. Similarly, ensuring that infected persons do not go near the ponds is another way of breaking the transmission in that once the larva does not get into the water, the water will always be safe at least from Guinea Worm infection. Filtration of drinking water to remove copepods which is also considered an effective means to reduce infection although people often do not have the time or equipment to effectively filter water (WHO, 2000).

3.4 The link between disease and poverty

The link between disease and poverty is well established at both the individual and societal level. ''At the individual level, for example, personal experience of poverty may be associated with poorer health. At the population level, societies with less equal distributions of income may experience worse health than those with more equal distributions of income'' (Phipps, 2003, p. 2). Health statistics in both poor and rich countries indicate the gulf in a range of health indicators among countries of varying wealth statuses. Common health indicators include mortality rates (adult and child), life expectancy, maternal mortality, disease burden or prevalence, health infrastructure, and doctor and nurses patience ratios. In Africa where poverty is the highest in the world, HIV/AIDS-related infections are the leading causes of deaths with Malaria in third place. According to the UNECA (2002), in 2001 only 1% of the 28.5 million Africans HIV/AIDS patients had access to antiretroviral drugs. In the

same year, 81% of the world's HIV/AIDS-related deaths and 90% of the world's malaria deaths occurred in Africa.

It has been observed that an improvement in a region's wealth has an effect on its health status (UNESCAP, 2007). For example, in Asia during the period 1988-2005 the region's developing countries experienced an average growth rate of 7.5 per cent per annum – more than twice that of the rest of the world. Along with economic growth, there has been a sharp drop in the infant mortality rate experienced by almost all countries in this region. This in turn has contributed to a substantial increase in life expectancy in the region from 40.19 years (in 1960) to 68.17 years (in 2004). Facts and figures are not the only the means by which to examine the complementarily relationship between poverty and disease. Indeed, a number of theorists have investigated this relationship. For example, Phipps (2003) maintains that while an individuals' health status does improve their level of personal income, it does so at a decreasing rate – known as the absolute income hypothesis. The absolute deprivation hypothesis has it that very low standards of living are bad for health, but that once the deprivation threshold is reached, additional income is not particularly important for health.

3.4.1 Does poverty cause poor health?

In response to this question, there are generally two arguments. Some argue that poverty causes poor health (Proponent A) while others maintain that poor health causes poverty (Proponent B). Proponent A subsequently coined the phrase ''diseases of poverty'' (i.e., diseases that are caused by poverty). This implies that those diseases can only be found or more prevalent in the developing countries. Regardless of the range of measures used to assess either poverty and/or health, a dependent relationship usually exists. With the existing medicines and technology, many diseases are now either treatable or preventable at a cost at which people in developing countries cannot pay resulting in a large proportion of the population dying or becoming disabled from these otherwise treatable and preventable diseases. Malaria for example is effectively and easily prevented with insecticide sprayed mosquito nets that cost only five U.S. dollars each, but still more than 1 million people die and over 500 million cases of malaria continue to occur each year (SPICE

DIGEST, 2009). Of course, it is expensive to purchase a mosquito net for five dollars when a significant proportion of infected people are living on less than one dollar a day. In 1967 a U.S. Surgeon General William H. Stewart declared that ‘‘it is finally time to close the book on infectious disease," because many of them are now preventable and curable using low cost intervention strategies (SPICE DIGEST, 2009, p. 1). However, while some may have forgotten the existence of some diseases it remains a problem to others particularly in the developing world.

According to Stevens (2004, p. 4), the burden of disease in developing countries is a result of poor nutrition, indoor air pollution, and lack of access to proper sanitation and health education. Following from this assertion, poverty also makes preventable and curable diseases culminate into an epidemic. Malaria remains the number one killer in developing countries whose prevention needs a maximum of ten dollars. The inability of people in developing countries to have access to safe drinking water makes them suffer from the debilitating effects of Guinea Worm. Poverty also played a role in the growth and spread of HIV/Aids by, amongst other things, increasing the labour mobility of the poor in their quest for sustainable livelihood. Residential mobility is an important factor through which the virus spreads (Cohen, 2000). This is particularly the case for women who often resort to commercial sex as a faster way to cater for the family.

The economic and social behaviors of the poor seem to give much ammunition to the stance of Proponent B. Indeed, for the poor it is the here and now that matters (Cohen, 2000). This in part explains why despite in-depth knowledge on the effects of deforestation and desertification, local Amazonian communities continue to use and abuse these resources. Similarly, the poor continue to engage is risky sexual practices increasing their risk of HIV/Aids and local residents in Ghana continue to drink unsafe water increasing their risk of Guinea Worm.

Proponent A also reinforces their argument with the fact that poverty affects health throughout the life cycle of the human being and that the health impacts of poverty accumulate and reinforce each other over a lifetime. If a child is born to the poor, the health condition of the child at various stages of development will be shaped by poverty, especially at the sensitive points in human development: birth, starting

school, adolescence and developing sexual relationships, leaving home, getting a job, marriage, parenthood, chronic disease and illness and retirement (Ross, 2003). One need not be a supporter of Proponent B to accept the fact that human capital, which represents the cornerstone of every development, is often badly affected in areas where diseases are prevalent. The presence of diseases inevitably leads to a decrease in labor supply as people will not only be incapacitated and unable take part in the production process, but will also result in the supply of less efficient labor if they are not totally incapacitated. This direct effect of disease is less disastrous as compared with its effects on schoolchildren and those undergoing training to replace the aging laborers. Some of these diseases have daring consequences on children's ability to develop sharp minds to suit their area of study especially when it has effects on human cognition; the ability to perceive, understand, and interact with our environment in an intelligent manner. Aside from those diseases that eat away the lives of the labor force, some diseases maim while others cause an irreversible disability on the infected person. River Blindness for example is capable of permanently blinding an infected person.

Improvements in health increases quality labor supply by ensuring greater access to education and training. It is estimated that children with the most severe health problems obtain about 20 per cent fewer years of schooling than their healthier counterparts and this reduction in schooling has a direct impact on incomes: it can lower hourly earnings by around 17 per cent. A one-percentage point increase in the adult survival rate can increase labor productivity by as much as 2.8 per cent (UNESCAP, 2007, p. 1). Yasmin and Catherine (2002, p. 21) note ''Africa's GDP would probably be about US $100 billion higher if malaria had been tackled 30 years ago, when effective control measures first became available.'' Malaria alone according to the researchers is estimated to slow economic growth in Africa by up to 1.3% each year.

An answer to the question will remain elusive as explanations from both sides prove evident and practical coupled with evidence around the world to support them. What is explicit however is that the two exists together but as to which causes the other one would probability have to go back in time to find out which of them came into being first. The causal relationship between the two is defined by the researcher who

decides to control one and tries to establish a causal effect. This method is used to establish those stands (Proponent A and B), establishing why both make cogent and convincing points as seen from the preceding paragraph. Phipps (2003) after admitting to this fact was quick to observe that most studies control for the possibility that ill health causes low income rather than that low income causes ill health.

3.4.2 Guinea Worm and the Millennium Development Goals (MDG)

At any point in time, Guinea Worm has a direct and immediate effect on poverty and disease which are directly related to the MDGs. 'The disease of the empty granary' as the Dogon people Mali refer to it seems to be the best and the most accurate description that incorporates both terms: poverty and disease (Cairncross et al., 2002). Regarding the effect of Guinea Worm on agricultural productivity, Ahearn and de Rooy (1996) provide evidence of the devastating effects of Guinea Worm on crop development using satellite imagery. Cairncross et al (2002) also found that Guinea Worm accounted for a reduction of 5% in the overall production of two important subsistence crops: sorghum, mainly grown by men, and peanuts, cultivated by women in Nigeria. The also notes an estimated annual loss of $20 million due to Guinea Worm disease in only three rice-farming states in Nigeria.

As part of the objectives of this research, Guinea Worm has everything to do with education, hence the second goal. Because it is a seasonal phenomenon, that part of the academic calendar will always be affected, as most children will not attend school for more then an academic term. There are instances where the teachers themselves are the victims leaving the schools closed even if the children are not infected. Even if the students and the teachers are not infected in a particular year, the children stay home to take care of infected parents. Women are responsible for activities that have to do with water and are responsible taking and nursing the sick.-the gender side of it.

As far as maternal and child mortality is concern, Guinea Worm has an indirect effect because it is rarely fatal. According to Tayeh and Cairncross (1996), children in a household with adults infected with Guinea Worm are three times more likely to be malnourished, increasing the risk of disease and early death. Meanwhile malnutrition

plays a major role in half of all deaths of children under age five (5) in developing countries. The eradication process of Guinea Worm has been marked as one the most successful efforts through global partnership. It has previously successfully harmonized efforts from willing governments, foundations, nongovernmental organizations (NGOs), and corporations and of course the affected countries. This has been the brainchild behind the Jimmy Carter's article ''the power of Partnership''. The fact that Guinea Worm is a water-borne disease requires the incorporation of the health of the environment in its eradication process. Lastly, being a disease, Guinea Worm is the second target after smallpox for eradication. There has been more than 99% reduction in the cases worldwide since the fight against it started in 1982 (WHO, 2009b)

Chapter 4: Methodology

4.1 Research strategy

According to Bryman (2008) a research strategy directs a general orientation to the conduct of social research. A research strategy can involve quantifying data or can emphasize words or phrases (qualitative) rather than numbers and statistics (quantitative). However, a mixed strategy, which is a hybrid of both qualitative and quantitative approaches, is considered appropriate by many for its moderation and integration. This strategy has gained precedence in recent times and a number of scholars see no need to distinguish between quantitative and qualitative approaches. According to Bryman (2008) the distinction is however necessary for at least two reasons;

- First, it represents a useful means of classifying different methods of social research, and second,
- It is a helpful umbrella for a range of issues concerned with the practice of conducting social research.

Before elaborating on my research strategy, I will like to discuss both quantitative and qualitative methods in more detail.

4.1.1 Quantitative research methods

Quantitative research methods typically employ a deductive approach to research with much emphasis on testing existing theories. The method intends to seek research outcomes that are reliable, objective, and above all generalisable. In order to achieve this, the methods are designed to reduce bias by obtaining a random sample from a research population, and administering a research aid (e.g., structured questionnaire) to the sample. In this process the researcher is considered external to the research. The data that is obtained in such a process as well as the results are reliable and are used to generalize to other cases outside the chosen sample and study area, with the strong conviction that the process is replicable. This is what Bryman (2008) summed up as saying that measurement, causality, generalization and replication are the main preoccupation of quantitative researchers.

Of course, quantitative research methods become complicated when the variable or the phenomenon under investigation is difficult to measure or quantify. This is especially relevant if the variable is important to the research question being asked. In this way, the real world setting is compromised, as certain variables may need to be eliminated from the study. As a result, the method relies on instruments and procedures that hinder the connection between research and everyday life, rather than complement it.

4.1.2 Qualitative research methods

Unlike quantitative methods, qualitative research methods do not involve the calculation of statistics. The process is designed to provide answers to the 'how' and 'what' questions which statistics often struggle to capture adequately. In qualitative research, the researcher aims to immerse him or herself totally in human cultures and the physical environment. Both of which are made up of very unstable but complex interactions. The actions, records, and words of people under study are closely monitored for a better understanding of the phenomenon under investigation. This requires that the researcher has a very close interaction with the people under study.

Utilizing this method, qualitative researchers generate a sizeable but informative sample - through any of a number of non-probability sampling methods - and administering a research aid (e.g., interviews) to the sample. Researchers then document and analyze the data through a personal understanding of the current setting. In this respect, the researcher is an instrument of the whole data collection process, implying that results can often depend greatly on who is conducting the research. Replication in this case is almost impossible. It must be noted that observations, focus groups, archival collection, video tapes, as well as pictures may be employed in some cases. According to Bryman (2008) qualitative researchers are preoccupied with the following;

- Seeing through the eyes of the people being studied
- Description and the emphasis on context
- Emphasis on process
- Flexibility and limited structure

- Concepts and theory grounded in data.

In this method, theory is generated from research implying an inductive approach (Bryman, 2008). Facts, relationships, variables, theories are dug out from the response and actions of the people under investigation. It is therefore the duty of the researcher to grasp the subjective meaning of the actions and responses heard (interpretivism). The theories and patterns that emerge are original and inductive. Qualitative methods aim to obtain rich and detailed information. However, it has been criticized in the past for being subjective, not replicable, lacking transparency as well as its inability to generalize results (Bryman, 2008).

4.1.3 Mixed research strategy

A strategy that combines quantitative and qualitative research is what Bryman (2008) refers to as a mixed method strategy. To Johnson and Onwuegbuzie (2004), it is a class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study. They add that ‘‘its logic of inquiry includes the use of induction (or discovery of patterns), deduction (testing of theories and hypotheses), and abduction (uncovering and relying on the best of a set of explanations for understanding one’s results) (p. 17)’’

The mixed method approach is considered by many as the strategy that harmonizes qualitative and quantitative methods by ironing out the flaws in the applications of the two methods individually (Bryman, 2008). For example, paying little cognizance to the real world setting to operate is often misleading (as in the case with quantitative research), and it is also time consuming and labor intensive to fully understand all aspects of any given topic (as is the case with qualitative research). By combining the two methods however you are able to offset these differences. An integration of the two in this case would seem to be the solution or at least offer a logical and practical alternative to each method considered separately.

4.1.4 My choice of research strategy and justification

The strategy that I will employ in my research is the mixed method strategy. This choice was made as a result of the nature of the research. Just as I would like to establish some form of statistical link between poverty and disease, I would also like to conduct a personal in-depth analysis of the disease in the district. The latter would be aimed at unearthing the hidden reasons for the persistence of the disease in the area. My motivation is also drawn from the type of data I will be collecting as well as the research questions that must be answered.

Johnson and Onwuegbuzie (2004), and Williams (2007) maintain that the mixed methods approach to research is an extension of - rather than a replacement for - the quantitative and qualitative approaches to research. The strengths and weaknesses associated with various research approaches are not absolute but rather relative to the context and the manner in which researchers aspires to address the phenomenon under investigation. There are many approaches to a mixed method strategy. According Johnson & Onwuegbuzie, (2004) these possible approaches are influenced by two paradigms, i.e. deciding whether to give the quantitative and qualitative components of a mixed study equal status or to give one paradigm the dominant status. Also important is the ordering of the two, i.e. whether they can be carried out sequentially or concurrently. Another consideration is the degree of mixture and where in the course of the research should the mixing take place. Notwithstanding all these considerations, the mixing can be done by either mixing qualitative and quantitative approaches within or across the stages of the research process (mixed-model) or the inclusion of a quantitative phase and a qualitative phase in an overall research study (mixed method) (Johnson and Onwuegbuzie, 2004). I will be employing the former with specific utilization of across-stage mixed model research. The quantitative methods will be more descriptive in the sense that most of the statistics calculated from the data will not have a clear picture in isolation unless more exploration is conducted using qualitative methodologies.

4.2 Research design

According to Bryman (2008) the research design refers to the framework of the collection and analysis of data. He identified five different prominent research designs: experimental design, cross-sectional or survey design, longitudinal design, case study design, and comparative design. The processes within each design vary considerably but they all have the same purpose, which is to find answers to the research problem, and research questions that has been identified. Examining all these designs, the case study design is the one that suits my research both in theoretical and practical terms. Though the case study design has often been associated with qualitative researchers, Bryman (2008) notes that such an association is inappropriate and stresses that a case study design can suit both quantitative and qualitative research. In my research, I am aware of the difficulty in generalizing my findings to other parts of Ghana - this represents a standard criticism against the case study design (Bryman, 2008). The purpose of this case study is however not to generalize to the population beyond the current context.

4.3 Sampling

To quote Marino (2010): ‘‘To the scientist, however, representative sampling is the only justified procedure for choosing individual objects for use as the basis of generalization, and is therefore usually the only acceptable basis for ascertaining truth.’’ The region under investigation has a population of approximately 122,575 people in 149 communities. It is therefore imperative to obtain a representative sample for this research. In my study, I used probability sampling to obtain my sample of 109 residents, 100 of whom where farmers, 2 Guinea Worm officers and the remaining teachers from the communities I visited. I initially targeted ten teachers, i.e. one from each community in the district, but it came to my realization that some communities do not have any form of educational facility. According to Bryman (2008) probability sampling allows accurate inferences to be made from the population from which it was selected. After careful consideration of the objective of the research - the target group of the research were farmers who make up 97 % of the total number of people in the district. Additional information was obtained from

officials of the district assembly, including the office in charge of the Guinea Worm control.

4.4 Data collection

The data collection took place during three separate trips to the district. During the first trip, I familiarized myself with the area and obtained some information from the study sample. I also randomly visited some surrounding communities in addition to visiting the Savelugu-Nanton District. I introduced myself to the Cater Center in the district whose aim is to eradicate Guinea Worm. The second trip occurred when it was hastily announced in the press that the disease had been eradicated in the district and the final trip was when I collected the data for the research.

4.5 Data collection methods

My data collection techniques were informed by my research strategy and design, not on the relative advantage of one over the other. According to O'Leary (2004, p. 150) "Collecting credible data is a tough task, and it is worth remembering that one method of data collection is not inherently better than another." He added that what makes one method better at point in time is the research goals and strategy.

4.5.1 Self-administered questionnaires

I utilized self-administered or self-completion questionnaires as my research tool even though the formal definitions of each tool does not adequately describe the manner in which the data was collected. I was faced with a situation of reading out the questions to the respondents and at the same time filling in the responses making the whole process more like a face-to-face structured interview. This was necessary because most of the subjects were illiterate. On a few occasions, I found someone who could read but they usually needed my assistance because of their poor writing skills or problems with understanding the questions. During the interviews, I prompted subjects if they found it difficult to answer any question; I also probed respondents to

elaborate on answers. I was also able to collect additional data. In total, I had a 100% response rate.

It may be argued about the choice of data collection method whether the respondents were not considered in the planning stage of the research. They were actually considered, as a prerequisite for any research, but the problem of high illiteracy as I envisage was the only obstacle to my selected method of data collection; self-administered questionnaires. Consideration of the respondents is of paramount importance to the effective designing and administration of good questionnaires (Bryman, 2008; Hague, 2010). According to Bryman (2008), a self-completion questionnaire is a questionnaire that a respondent answers without the aid of the interviewer. Though in definition Bryman (2008) seems to use the terms interchangeably, in terms of application he draws a thin line between the two terms on page 216-217, base on which I termed my questionnaires as self-administered ones. I personally administered the questionnaires after a long rehearsing on the Dagbani translation of my questions, which happens to be my mother's tongue. Self-administered questionnaires are often known to contain few open-ended questions, in my case however, there were a lot of them. This was necessitated by the amount of enquiries that were needed to help respondents answer questions appropriately.

4.5.2 Interview

Interviews are the most utilized qualitative data collection technique not only in its wide usage but also in its presence in almost all the other forms of data collection. Interviews are carried out in participant observation, ethnography, as well as focus groups, all representing different data collection techniques (Bryman, 2008). Generally, interviews are classified into three: structured, unstructured, and semi-structured interviews. They each have distinct characteristics. Bryman (2008) points out that a qualitative interview is now used to represent unstructured and semi-structured interviews. As far as the two main research strategies are concern; quantitative and qualitative strategy, the difference in interview method are made between structured and qualitative interview respectively. (Bryman 2008)

All the interviews I carried out were meant to satisfy the qualitative part of the research, hence as expected was unstructured. They were design to target the teachers in the district and officials of the Guinea Worm control department of the District Assembly. I chose to use this method of collection on this group because they are educated people directly working on the ground with the disease. They also observe the people firsthand and could have some information on the people and the disease. However much consideration was given to what I was seeking to outline in my interview guide, making sure that everything on the interview guide is covered. As Bryman (2008) noted unstructured interviews have the problem of generating much data that is not relevant for the study, and it is also time consuming. Even though I did not see the too much information as a disadvantage once I exhausted what was on the interview guide. What I actually did in this case is conveniently summarize in the quote of James Nathan Miller (1965) ‘‘there is no such thing as a worthless conversation, provided you know what to listen for, and questions are the breath of life for a conversation.’’ I did not consider the time spent as a disadvantage but made sure what I was looking for was covered and at the same time fuelled the conversation with questions.

4.5.3 Observation

In order to identify the reason why Guinea Worm is still prevalent, I thought it wise to supplement my survey and interviews with direct observations of the respondents. Observations can yield unreliable data because of problems such as problem of memory, and the gap between state and actual behavior (Bryman, 2008). Observation research has so many types including structured/systematic observation, participant observation, non-participant observation, unstructured observation, and simple observation (Bryman, 2008). Among all these, I observed that an integration of participant observation and structured/systematic observation in a covert way would serve the purpose. Bryman (2008) stresses that structured observers are usually non-participants and that the term non-participant observation is used in connection with unstructured observation. I spent two days at each major water source in all the eight communities, but I must add that some of the communities shared the same water source.

In my observation I kept all documentation hidden and hired a donkey with a two-wheel track attached to it, the most common method men use in fetching water while women carry on their head any container. I also used the same dialect to converse with the local communities in order to blend in with their culture. I carried out these observations before using the self-administered questionnaires and interviews, lest I risk meeting someone I have interviewed at the dam or riverside. I carried with me two barrels to fetch water which I did the whole day but had some break in the afternoon. I attend to my schedule and make my notes in each trip hence using the covert approach and still evaded all the problems associated with covert role.

Chapter 5: Analysis and findings

5.1 Working days lost

The first task was to determine the average number of weeks a person loses to Guinea Worm. This was calculated by multiplying the value of the number of times a person has been affected by the length of time (in weeks) that it takes the person to be completely healed. The emphasis on the working days initially made me prepare for allowances for days they do not work, but the survey revealed that they mostly work six days in a week, the other day is used for visiting the farm, which they do not count as a working day. On Friday for example, which is the day most people do not go to work, workers typically visit the farm from the morning until 12:00 noon when they come back home to prepare for their Friday prayers.

Table 5.1 below shows that – based on my sample - on average each infected person within the District loses 107 weeks of his or her lifetime to Guinea Worm.

Table 5.1: Descriptive Statistics on the variable 'Number of weeks lost to Guinea Worm infection'

	Sample size, *n*	Minimum number of weeks lost	Maximum number of weeks lost	Average number of weeks lost	Standard Deviation
Number of weeks lost to Guinea Worm infection	82	24.00	266.00	107	49.49482
Valid N (listwise)	82				

The varying ages of the sampled group could explain the big range (i.e. the difference between the maximum and the minimum). From the table, it can be observed that the sample size is short of eighteen (18) responses, this was not due to non-response as I got a 100% response rate, but because of missing data. One would not have expected such a large amount of missing data but the wording of the question could have been the reason for this occurrence. This was also observed during the pilot stage of the

data collection but I could not find a better way of presenting the question. The question required them to tell me the number times they have been infected in their lifetime. I could observe from the data that the younger people were able to remember and give me the figure while the older people could not or give a guess probably because they are too many to be counted or decline in memory. The justification of this stems from the fact that about 78% of those who could not provide the answers to the question were above 46 years of age.

5.1.1 Lower life expectancy

The life expectancy in Ghana currently stands at 58 years for females and 56 years for males. This figure has however been declining since 1990 (WHO, 2009b). As stated earlier in the problem statement, almost all the health-base indicators that are improving throughout Ghana are worsening in the Northern regions of the country. Life expectancy is no different. Life expectancy in the Northern regions is currently lower than the national figure of 57 years (Ghana Health Service, 2004). Malaria remains the top cause of death in the country increasing from 42.9% in 2003 to 43.1% in 2003 (Ghana Health Service, 2007, p. 4), however in the Northern region the same sickness is responsible for about 56% of deaths (Ghana Health Service, 2005). According to a research by Bawah and Binka (2005, p. 5) entitled: ‘‘How many years of life could be saved if malaria were eliminated from a hyper endemic area of northern Ghana?’’ their results show that life expectancy at birth would likely increase by more than six years if malaria were eliminated as a cause of death.

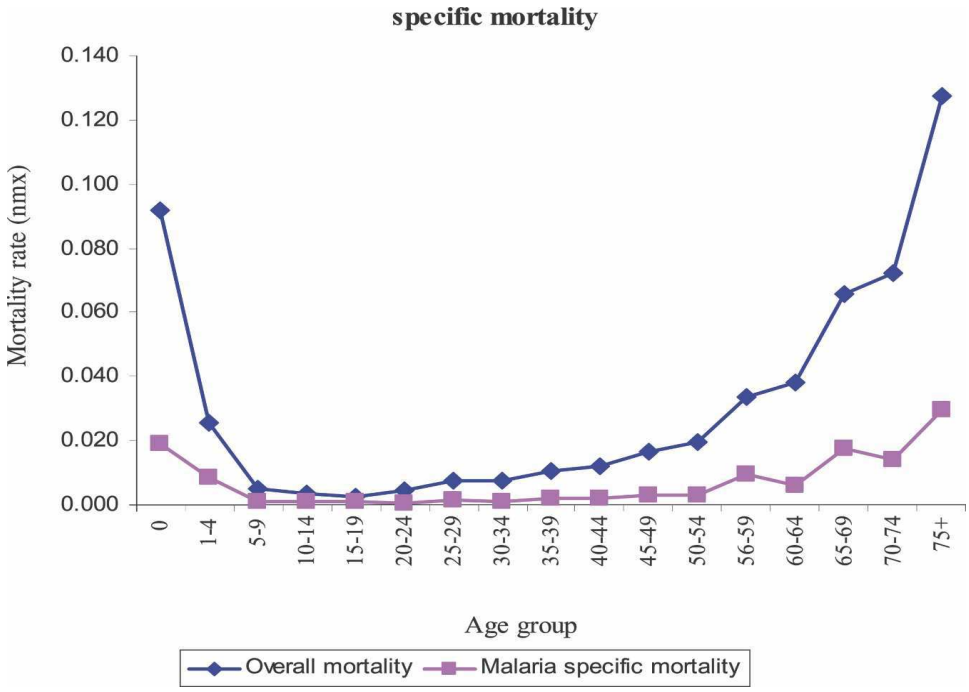


Figure 5.1: Overall mortality and Malaria specific mortality across age groups

Source Baawa and Binka (2005, p. 4)

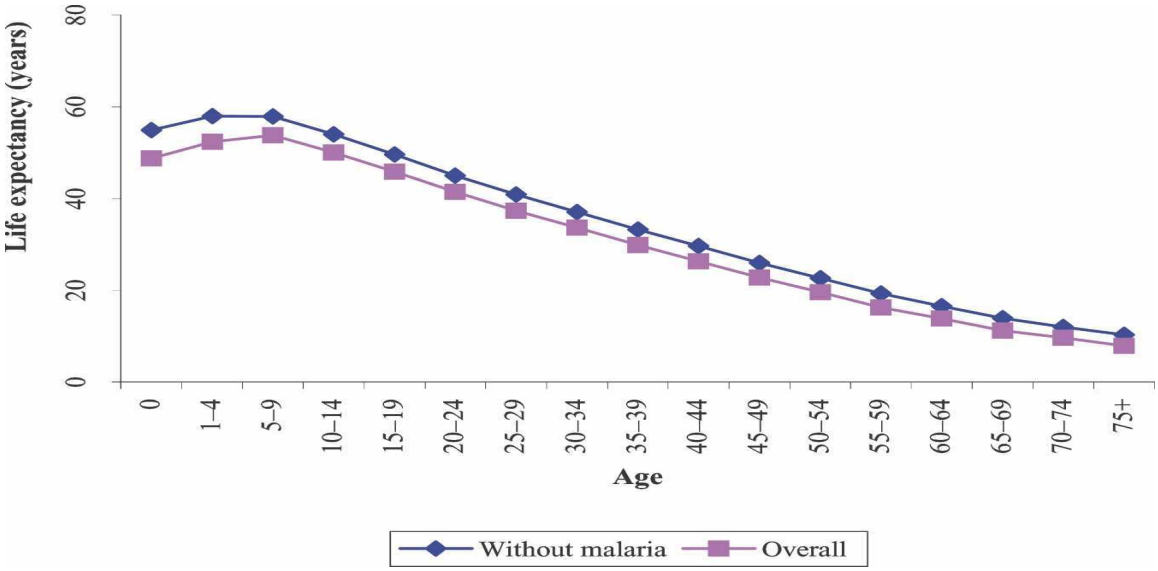


Figure 5.2: Life Expectancy with and without Malaria across age groups

Source: Baawa and Binka (2005, p. 6)

5.1.2 Input of men to farming

In the Northern region of Ghana, women are generally dependent on men; hence a woman or a child rarely owns property. A woman can be a farmer but always works under the auspices of her husband. To some extent, this is revealed in Table 5.2 below.

Table 5.2: Cross tabulation of Gender of respondents on Ownership of farm

		Ownership of farm		Total
		1(yes)	2(no)	
Gender of respondents	Male	60	14	74
	Female	6	20	26
Total		66	34	100

From the table, about 82% of the men surveyed owned their own farms while the remaining 18% work for the landlord or their father. A quick glance through the data reveals that almost all who do not have their own farm are men who never married and hence still stay in the family house and even the very few who are married still live in the family home hence are not likely to have their separate farms while still residing in the father's house. From the table, only 23% of women surveyed own their farms (6 out of 26). Of which most of those surveyed were either widowed or highly educated.

These findings indicate the domineering role that men play in the ownership and management of farms in the area. Coming from that cultural setting, I am aware that the women mainly take part in the sowing process as well as the packaging of the harvested output; otherwise they stay home or sometimes go to the farm to prepare food as well as other household duties. A lot of them are also engaged in trading in foodstuffs in the dry season, which explains why most of them are not idle in the dry season; this trading business however is subject to the quantity of harvest and the reliability of rains. About 34% of the females surveyed are traders while close to 87%

of the men are idle in the dry season since there are very few irrigation facilities. Refer to the Bar chart below, Figure 5.3

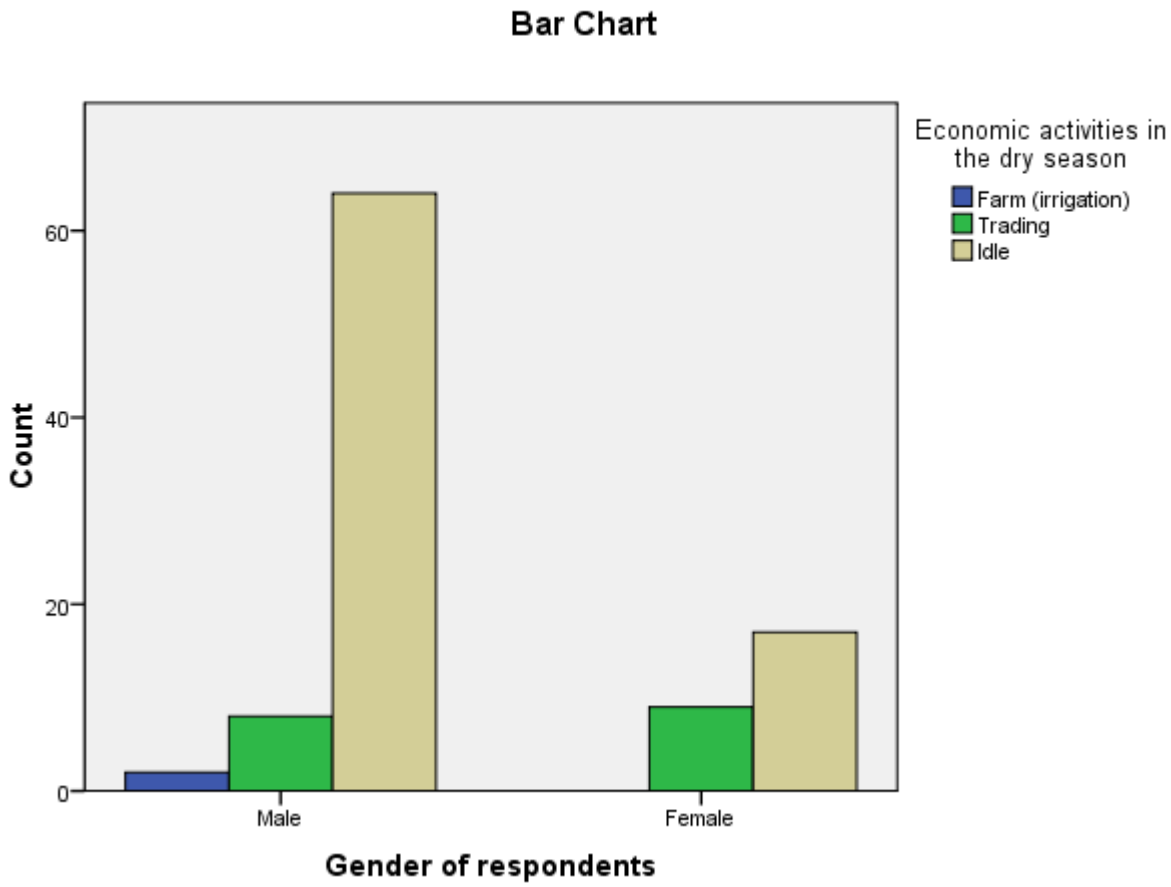


Figure 5.3: Gender response to Economic Activities in the dry season

5.1.3 The average number of infections

Of importance to my research is to gain an understanding of how often a person is infected with the disease. Each person surveyed in my research has been infected an average of nine (9) times (see Table 5.3).

Table 5.3: Descriptive Statistics on the variable 'Number of times of infection'

	Sample size, *n*	Minimum number of infections	Maximum number of infections	Average number of infections	Standard Deviation
Number of infections	82	2.00	19.00	8.9634	3.80203
Valid N (listwise)	82				

Approximately 92% of the respondents said they are normally infected in the rainy season, the remaining 8% responded all year around which includes both the rainy and the dry season. No one singled out the dry season as the season of most infections. One could wonder why a single Guinea Worm infection will represent a whole rainy season. A typical raining season or farming season takes 24 weeks as found in section 5.1.4, while a single infection takes 12 weeks to heal completely as seen in section 5.1.5. Logically, this then implies that two infections are required to exhaust a farming season. This is represented in figure 5.4 where the two black lines that represent the length in weeks of infection cover all the activities of the farming season represented by the green line. Figure 5.5 represents the realistic picture, where a single infection can start and end anywhere within the rainy season. Considering the strict time schedule of the farming activities in the North, a mistiming in any stage can cause a huge loss to the farmer. Infections 1 to 7 are possible infections, any of which represents a loss of that rainy season to the farmer. The loss is the same when the infection did not start in the rainy season but extends into it and in a case where it starts in the rainy season and extends out of it like infection 1 and 7 respectively. Infection 2 for instance, the person will prepare the land but will not be able to attend to the farm at the time they are suppose to be sowing and at the time they are weeding for the first time, thereby missing these two important farming activities. With infection 4, the farmer prepares the land, sows the seeds and weeds for the first time but will not be there to apply manure and fertilizer as well as weed for the second time, in which case the weeds outgrow the crops and the farmer may abandon the

farm or may produce little. Infection 5 will also suffer the same fate as the timing of infection 4, as he will not be able to weed for the second time, leaving the crops to the mercy of the weeds, and even if there is something little to harvest in the farm he will still be down with Guinea Worm and will be unable to work. This explains why the number of infections a person experiences in their lifetime represents the number of farming seasons lost.

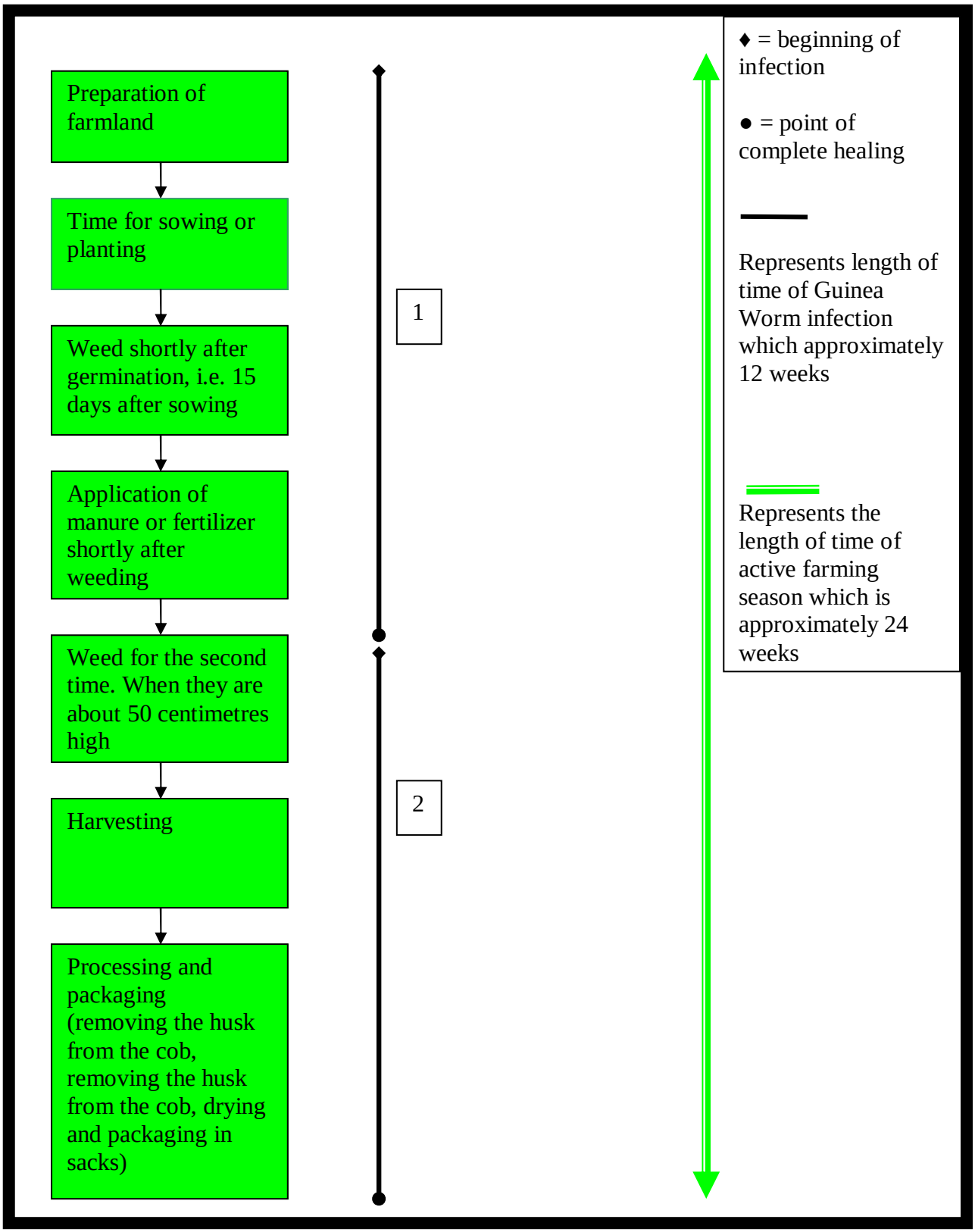


Figure 5.4: Farming activities and Guinea Worm infection

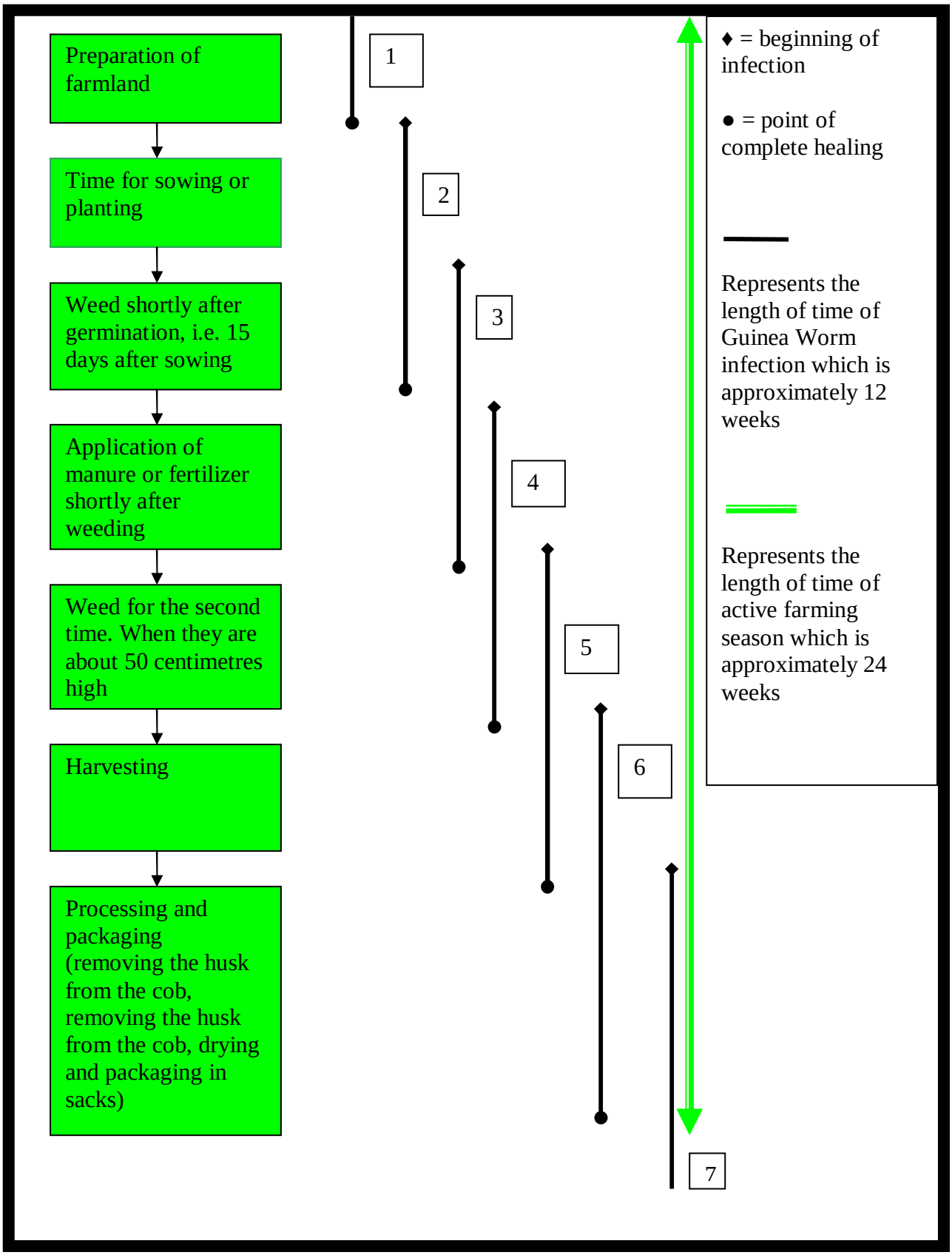


Figure 5.5: Farming activities and Guinea Worm infection

5.1.4 The average number of active weeks of farming

The average number of weeks an individual spends farming per year will likely vary with the size of the farm, but an average calculated over the sample should give some indication. It is obvious that the time it takes the crops to mature for harvesting has nothing to with the size of the farm, and this represents the 20 weeks of rain in a year at their disposal. The difference now lies in the number of weeks it takes to prepare the land for sowing and the number it take to harvest the yield. The average number of weeks each individual spends in active farming can be computed by summing the values for the number of weeks used to prepare the land, the time the crops take to mature for harvesting; and the number of weeks used for harvesting. The average of this gives the average number of weeks people in the community spend in active farming. The analysis according to table 5.4 shows that, on average, a person spends almost 24 weeks in active farming.

Table 5.4: Descriptive Statistics on the variable 'Number of active weeks of farming'

	N	Minimum	Maximum	Mean	Std. Deviation
Average number of active weeks of farming	100	22.00	26.00	23.2250	1.08333
Valid N (listwise)	100				

Table 5.5: Descriptive Statistics on the variable 'Number of weeks it takes to heal'

	N	Minimum	Maximum	Mean	Std. Deviation
number of weeks it takes to heal	100	7.00	17.00	11.8700	1.86761
Valid N (listwise)	100				

As seen from the table 5.5 above, it also takes on average 12 weeks for a person to recover completely from a Guinea Worm infection.

5.2 Why is the disease still prevalent in this region despite numerous strategies aimed at eradicating it?

Access to portable water is one way of eradicating Guinea Worm. However, in the absence of a clean source of water a strict surveillance of the existing untreated water sources is required to make sure that it is free of the lava that causes Guinea Worm. In a developing country like Ghana, infrastructure and other basic needs are not met uniformly throughout the region especially when inequalities exist between the Northern and Southern areas of the country. Other developing countries have been able to eradicate the disease with the same level of support as what Ghana is currently receiving from the international world, yet Ghana lags behind. What could be the cause of this? The insecurity in Sudan could be hampering their eradication efforts. What is Ghana's excuse? After all, its eradication is rather straightforward and simple by all accounts.

Greenaway (2004, p. 5) notes the following about the simplicity of winning the war against Guinea Worm:

''Guinea Worm disease is a good candidate for eradication for several biological reasons.

- *First, the disease has a limited geographic distribution and the marked seasonal occurrence allows for periods of more intensive intervention.*
- *Second, transmission is only from those with clinical disease and there is no known animal reservoir.*
- *Third, because symptoms develop within 1 year after infection, with predictable timing, the disease is easy to recognize and diagnose, which facilitates identification and containment of active cases.*
- *Finally, effective preventive measures such as health education and water filtration are available to prevent transmission''.*

The WHO adds that the fact the transmission agent, a "Cyclops" , is not a free-flying vector as is a mosquito but restricted to water bodies, also makes it very simple to target for break in transmission (WHO, 2010b). Over time, many countries have adequately demonstrated the ease at which the disease can be eradicated and have

completely eradicated it. A classical example is the case of Uganda. In 1992, Ghana reported 33,464 incidences of the disease and Uganda 126,369. Presently, Uganda is in the pre-certification phase of eradication (WHO, 2009b).

Another instance of where the eradication of Guinea Worm has proven to be simple is the cases of Uzbekistan. Their water supply as at that time was mostly ground water and they used step up wells in order to reach the water. A step up well is a well usually a few meters in diameter with steps leading down the well to the water table. According to Muller (1979), Tashkent, the capital of Uzbekistan and Samarqand a town in the country were able to eradicate Guinea Worm over 70 years ago. This they did by simply filling in the step wells and digging new ones that were drawn up (a well in which the human does not come into contact with the water table but do so with a can attached to a chain or rope), or converting the existing step up wells to drawn up ones.

In order to explain the persistence of Guinea Worm in the Savelugu district, I came across some reasons during the qualitative phase of my research. I grouped my findings under the following headings:

5.2.1 Nature and swiftness of infection

The first point worth noting is that Guinea Worm is a waterborne disease, and is transmitted by drinking contaminated water. In a place like the Savelugu-Nanton district where treated water is very scarce, the prevalence of Guinea Worm is the norm. Even those who have access to safe drinking water are not safe because of the unreliable nature of the water companies, and at some point in time even those individuals may have to resort to unsafe water sources. The risk then lies in using those unsafe sources as portable water.

The nature as well as the swiftness of infection makes it very difficult to control the disease once infected. In addition, an infected person who enters the water puts the whole town at a risk as there is nothing that can be done unlike other diseases, once they drink from that water source. If an individual is not aware that someone has

polluted the water, the outbreak takes them by surprise in the coming year. However, if an individual is aware of the presence of the lava in the water, they will try in their own way to purify the water traditionally, but in most cases, they see it as a waste of time.

This complacency partly explains why target eradication dates are most often missed. For example according to the WHO (2008), 1995 was set as the elimination date for Guinea Worm in Ghana. This date was not met although the number of cases reported to WHO decreased by 75%, from approximately 547 575 cases in 1991 to 130 000 cases in 1995. The Indian national eradication program targeted 1984 as the eradication date but extended it by two years to 1986. Despite the extension, they were not able reach a zero case until 1997, eleven years later (Tayeh and Cairncross, 2007). In May 2004, a meeting comprising representatives from the 12 endemic countries, WHO, UNICEF and The Carter Center signed what they called The Geneva Declaration, which set 2009 as the year when the world will be free of Guinea Worm - this has also been missed (WHO, 2010a).

Ghana's Guinea Worm eradication program set 2006 as the target year for breaking the transmission of the disease. This deadline was also missed and in fact, an epidemic nearly broke out that year (WHO, 2005). Little wonder that the WHO (2008) lists complacency as part of their biggest challenge in the fight against Guinea Worm in Ghana. According to the WHO (2005), complacency and apathy must be combated and momentum must be sustained even when case numbers are low. Up to date information is needed even when reported cases are zero. The risk of the disease should also be viewed in terms of the other communities and neighbors.

Importation of cases-it devastating effects.

Readers will recall that in 2006 a teenage male student walked about 400 km from Tinadjarof village in Ansongo District of Mali's Gao Region to Tadjimart village in Tessalit District of Mali's Kidal Region and contaminated a water source there. This contamination was not discovered until after an outbreak of 85 cases of dracunculiasis erupted in Tadjimart in June 2007 and was reported to Mali's national Guinea Worm Eradication Program (GWEP) in August 2007. Control measures began immediately, but were constrained by insecurity in the area, which previously had not had any case of dracunculiasis since the national GWEP began. The outbreak grew to 266 cases reported in Tessalit District in 2008, when authorities in Kidal also informed Mali's GWEP that several Malian Touareg residents had traveled to Algeria, and that some of them reportedly had come down with Guinea Worm disease in Algeria (See Guinea Worm Wrap-Up #185). We now learn from Algerian authorities, via a manuscript sent to a medical journal last November and published earlier this year, that four cases imported from Mali were seen at a clinic in Illizi, in another part of southern Algeria , in August 2007. These four cases were not reported to WHO before the team visited Algeria in May 2009. Algerian authorities assured the team from WHO that no subsequent cases were reported from Illizi in 2008, although reports from Mali allege that 13 cases were imported into three other Algerian villages last year (Map), in addition to the 266 cases in Achou, Alkite, An-Mallane, Inamzil and Tadjimart villages of Kidal Region. In all at least 352 cases in Mali, and as many as 6 cases of 18 alleged cases in Algeria in 2006-2008, resulted from one patient who was undetected and uncontained.
Mali has reported one case of dracunculiasis in May, that occurred in Gao District and was contained in a Case Containment Center.

DHHS (2009, p. 10)

Regarding the swiftness of the disease, it can be observed from Table 5.6 that some countries do not record any reported case of Guinea Worm (0) but shortly afterwards

record an epidemic. This suggests that infected migrants carry over the disease to the country. From Table 5.6 it can be seen that Ethiopia in 1990 recorded 2333 cases of Guinea Worm but did not record any case in the following year (1991). However, the years after the zero reported cases, 1992 and 1993 reported 303 and 1120 incidences respectively. The records of Mali also changed from 16024 cases in 1991 to zero in 1992 to 12011 cases in 1993. Niger also moved from zero cases in 1990 to 32829 in 1991. This explains how swift the disease can spread. The same patterns exist throughout the data just that the zero cases provide a clear picture of the point. In Ghana, 43% or 426 villages out of 981 that reported cases in 2000 were re-infected shortly afterwards (Tayeh and Cairncross, 2007). The nature of infection of Guinea Worm does not allow complacency even if figures are zero. Though Ghana as a whole has never reported a zero case, the same pattern can be seen from a line plotted (Figure 5.6) from reported figures of Ghana alone from 1989 to 2008. It can be seen that aside from the sharp fall from the hundreds of thousands to the tens of thousands, the line is undulating starting from 1994, implying a rise after every fall in reported cases. The pattern revealed by the reported cases in Ghana is the same as the global reported cases.

The first sharp drop as I have learnt and inferred from a prolong conversation with an elderly man who was among those I interviewed, was that the immersion of the infected part in the water was the only way they could quell the pain they experience when the blister is about to open. They did not have the slightest idea that they were rather continuing the life cycle of the worm. He mentioned that someone could wake up in the night and run to the riverside just to immerse the leg in the water in order to be able to sleep. This was the first information passed on to them when the Guinea Worm eradication program came into inception. The man added that people also intentionally enter the water sources with an infected leg, and that most people now get into the water sources out of necessity rather than because of ignorance.

Epidemiological data (1989 - 2008)

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Currently endemic countries																				
Ethiopia	3565	2333	0	303	1120	1252	514	371	451	366	249	60	29	47	28	17	37	3	3	41
Ghana	179556	123793	66697	33464	17918	8432	8894	4877	8921	5473	9027	7402	4739	5611	8290	7275	3981	4136	3358	501
Mali	1111	884	16024	0	12011	5581	4218	2402	1099	650	410	290	718	861	829	357	659	329	313	417
Niger	288	0	32829	500	25346	18562	13821	2956	3030	2700	1920	1166	417	248	293	240	183	110	14	3
Nigeria	640008	394082	281937	183169	75752	39774	16374	12282	12590	13420	13237	7869	5355	3820	1459	495	120	16	73	38
Sudan	0	0	0	2447	2984	53271	64608	118578	43596	47977	66097	54890	49471	41493	20299	7266	5569	20582	5815	3618
Subtotal	**824528**	**521092**	**397487**	**219883**	**135131**	**126872**	**108429**	**141466**	**69687**	**70586**	**90940**	**71677**	**60729**	**52080**	**31198**	**15650**	**10549**	**25176**	**9576**	**4618**
Countries in pre-certification phase																				
Benin	7172	37414	4006	4315	16334	4302	2273	1427	855	695	492	186	172	181	30	3	1	0	0	0
Burkina Faso	45004	42187	0	11784	8281	6861	6281	3241	2477	2227	2184	1956	1032	591	203	60	30	5	3	1
Chad	0	0	0	156	1231	640	149	127	25	3	1	3	0	0	0	0	0	0	0	0
Côte d'Ivoire	1555	1360	12690	0	8034	5061	3801	2794	1254	1414	476	297	231	198	42	21	10	5	0	0
Kenya	5	6	0	0	35	53	23	0	6	7	1	4	8	17	12	7	2	0	0	0
Mauritania	447	8036	0	1557	5882	5029	1762	562	388	379	255	136	94	42	13	3	0	0	0	0
Togo	2749	3042	5118	8179	10349	5044	2073	1626	1762	2128	1589	828	1354	1502	669	278	73	29	2	0
Uganda	1309	4704	120259	126369	42852	10425	4810	1455	1374	1061	321	96	55	24	26	4	9	2	4	0
Subtotal	**58241**	**96749**	**142073**	**152360**	**92998**	**37415**	**21172**	**11232**	**8141**	**7914**	**5319**	**3506**	**2946**	**2555**	**995**	**376**	**125**	**41**	**9**	**1**
Countries that had been endemic in early 1980's and were certified as disease free																				
Cameroon	871	742	393	127	72	30	15	17	19	23	8	5	5	3	0	0	0	0	0	0
Central African Republic	0	0	0	0	0	0	18	9	5	34	26	35	36	0	0	0	0	0	0	0
India	7881	4798	2185	1081	755	371	60	9			0	0	0	0	0	0	0	0	0	0
Pakistan	534	160	106	23	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Senegal	0	38	1341	728	815	195	76	19	4	0	0	0	1	0	0	0	0	0	0	0
Yemen	0	0	0		0	94	82	62	7	0	0	0	0	0	0	0	0	0	0	0
Subtotal	**9286**	**5738**	**4025**	**1959**	**1644**	**690**	**251**	**116**	**35**	**57**	**34**	**40**	**42**	**3**	**0**	**0**	**0**	**0**	**0**	**0**
Total	**892055**	**623579**	**543585**	**374202**	**229773**	**164977**	**129852**	**152814**	**77863**	**78557**	**96293**	**75223**	**63717**	**54638**	**32193**	**16026**	**10674**	**25217**	**9585**	**4619**

Table 5.6: Epidemiological data of Guinea Worm(1982-2008)

Source: WHO (2009a)

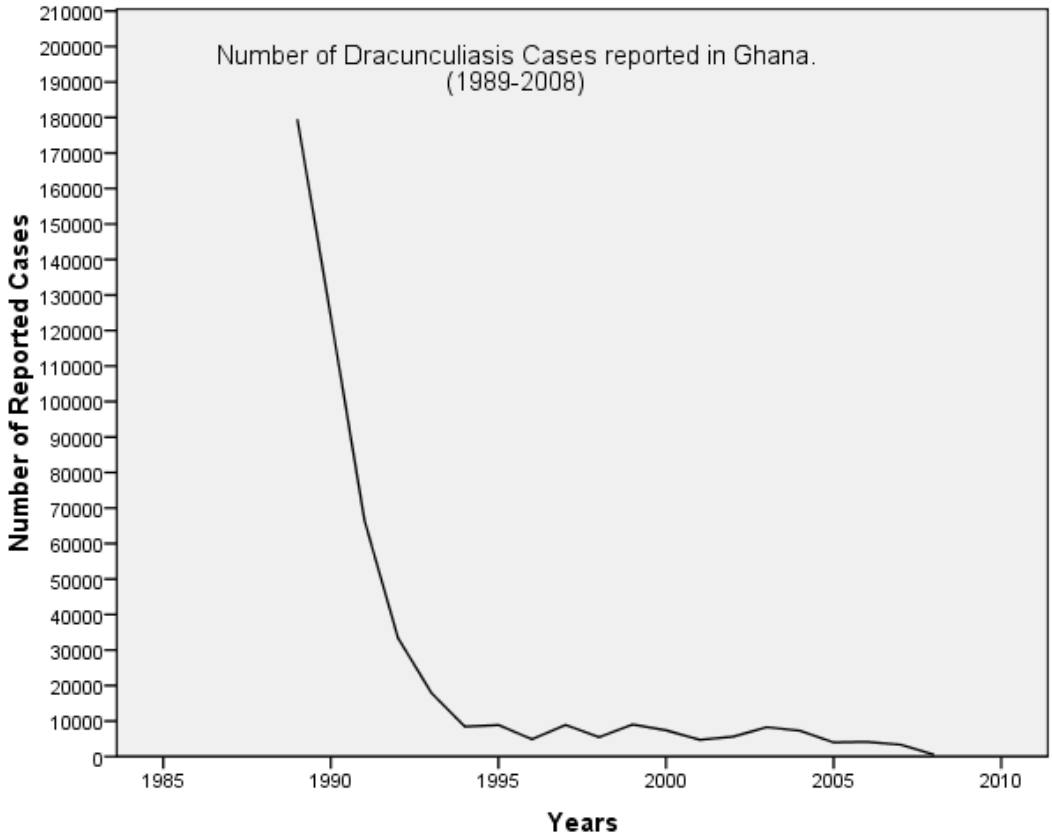


Figure 5.6: Trend in Ghana's Guinea Worm data (1989-2008)

Source, author (using epidemiological figures of Ghana from Table 5.6)

At the district level, the Guinea Worm Eradication program prepares detailed reported cases in every month, which they called the forecast list. The forecast list for the Savelugu-Nanton administrative zone is shown in Tables 5.7-5.9. In Table 5.6, Ghana reported 3981, 4136 and 3358 incidences of the disease for 2005, 2006 and 2007 respectively. From Table 5.7 values for reported cases for those same years for the Savelugu-Nanton district are 422, 1182 and 2049 respectively representing 10.6%, 28.6% and 61% of the national figure. Though I do not have data on all districts in Ghana, it is obvious that the district may not have been the highest in 2005. The district has been experiencing a downward trend when suddenly they moved from reporting 10.6% in 2005 of the national figure to over 60% in 2007.

Table 5.7: The forecast list for the Savelugu-Nanton district from 2004 to 2009

SAVELUGU-NANTON DISTRICT - GUINEA WORM DISEASE FORECAST LIST

Sub District	Zone	Village	STATUS	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL

	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Totals
Savelugu-Nanton District Totals	2004	80	86	165	81	87	71	30	15	5	3	3	12	638
	2005	26	44	29	20	85	99	28	7	5	7	25	47	422
	2006	99	156	111	116	124	126	52	18	10	23	91	256	1182
	2007	666	513	341	168	126	126	48	13	8	4	16	20	2049
	2008	27	53	22	24	20	12	10	3	3	0	2	0	176
	2009	2	1	2	4	19	13	5	1	0	0	0	0	47

From 2005, the reported cases of Guinea Worm for the Diare administrative zone increased by 50% in 2006; i.e. 220 to 419 cases. Though the Savelugu-Nanton district was relatively high, it recorded an increase of just six cases for that same period. However in 2007 because the Diare zone had an increase of about 50%, eradication efforts were directed there in order to contain the situation. As a result, there was a reduction in incidence of the disease in 2007; a total of 26 incidences were recorded in 2009. In the Savelugu-Nanton zone reported 1375 in 2007; an increase of about 227.4% from 2006 pushing the figure in the district to become the highest in the country (60%). As expected, attention was then directed to that area in 2008 and in 2009 the number of recorded cases dropped to 15. Anecdotal evidence suggests that this undulating trend in Guinea Worm in the area was the result of a person who was a mentally unstable. The man was from Gushie - a community in the Diare zone - who in 2005 was infected with Guinea Worm and was found bathing in the water source used by both Gushie and Diare. According to sources, this caused the 50% increase in 2006 in that zone. The investigation also revealed the same man bathed in the water source of Savelugu-Nanton in 2006, which saw the 2006 figure nearly quadrupling.

Based on my research in both communities, I am of the opinion that the nature and swiftness of the disease are the reasons for its continuous presence in these communities.

Table 5.8: The forecast list for Savelugu-Nanton zone covering from 2004 to 2009

SAVELUGU-NANTON DISTRICT - GUINEA WORM DISEASE FORECAST LIST

Sub District	Zone	Village	STATUS	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Savelugu	Savelugu	*Savelugu*	Endemic	2006	29	78	56	32	30	31	13	6	1	2	18	113	409
				2007	506	424	261	95	43	12	9	2	2	0	6	4	1364
				2008	11	33	16	11	5	3	3	1	0	0	0	0	83
				2009	1	1	1	6	2	2	0	0	0	0	0	0	14
	Bunglung	Yemo	Import	2006	0	0	0	0	0	0	0	0	0	0	0	0	0
				2007	1	0	1	0	0	0	0	0					2
				2008	0								1				1
				2009	0	0	0	0	0	0	0	0	0	0	0	0	0
	Bunglung	Nyetua	At Risk	2006	0	0	0	0	0	0	0	0	0	0	0	0	0
				2007	0	0	0	0	0	0	0	0					0
				2008	1												1
				2009	0	0	0	0	0	0	0	0	0	0	0	0	0
	Biyooni	Kpalung	Import	2006	0	0	0	0	0	0	0	0	0	0	3	0	0
				2007	1	0	0	0	0	0	0	0					1
				2008								1					
				2009	0	0	0	0	0	0	0	0	0	0	0	0	0
	Biyooni	*Tootenyili*	Endemic	2006	0	0	0	0	0	0	0	0	0	0	0	0	0
				2007	0	0	0	0	1	0	0	0					1
				2008	0	1											1
				2009	0	0	0	0	0	0	0	0	0	0	0	0	0
	Kugafong	*Laligu*	Endemic	2006	0	0	1	0	1	1	2	0	0	0	0	0	5
				2007	1	0	0	1	0	0	0	0					2
				2008	2												2
				2009	0	0	0	0	0	0	0	0	0	0	0	0	0
		Chahiyili	Endemic	2006													0
				2007													0
				2008			1										1
				2009	0	0	0	0	0	0	0	0	0	0	0	0	0
Savelugu Sub District Totals =				2005	29	78	57	32	31	32	15	6	1	2	18	113	414
				2006	29	78	59	32	32	32	15	6	1	2	21	113	420
				2007	510	425	263	99	44	12	9	2	2	0	6	4	1376
				2008	14	34	17	11	5	3	3	2	1	0	0	0	90
				2009	1	1	2	1	6	2	2	0	0	0	0	0	15

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Table 5.9: The forecast list for Diare zone covering from 2004 to 2009

SAVELUGU-NANTON DISTRICT - GUINEA WORM DISEASE FORECAST LIST

Sub District	Zone	Village	STATUS	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Diare	Diare	*Diare*	Endemic	2006	13	12	8	34	37	63	27	9	6	12	26	52	299
				2007	62	23	31	31	36	76	27	10	4	2	1	7	310
				2008	7	5	1	7	13	9	6	1	1				50
				2009	1	0	0	0	3	6	1	1	0	0	0	0	12
	Diare	*Gushie*	Endemic	2006	0	1	4	2	0	0	0	0	0	0	0	4	11
				2007	3	15	12	5	2	0	0	0			1	2	40
				2008	0	11											
				2009	0	0	0	0	0	0	0	0	0	0	0	0	0
	Diare	*Kadia*	Endemic	2006	0	1	0	1	1	2	1	1	0	0	0	0	7
				2007	1	1	0	0	0	0	0	0			2	3	7
				2008	1	2	1										4
				2009	0	0	0	0	0	0	0	0	0	0	0	0	0
	Diare	Zoosali	Import	2006	1	1	11	17	41	16	2	0	0	0	0	0	89
				2007	1	0	1	5	5	10	1	0					23
				2008	0	0			1								1
				2009	0	0	0	0	0	0	0	0	0	0	0	0	0
Diare Sub Total =				2005	12	5	11	5	55	79	21	4	2	1	7	18	220
				2006	14	16	23	54	80	87	33	12	6	12	26	56	419
				2007	70	40	45	41	48	89	30	10	4	2	4	12	395
				2008	8	18	2	7	14	9	6	1	1	0	0	0	66
				2009	1	0	0	2	11	10	1	1	0	0	0	0	26

April | Depali – 2
May | Depali – 8
June | Depali – 4

5.2.2 Absence of a vaccine

Currently there is no known vaccine, drug or a therapy for Guinea Worm. One cannot argue that the presence of a drug or a vaccine for Guinea Worm would not have aided its eradication. It is potentially the only way the disease can be completely eradicated. Since what is required in the eradication is the breaking of the worm's life cycle by killing the worms in whatever stage they are in the human being and chemicals could be applied to the remaining water sources to kill those in the water, because there has not been any known reservoir of the diseases apart from humans.

5.2.3 Activities of the people; swimming and washing legs

All 100 respondents indicated that they were aware of the fact that infected persons are not supposed to enter the water sources. I took the opportunity to find out from the children on that same issue, and all were aware of this fact. Evidence of this was confirmed from my observation, as people who had bandages on their legs (and who are therefore assumed to have Guinea Worm) were not going into the water. They normally just stood by the bank of the river or very close to the water and let their colleagues go into the water and fetch buckets of water and help the infected person carry.

Though the diagnosis of Guinea Worm is relatively straight forward, Muller's (1979) notes that in cases where the blister bursts and the worms do not show up completely, the verification method is made by applying cold water to the ulcer after which a drop of water from that is taken to the laboratory for examination under a microscope for the presence of active larvae. This implies that the direct immersion of the ulcer in the water by an individual is not necessary for transmission – rather a simple drop of water from the ulcer is enough to transmit the lava putting the whole community at risk. At the pond and dam sites, I observed that it was normal for anyone who comes there to wash their legs along the slope of the river a few meters away from the main water body itself. The practice was the same for those with blisters and those with bandages, a strong indication that even though they do not immerse their infected parts into the water the drops that contains active larvae can run down the slope and back into the main source.

At Kadua, a community in the Tampion Area Council (pop. 787), I observed that none of the infected individuals were entering the water sources directly but were supporting themselves with a stone or a pillar and stretched with cans and containers to fetch the water. Residents in the Kadua community do not have any of the available safe water sources such as borehole, pipe system, and hand dug well. The pond is the only source for them and according to them the community came together to pass a law that no one whether infected or not should not enter the water sources. The nature of data collection methods I employed did not allow me to take pictures, but a similar picture is shown below in Figure 5.7

Figure 5.7: Inhabitants fetching water without body contact with source
Source: WHO (2008, p. 6) Eradicating Guinea Worm Disease, photo by Dr A. Tayeh/WHO

The law passed by this community and the resultant behaviour was only witnessed at Kadua even though some communities outside my sample could be practicing it. There were two reasons behind the passing of that law; first, to have access to clean water and second, to prevent the source from being infected with Guinea Worm lava. Water at the immediate banks of the river is often dirty and contains debris, which turns the water milky. Despite the law being in place and the water appearing to be relatively clean, a number of cases of Guinea Worm were reported in the community.

Local residents explained to me that they believe those reported cases are imported. Their practice is not an exception to my observation in the sense that everyone who fetch water rinse the feet just near the water itself. As seen from the picture in Figure 5.7, the area I marked by the red line is the places they stand to rinse their legs and feet before carrying the water on their heads.

5.2.4 Improper monitoring of the activities of children

Children in these communities were observed to have some knowledge about Guinea Worm. They were especially aware of the fact they should avoid contact with the water when they are infected. Despite this awareness, the children still tend to go into the water when they are infected perhaps due to their immaturity. Young children in particular will break the rules they are taught in the house including avoiding contact with a water source when they are infected. However, what typically happens is that they go swimming at places where the adults will not see them. On three different occasions in Gbanga, Galogu and Kpunduli I came across a group of children and decided to interact with them. Those in Gbanga and Kpunduli told me that they went swimming while those in Galogu said they when hunting but went to swim afterwards. I could observe that some of them were having open sores while other had their bandage on their legs and hands. In every community, there were groups of children coming from swimming practice in potentially contaminated water but it was not until I took the opportunity in Galogu to interact with them that I realized the importance of this issue. A community may use more than one pond or dam at a time and when that water source dries up or becomes too milky they migrate to the next nearest one. In the meantime, the children take advantage of the water sources that have been ‘left behind’ and swim in them because the elderly will not allow them to swim at water sources that they are currently using. There is a high possibility that these neglected water resources have been contaminated. Figures 5.8, 5.9, 5.10 and 5.11 represent pictures of infected children who have been infected probably because their movements were not adequately monitored.

Figure 5.8 (left): An emerged Guinea Worm is being pulled out from a small girl in Tamale, Ghana.

Figure 5.9 (right): A Ghanaian girl walking to her house after the village-based volunteer bandaged her Guinea Worm infected leg

Source (figure 5.8 and 5.9): WHO Photo Gallery (2010c)

Place: Savelugu-Nanton, Ghana. Date: Feb. 8, 2007 (Source: Louise Gubb/The Carter Center)

Figure 5.10 (left): Former U.S. President Jimmy Carter tries to comfort 6-year-old Ruhama Issah at Savelugu-Nanton Hospital as a Carter Center technical assistant dresses Issah's extremely painful Guinea Worm wound.

Figure 5.11 (right): Volunteer dressing a wound.

Guinea Worm researchers have argued that the successful eradication of the disease depends not only on favourable biological factors, as mentioned earlier, but also on society accepting the interventions and as well as governments having the political will to execute them (Greenaway, 2004). In the case of the people in the Savelugu-Nanton district, the communities have been implementing the interventions to the best of their ability as everyone seems to be well informed. The issue of rinsing legs at the bank and improper monitoring of children activities are things they have not noticed could increase their risk.

5.3 Effects on education

While the effects of Guinea Worm on the agricultural sector are direct and relatively immediate, the effect of the disease on education is indirect and long-term. In terms of the former, people see the effects of the disease when they see their farms overgrown with weeds and becoming unproductive. In terms of the latter, the obvious result is less than forthcoming with few people observing the relationship between not going to school and their achievement. In fact, some even see the attendance of school as reducing the potential labour force that could be working on farms. Within this context, Brieger et al (1983, p. 324) stressed the need to consider the effect Guinea Worm has on what they referred to as ‘‘the work force in training’’.

Absenteeism from school - which time did not permit me to measure - is the obvious effect Guinea Worm can have on a child’s education. The very nature of the educational infrastructure as mentioned earlier increases absenteeism as in the rainy season even the threat of rain results in schools closing. On the side of the educational staff, absenteeism and refusing posting to outlying communities, which are plagued with Guinea Worm, stand out as its direct effect on education in the district.

Table 5.10: Response from schoolchildren

Community	Class	Infected students	total	Percentage
Kadua	2	26	26	100
Gbanga,	1	22	34	64.7
Kpunduli	3	19	19	100
Sindigu	3	21	21	100
Chankpem	3	29	32	90.6
Galogu	2	17	17	100
Yilikpani	2	48	52	92.3
TOTAL		**182**	**201**	**90.5**

Source: Field survey (Author)

Table 5.11: Response from teachers

Community	trained	Teachers infected whiles in community
Kadua	no	yes
Gbanga,	no	yes
Kpunduli	no	yes
Sindigu	no	yes
Chankpem	no	no
Galogu	no	yes
Yilikpani	no	no

Source: Field survey (Author)

In Ghana, the average age of a child in class one is 6 years. Teachers in most of the rural communities with the exception of the larger ones are multi-grade teachers. A multi-grade teacher is one who teaches more than one class at the same time. This they do by either teaching classes that are physically close to each other or they mix the two classes of different grades together. The extreme case of multi-grade teaching was witnessed at Chankpem where only one teacher teaches the whole school (one-teacher school).

5.3.1 Absenteeism

According to Kearney (2008) absenteeism refers to excusable or inexcusable absences from school. Excusable absences can be a result of medical illness or injury and inexcusable absences can be because of environmental, social, psychiatric conditions that may prevent a student from coming to school. Inexcusable absences may also include parents deliberately keep a child home from school for economic purposes, to conceal maltreatment, to prevent abduction from an estranged spouse, to protect a child from perceived school-based threat, or to assist a parent with psychopathology. In Ghana inexcusable absenteeism are rampant because children are frequently required to go to farm and work when the demand for work is high or when a member of the family is indisposed or traveling.

As mentioned earlier, absenteeism among students was one of the main issues I set out to investigate in my research. I soon found out based on my pilot study that it required a considerable amount of time since such research would have required me to trace every absentee to determine why he or she was not in school and whether it was because of Guinea Worm. The teachers I talked to stated that Guinea Worm is among many reasons why a student is absent from school, but the problem was how to separate those absent as a result of Guinea Worm from those that are absent because of some other reason. Unfortunately, this information was not always available from the schools I visited. This confirms the fact that research on absenteeism and Guinea Worm infection is difficult to assess. This relationship is also influenced by a number of other factors including poor motivation, chronically poor health, familial, economic status and other social problems.

Yahaya et al (2010, p. 626) explores the problems of absenteeism in the following words:

> *‘‘Student nonattendance is a problem that extends much further than the school. It affects the student, the family, and the community. Absenteeism is detrimental to students' achievement, promotion, graduation, self-esteem, and employment potential. Clearly, students who miss school fall behind their peers in the*

classroom. This, in turn, leads to low self-esteem and increases the likelihood that at-risk students will drop out of school.''

In addition, absenteeism at the lower levels of schooling is a strong predictor of absenteeism in middle and high school, which in turn is a determiner of high school dropout and ensuing problems later in life. Could this potentially explain the high dropout rate currently in the Savelugu-Nanton district? Even at the tertiary levels where students are more mature absenteeism is a problem. This has led researchers like Romer (1993, p. 173) to comment: ''I believe that the results here both about the extent of absenteeism and its relation to performance are suggestive enough to warrant experimenting with making class attendance mandatory in some undergraduate lecture courses.''

It was common to see incidences and effects of Guinea Worm in the classes that I visited. Most school children I spoke to said that they spend an average of three months in the house nursing Guinea Worm. These months of absence from school in the calendar system of Ghanaian schools amounts to more than an academic term - which normally last for two and a half months. The effects of Guinea Worm on absenteeism and education on an individual schoolchild are not only witnessed when the child in question is infected, but also when members of his or her household are infected: ''Guinea Worm has a dramatic effect on school attendance. Children miss school when they have the disease themselves, and also when they have to stand in for their sick parents, working in the field or at home. Schools in endemic areas often have to close for a month or more each year as a result'' (Burgers, 2000, p. 3). As mentioned earlier, the care and attention an infected person deserves also demands that someone take care of that person. Children are mostly used to take care of the infected person resulting in a loss of time that could be spent at school. Of course, the student can never make that up because no one will have that special attention for him or her when they return to school. Just consider the missing the whole term in the context of academic work, quizzes, class tests, and end of term examinations.

Regarding teachers' absenteeism, it was found that only two teachers I interviewed had never been infected with Guinea Worm. When I asked about the amount of time they had been living in the district it was determined that only one teacher was newly

posted in the school while another was from outside the area in Tamale - the regional capital - but came to school every day by motor bike. She showed me her water container, which she brings from Tamale every day. Ehrenberg et al (1991) stated that the adverse effect of teacher absenteeism on students' academic performance cannot be covered up even if a teacher is substituted. Ehrenberg also found that there was a high correlation between teacher absenteeism and student absenteeism, which in turn decreases the performance of both.

The question was then asked of the teachers: If Guinea Worm infects teachers, what happens when they are infected? Does this mean three months or more of no classes? Or in the case of the one teacher school, like the one at Chankpem will it mean three months of no school?

This problem is potentially the biggest blow Guinea Worm could give to education in the district, because not only will the students miss school for three months, but the absenteeism of the teacher could encourage students' absenteeism as Ehrenberg and his colleagues suggest. Indeed, the students will have a whole term wasted and there will be a serious distortion in the academic calendar. The teacher at Sindigu told me that there are occasions when there is an outbreak the teachers have to leave the community even if they are not infected in order to prevent themselves from an infection the following year. This is because almost all of them do not come from the communities in which they teach making them seek refuge in their hometowns in an event of an outbreak. It was also found that in the time of an outbreak, a teacher who decides to stay in the community may not have many students to teach as the students themselves will stay away from school. In some cases, most of the students will be well and the teacher will not be available to teach, and yet still both the teacher and the most of the class may all not be well, that is when the school closes down. These possibilities reveal a very serious impact that Guinea Worm can have on education in the endemic communities.

Of all the schools I visited, none of the teachers in the classes I went was professionally trained but were all pupil teachers. Pupil teachers are those who have no qualification to further their education after senior high but have interest in teaching. In the face of serious shortages of teachers even in the urban areas, the pupil

teachers are employed to complement the trained ones. However, they are sent to the deprived communities where the trained teachers will not go. In response to the question, whether they think the prevalence of Guinea Worm has something to do with the scarcity of trained teachers in this district. They all answered in the affirmative but were quick to add that the absence of electricity also contributes. According to them it is known nationwide about the disease and its prevalence in the Savelugu-Nanton district, hence any worker, not only teachers who are sent there to work often find a way to change to a different district or region. I also found that in some cases when a teacher wants to move to a more deprived area in the district their families are reluctant to join them. This was revealed after an extended conversation with one of the teachers at Sindigu who planned to find another job because his family refused to come with him.

Chapter 6: Conclusion

This study investigated the relationship between Guinea Worm and poverty in the Savelugu-Nanton district of Ghana. The use of both quantitative and qualitative analysis allowed me to gain a full understanding of the context in which Guinea Worm is affecting this district. I observed that a lot of time is lost to Guinea Worm by farmers annually. In the context of the district the loss of time is very valuable as there is only one major rainfall event per year in the district. Information I obtained from the field such as the average number of times a person within the district is infected; the average number of active weeks of farming; and the average number of weeks it takes to heal I found that the effect of a single infection is devastating. The disease has the potential of affecting more than one half of a village's population simultaneously during the main harvest or planting season (Hopkins et al., 2008).

It is my opinion that there is a lack of political will towards the eradication of Guinea Worm in Ghana. I make this inference based on the unnecessary transfer of staff and resources between ministries and departments in Ghana. Ghana started the eradication initiative with countries whose incidence were three times higher (refer to Table 5.6), but they are now certified free or at the pre-certification stage. The table below (Table 6.1) represents a study by Tayeh and Cairncross (2007) documenting the initial number of cases and the time needed to be disease-free, by country. Ghana started the full-scale eradication initiative in 1989, which was ahead of all but India among those that have eradicated it. Of the remaining four endemic countries, (Ghana, Sudan, Mali and Ethiopia), Ghana is the one among them to have started the eradication initiative the earliest. The sense of agency attached to it from the policy making stage has been lacking in Ghana. It therefore comes as no surprise that it was not until August 2006 that the government in Ghana declared the Guinea Worm disease to be a public health emergency in the Northern region of Ghana. This was not even a self-initiative since it resulted of the August 2006 review of Ghana's program by the Carter Center, WHO, and UNICEF, which was attended by President Carter himself. (Hopkins et al, 2008)

Table 6.1: endemic countries and the state of their eradication campaign

Country	Initial year of the full scale programme	Year the country reported zero cases	Duration until reporting zero cases (years)	Highest number of cases reported at beginning of programme
Countries that have interrupted disease transmission				
Uganda	1992	2004	12	126 369
India	1985	1997	12	30 950
Benin	1993	2004	11	16 334
Mauritania	1993	2005	12	5882
Pakistan	1987	1993	6	2400
Senegal	1991	1998	7	1341
Chad	1993	2001	8	1231
Cameroon	1989	1998	9	871
Yemen	1994	1998	4	94
Kenya	1994	1995	1	53
CAR	1998	2002	4	34
Countries still endemic in 2006				
Nigeria	1989		>17	640 008
Ghana	1989		>17	179 556
Sudan	1996		>10	118 578
Burkina Faso	1992		>14	45 004
Niger	1991		>15	32 829
Cote d Ivoire	1991		>15	12 690
Mali	1991		>15	16 024
Togo	1993		>13	10 349
Ethiopia	1992		>14	3565

Source: Tayeh and Cairncross (2007, p. 1405)

Surveillance and containment or a ‘search and contain’ strategy, which proved very effective in the complete eradication of smallpox, has worked well in the eradication process of Guinea Worm in a number of countries. In Ghana however, an evaluation carried out in 1996 found evidence of its effectiveness, but shortly thereafter Ghana’s eradication program abandoned the strategy when others took advantage of it (Tayeh and Cairncross, 2007). India and other countries have aptly demonstrated the effectiveness of the treatment of water sources with Abate, but differences in political commitment is clear in the eradication process. While India used 2044 liters of Abate in the Dhar district, which has since reported only 13 cases of Guinea Worm, Ghana used 4000–5000 liters of Abate in 2005 and subsequently reported 3981 cases of infection.

The ineffectiveness in the eradication initiative under the Ministry of Health is manifested in the underreporting of Guinea Worm cases in Ghana. Although this phenomenon is common in Ghana and Sudan, insecurity explains that of Sudan and inefficiency and lack of sense of urgency will probably explain Ghana's situation. For example, an evaluation of Ghana's eradication program by WHO in 2005 found that only 56% of the cases found had been reported, implying that the real national total in 2006 was closer to 7400 than the reported 4100 cases (Tayeh and Cairncross, 2007). This lack of urgency manifested itself in the course of this research when I had to move promptly to the district to confirm the information that the disease has been eradicated. The urgency of the situation is clearly seen in the eyes of the people themselves, who according to the findings are doing their best as far as adherence to the advice concerning the spread of Guinea Worm is concerned. I am not ruling out the contribution of social change in the eradication initiative but the policy making body does not seem to see the urgency of eradicating this disease.

6.2 Why still Ghana?

The question about why Ghana continues to be plagued with Guinea Worm still abounds particularly among policy makers. In my research, I came to the opinion that the nature of Guinea Worm is a possible reason for its continued presence in the country, together with a lack of will from policymakers. What about the people themselves; are they to blame? I found that the people in the district are aware of the nature of the disease indicating how effective the educational part of the eradication campaign has been. I however identified some possible factors that could increase the risk of polluting the water with the larva. Most notably, the risky bathing behaviors of local residents I see as being unintentional and ignorance on the part of the people. The habitual washing of feet after fetching water and the indifference about the activities of children are the other factors identified. This means that adhering to the formulated manuals is not enough as there are other activities, which may not be captured in the standard eradication procedure.

6.3 Recommendations

The provision of safe drinking water is first and foremost among all recommendations as far as the eradication of Guinea Worm in Ghana is concerned. The word 'safe' here means safe from Guinea Worm larva. This is just to buttress the point that the existing water sources available to the people can be made safe for them and not just treated water. For example, if an infected person does not enter the water sources they automatically become safe in the sense that the water fleas that harbor the infective larva have a limited lifespan over and above which, they will die. The increase and regular use of Abate will speed up the safeness of the water sources. In an effort to avoid contact with the water, I suggest that each community construct a simple wooden bridge over their water so that they can have access to cleaner water while on the bridge. The style adopted by the people of Kadua gave rise to this idea. Even though they were using stones to step on, there may be an occasional slip over into the water; the community cannot afford to pay the cost of just a single slip over by a patient. I also think this idea will avoid the washing of the legs since they will not have a direct contact with the land. I occasionally came across dug out wells and boreholes and though most of the boreholes had mechanical faults and were out of use, the wells were very deep. I think the long period of no rain makes the water table very deep. Very shallow wells dry up. I will then suggest that more deep wells and boreholes should be provided, with proper maintenance.

The communities themselves also have a social responsibility to protect their water resources from infection. Some people can be hired at a cost borne by the community to watch over their water sources to make sure that children especially are monitored in terms of their use of the water. This will also take care of instances where insane persons pollute the water without the knowledge of the users. If implemented successfully across the infected communities in the Northern region, it would only be a few years before the water sources will become safe and Guinea Worm is eradicated.

Aside from the standard methods used by the eradication team, time should be taken to observe some hidden factors that might increase the risk of infection among local residents. Some factors might be unique to a particular type of people and might only

be known after thorough observation of the socioeconomic lifestyle of the people. There should also be an effort by various ministries to retain workers especially teaching and health staff in the district by finding a way to make them feel secure about Guinea Worm infection. The increase use of the Abate as one of them pointed out increases their confidence of being safe. They may also be provided with water storage tanks that supply safe water.

Rainwater harvesting and storage I think can be a feasible alternative to a safe water supply at least for the foreseeable future. As in all developing countries, there is inability of the government to provide treated water to the district, despite the urgency of the situation. Thought the region has a single maxima rainfall spanning five months in a year, the rains within this period are enormous and often cause floods annually, which quickly reside into the major rivers that head towards the south, which has rains for most part of the year. This makes it environmentally possible but waiting on a little investment from either the government or elsewhere to make it real. More research aim at unearthing more risk factors must be conducted in each infected socioeconomic setting since each setting has unique circumstances that need to be taken into account.

6.4 Limitations of study

Time was the biggest restriction to this research. I had initially planned on running a regression analysis in order to determine the effects of Guinea Worm on school absenteeism and performance. Although it was measurable, it required a considerable amount of time in order to generate a variable that indicates absenteeism I needed to trace each absentee each day and determine the cause, and at the same time, the seasonality of the disease required a data collection over a year. In addition, the lack of statistical records made it very difficult to collect certain data I originally planned to obtain. The lack of a documented list of addresses also prohibited me from carrying out a traditional random sampling method. To determine a measure of income for the district was also impossible because there is no documented statistics that will aid in the measurement. The fact that they are subsistent farmers also makes it difficult to determine how much money they earn from their activities. Using the national

minimum daily wage which currently stand at GH¢3.11 (2 US Dollars) (MOFEP, 2010) is inadequate since this rate applies to only those in the public sector.

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Appendices

Appendix 1: Structured Questionnaires for Farmers

Questionnaires for Farmers

Date of Interview..... Name of Town.....

1. What is your name?
2. How old are you? *(please tick)*
€ Below 15 € 16-30 € 31-45 € 46-60 € above 60
3. Gender *(please tick)*
€ Male € Female
4. What is your marital status?*(please tick)*
€ Single € Divorced € Married € lost spouse
5. What is your Level of education? *(please tick)*
€ No formal education € Primary level € Junior high

€ Senior high € Tertiary € vocational
6. Do you farm for yourself? *(please tick)*
€ Yes € No
7. What economic activities do you do in the dry season?*(please tick)*
€ Farm (irrigation) € Trading € Idle € Other
8. What is the most common source of your drinking water?*(please tick)*
€ Treated water € Rivers and dams
9. If rivers and dams, do you treat it before usage?*(please tick)*
€ Yes € No
10. When was the first time you contracted Guinea Worm disease? *(please tick)*
€ During childhood € Adolescence € Adulthood
11. How many times have you been infected?
12. How many times do you normally (averagely) get infected in a year?
13. How long does it take to heal?(weeks)
14. Do you feel totally fit after its healing? *(please tick)*

€ Yes € No
15. What daily economic activities can you perform whiles infected?
16. Which part of the year do people normally get the infections? *(please tick)*
€ Rainy season € Dry season € All year round
17. What do you think is the cause of Guinea Worm?
18. How do you think it can be prevented?
19. Do you enter into sources of drinking water with it? *(please tick)*
€ Yes € No
20. If yes why, knowing the consequences.
21. Are you aware infected persons are not supposed to enter into sources of drinking water? *(please tick)*
€ Yes € No
22. Do you think there is a way of fetching water without entering into the source?*(please tick)*
€ Yes € No
23. If yes, how?

24. Who do you think is responsible for its prevention? *(please tick)*
€ Government € The people € Both
25. If government, what if government fails?
26. I f people, how?
27. How many weeks do you start preparation before rains
28. How many weeks do you use in harvesting and packaging?
29. How many bags of staple food do you get in a year when you or no one within the family is infected with Guinea Worm?
Rice= Maize= Groundnuts= Total=
30. How many days in a week do you go to farm during the farming season?
31. How long do you stay in the farm?
32. How do you till the land? *(please tick)*
€ Tractors € Bulls € Hoe an cutlass
33. Do you use weedicide and insecticide? *(please tick)*
€ Yes

€ No
34. What about fertilizers?
€ Yes € No
35. How long from home to farm?
36. How do you get to the farm? *(please tick)*
€ Walking € Bicycle € car

Appendix 2: Interview Guide for Teachers

1. Do you think the prevalence of Guinea Worm has something to do with the scarcity of trained teachers in this district?

2. If yes, how?

3. What do you think is the effect of the disease on the attendance rate of school children?

4. Do think it has an effect on their performance.

Appendix 3: Interview guide for officials

Position in the office.....

1. What prevents you from eradication it?

2. Do think the people are listening and adhering to your instructions?

3. What do you think is the people's view about it?

Appendix 4.1: List of communities in the District by Area councils

Moglaa Area Council (13)

1. Tarikpaa
2. Langa
3. Moglaa
4. Nyoglo
5. Kanshegu
6. Yilikpani
7. Libga
8. Yizegu
9. Duko
10. Zaazi
11. Bihinaayili
12. Nyoglo-Balshie
13. Zaazi-Kukuo

Diare Area Council (24)

14. Diare
15. Kadia
16. Zoosali
17. Gushie
18. Dipale
19. Nambagla
20. Pigu
21. Kukuobia
22. Sugu Tampia
23. Adaayili
24. Tuunaayili
25. Dikpungni
26. Dinga

27. Gbanga

28. Tamalgu

29. Sakpuli

30. Tigla

31. Sana

32. Safam

33. Yoggu

34. Disiga

35. Galogu

36. Sugu

37. Wawani

Nanton Area Council (40)

38. Nanton

39. Nanton Kurugu

40. Zieng

41. Sandu

42. Dingoni

43. Kpachelo

44. Kpunduli

45. Kpano

46. Janjori Kukuo

47. Guno

48. Guntingly

49. Chankpem

50. Gbumgbum

51. Nyamandu

52. Balshie

53. Sahakpalgu

54. Batangyili

55. Fazihini

56. Gbungnaayili

57. Nyerigiyili

58. Kparigilanyili

59. Nanton Yepalsi

60. Sanvili

61. Dohi

62. Moya

63. Manguli

64. Jana

65. Sahanaayili

66. Zali

67. Naprisi

68. Janakpiang

69. Goluri

70. Afayili

71. Kpana

72. Zetigu

73. Ajinjemyili

74. Nagaliyil

75. Chebsigu

76. Kparigiduli

77. Tahakpamo

Tampion Area Council (29)

78. Tampion

79. Zoggu

80. Nyeko

81. Nyoligu

82. Zokuga

83. Kadua

84. Zoonaayili

85. Jegung Kukuo

86. Sahani

87. Nagdigu

88. Jegung

89. Tinkurugu

90. Tigu

91. Kunkundaniyili

92. Nyoligu Botingli

93. Sindigu

94. Digu

95. Tampion Gushei

96. Zisungnaayili

97. Yipeligu

98. Tampion Chahiyili

99. Zoggu Silimboma

100. Looni

101. Sakpali

102. Kufaduli zoo

103. Gagbini

104. Salow

105. Tibognaayili

106. Kpukpaligu

Pong Tamale Area Council (21)

107. Pong Tamale

108. Nabogu

109. Sankpem

110. Nakpanzoo

111. Tibali

112. Chahi Yepalsi

113. Tindang

Appendix 4.2: Communities in the Sample

Communities	**Area council**

Kadua	TAMPION
Gbanga,	DIARE
Laligu	SAVELUGU
Kpunduli	NANTON
Sindigu	TAMPION
Looni	TAMPION
Galogu	DIARE
Nakpanzoo	PONG TAMALE
Yilikpani	MOGLAA
Chankpem	NANTON