

# **Domestic Water Supply, Sanitation and Health in Rural Ghana: Perspectives from Nkwanta District**

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## **Abstract**

This paper examines the health implications of inadequate water supply and sanitation in Nkwanta district. A sample of 200 respondents was drawn from eight communities in the district using a systematic random sampling technique. Data collection tools were questionnaires, interviews and focus group discussions. The research found that inadequate water supply and sanitation, together with socio-economic and cultural conditions, has robbed the people of Nkwanta of good health. Diseases associated with water and sanitation still top the top ten causes of morbidity and mortality. A Chi-square analysis shows a significant association between water sources and guinea worm and diarrhoea. Skin diseases were however found to be associated with inadequate water for personal hygiene. The research notes that adequate provision of potable water and safe disposal of excreta and other waste are fundamental to reducing the myriad of health problems that the people in the district are saddled with. This must, however, be supported by vigorous public health education programmes. For the success of water and sanitation programmes an integrated approach involving poverty reduction, women's empowerment, basic education, health care and widening employment opportunities is recommended.

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## Introduction

Domestic water supply is one of the fundamental requirements for human life. Without water life cannot be sustained beyond a few days, and a lack of access to adequate water supply leads to the spread of disease. The quality of water that is consumed is well-recognised as an important transmission route for infectious diarrhoeal and other diseases (WHO, 1993). The importance of water quality continues to be emphasised because bad water can cause epidemics and contribute to endemic disease from pathogens (Payment and Hunter, 2001). The effects of poor quality water supply are felt in both developed and developing countries, although the greater part of the health burden is carried by children in developing countries (Prüss *et al.*, 2002; WHO, 2000).

Around 1.1 billion people worldwide do not have access to improved water supply sources, while 2.4 billion people do not have access to any type of improved sanitation facility (WHO, 2010). According to the World Health Organization (WHO) and United Nations Children's Fund (UNICEF) Joint Monitoring Programme for Water Supply and Sanitation (JMP), 28 percent of the population of sub-Saharan Africa defecates in the open, and an additional 23 percent uses unimproved sanitation facilities that do not ensure hygienic separation of human excreta from human contact (JMP, 2008).

Unsafe water, inadequate sanitation and insufficient hygiene account for an estimated 9.1 percent of the global burden of disease and 6.3 percent of all deaths, according to the World Health Organization (Prüss-Üstün *et al.*, 2008). Nearly half of all people in developing countries have infections or diseases associated with inadequate water supply and sanitation (Bartram *et al.*, 2005). Diarrhoeal diseases attributed to poor water supply, sanitation and hygiene account for 1.73 million deaths each year and contribute over 54 million Disability Adjusted Life Years, a total equivalent to 3.7% of the global burden of disease (Howard and Bartram, 2003). This makes diarrhoeal disease due to unsafe water, sanitation and hygiene the 6th highest burden of disease on a global scale, a health burden that is largely preventable. Other diseases related to poor water, sanitation and hygiene such as trachoma, schistosomiasis, ascariasis, trichuriasis, hookworm disease and malaria constitute an additional burden (*ibid.*). About 2 million people die every year due to diarrhoeal diseases, most of whom are

children less than 5 years of age. According to Esrey and Andersson (1999), nearly three million children five years of age or younger die of diarrhoea annually. The most affected are the populations in developing countries living in extreme conditions of poverty, normally peri-urban dwellers or rural inhabitants (WHO, 2010).

Among the main problems which are responsible for this situation are: lack of priority given to the sector, lack of financial resources, lack of sustainability of water supply and sanitation services, poor hygiene behaviours and inadequate sanitation in public places, including hospitals, health centres and schools (WHO, 2010). Poverty is a major handicap to development. It is the poor who suffer most from the unavailability of facilities for safe water supply and safe disposal of excreta. This is because they lack not only the means to obtain such facilities but also the information and technology to reduce the ill effects of unsanitary living conditions which lower their productivity and their enjoyment of a healthy life. Poverty means lack of resources for the provision and use of reliable, safe and dependable water and sanitation facilities and also limited capacity among individuals to change their behaviour. It is therefore not surprising that an improved method of water supply and sanitation in itself will not have a significant health impact.

Within developing countries good water and sanitation facilities tend to be concentrated in urban areas, although the neglected rural areas frequently carry more than seventy percent of the total national population. Most areas do not even have such facilities at all, thus hindering safe collection, removal or disposal of waste in these areas. The results of the 2000 Population and Housing Census of Ghana indicate that about 40% of the households in the country have access to pipe-borne water and tankers provide water for 2% of the households. One-third of the households obtain their drinking water from wells and boreholes while 25% of the remaining households depend on natural sources such as springs, rain water, rivers, streams, lakes and dugout wells (Ghana Statistical Service, 2005). The urban-rural differentials are worthy of note. While nearly 68% of the urban households have access to pipe-borne water, only 15% of the rural households draw water from the same source. The effect of water from unprotected sources on health is much more acute among rural residents than urban dwellers (Gaisie and Gyau-Boakye, 2007).

The country is saddled with the problem of indiscriminate solid waste disposal and this has given rise to the pollution of water bodies and the exposure of the populace to numerous health threats. There are strong links between water supply, hygiene and disease. Contaminated water and lack of adequate quantities of water for personal hygiene give rise to water-borne, water-washed and water-based diseases. Where households have no access to water or have to travel long distances or spend considerable lengths of time to obtain water, then the quantity of water required by the households cannot be secured, hygiene may not be possible and the risk to human life may be high. Apart from the tedious and time-consuming work connected with drawing water from sources far away, the situation is characterized by human suffering in terms of poor health.

Lack of access to safe and adequate water supplies contributes to ongoing poverty, through both the economic cost of poor health and the high proportion of household expenditure on water supplies in many poor communities, which arises from the need to purchase water and/or time and energy expended in its collection. The importance of adequate water for human health has been recognized for many years, and there has been an extensive debate on the relative importance of water quantity, water quality, sanitation and hygiene in protecting and improving health (Lesrey *et al.*, 1991). Despite this debate, international guidelines or norms for minimum water quantities that domestic water supplies should provide remain largely lacking.

Water supplies and sanitation are critical elements in a sustainable livelihoods strategy, being directly related to issues of access to and control over natural resources as well as basic infrastructure and services. Freshwater is a scarce resource and unless drastic improvements in water use efficiency and pollution control occur, four billion people – half the world's population – will live in countries with high water stress by the year 2025 (Cosgrove and Rijsberman, 2000). Providing access to sufficient quantities of safe water and facilities for sanitary disposal of excreta and introducing sound hygiene behaviours are of capital importance in reducing the burden of disease caused by these risk factors. Successful improvements to water supplies and sanitation however require an understanding of the interconnectedness of water and sanitation. It is well established today that the benefits of water supply will not be forthcoming unless attention is also given to sanitation (Andersson, 1996).

And there is growing awareness that improvements to sanitation can bring greater health benefits than improvements to water supply (Isray, 1996). There is also the recognition of the fact that inadequate improvements to sanitation can be worse than no improvements at all, particularly in the case of sanitation approaches which use scarce freshwater resources and risk contaminating water sources. A maxim gaining popularity is: Never consider water without sanitation and always consider sanitation with water.

A number of failings in the approach to improvements to water supply and sanitation over the past few decades have been identified. A major failing in many of the earliest programmes was the dependence on highly sophisticated technology. The focus was on uses of water rather than on users and this resulted in a lack of focus on people - women and men and girls and boys - in the development of the policies and programmes. There was little consultation, levels of participation were poor and the realities and needs of women and men were not taken into account in planning (Andersson, 1996).

There was also the problem of the high level of compartmentalization in the sector. Management of water resources was organized within narrow sectors, with different sub-sectors such as household water supplies, irrigation, flood control, wetlands preservation, fisheries, coastal management and hydro-electric power developed through separate policies and strategies and even managed by separate independent agencies. Investments in these sub-sectors, carried out in isolation, do not tackle the root causes of problems of water resource management (Hannan and Andersson, 2001). These problems or challenges are rarely solely connected to absolute resource constraints. Rather, they are often closely linked to socio-cultural, economic, political and institutional factors which govern the ways water resources are utilized and managed, as well as the extent to which different groups in society are able to gain access to water resources for their specific needs. An important development during the last decade has thus been the emergence of a more holistic view of water management, even though the linkages to other sectors such as health, agriculture, education and transport, are still too weak. A persistent problem is, however, the failure to understand the improvements to water supply and sanitation as a process of social change that requires a strong focus on the users and the identification of both women and men as actors and change agents in the process. The bacteriological quality of drinking

water has been shown to decline significantly after collection (Wright *et al.*, 2004). It is therefore important that policies that aim to improve water quality at the source are accompanied by corresponding measures to ensure safe household water storage and treatment. The main objective of this paper is to examine how the socio-cultural and belief systems of the people in the Nkwanta District of the Volta Region interact with domestic water supply and sanitation to produce their health outcome.

### **Domestic water supply and Sanitation Defined**

In its Guidelines for Drinking-Water Quality, WHO defines domestic water as *water used for all usual domestic purposes including consumption, bathing and food preparation* (WHO, 1993, taken from Howard and Bartram, 2003). This implies that the requirements with regard to the adequacy of water apply across all these uses and not solely to consumption of water. In the 'Drawers of Water' study on water use patterns in East Africa, White *et al.* (1972) suggested that three types of use could be defined in relation to normal domestic supply. These are:

1. Consumption (drinking and cooking)
2. Hygiene (including basic needs for personal and domestic cleanliness)
3. Amenity use (as in the case of car washing and lawn watering).

In updating the Drawers of Water study, Thompson *et al.* (2001) suggest a fourth category can be included. This is 'productive use', which was of particular relevance to poor households in developing countries. Productive use of water includes uses such as brewing, animal watering, construction and small-scale horticulture.

The first two categories identified by White *et al.* (1972), 'consumption' and 'hygiene', have direct consequences for health in relation to both physiological needs and the control of diverse infectious and non-infectious water-related disease. The third category (amenity) may not directly affect health in many circumstances. Productive water is critical among the urban poor in sustaining livelihoods and avoiding poverty and therefore has considerable indirect influence on human health (Thompson

*et al.*, 2001). In this paper, 'domestic' is defined in terms of the first two categories.

The term sanitation refers to the hygienic principles and practices relating to the safe collection, removal or disposal of human excreta, refuse and waste water as they impact upon users, operators and the environment (National Sanitation Policy, Republic of South Africa, 1995). It relates to personal hygiene, food hygiene, solid-waste disposal, environmental protection and excreta and wastewater disposal.

### **Effects of Water Supply and Sanitation on Health**

There is a wide range of diseases associated with water and sanitation. The transmission of water- and sanitation- related diseases may however be divided into four categories (White *et. al.*, 1972). The first of these is water-borne diseases caused by ingestion of water contaminated by human or animal faeces or urine containing pathogenic bacteria or viruses. Diseases in this category include cholera, typhoid, amoebic and bacillary dysentery, infectious hepatitis, gastro-enteritis and other diarrhoeal diseases. The second group of these diseases is termed water washed diseases, caused by poor personal hygiene and skin and eye contact with contaminated water. It is the result of the use of inadequate volumes for personal hygiene. Diseases of this type are skin diseases such as yaws, scabies and leprosy; eye infections such as trachoma and conjunctivitis, as well as fleas, lice and tick-borne diseases. These infections decrease as the quantity of water increases. The third group of diseases is water-based diseases, caused by parasites found in intermediate organisms living in water. They include dracunculiasis (guinea worm), schistosomiasis and other helminths which have aquatic hosts. Water-related diseases constitute the last group and are caused by vectors which breed in water. In other words, they are caused by microorganisms with life cycles associated with insects that live or breed in water. Diseases in this category are lymphatic filariasis, malaria, onchocerciasis, trypanosomiasis, dengue fever and yellow fever.

A study in rural Philippines (Johnson and Nelson, 1984) indicated negative correlation between child death rates and level of sanitation. Azurin and Alvero (1974), on the field evaluation of the effects of water supply and sanitation on cholera over five years, showed that the greatest reduction in cholera was achieved in a village with running water and

hygienic latrines. However, when the population began to depend on the facilities provided and to use them regularly the effect became more apparent. Another survey conducted in Pikine, a middle/low income suburb of Dakar, shows that mortality was 64% higher in households supplied by communal wells than in those with a tap in the dwelling (Gould, 1998).

The provision of water supplies and sanitation facilities does not automatically yield positive results. As Lindskog and Lundqvist (1989) argue, the proper functioning of an improved water system and the extensive use of it is no guarantee that it will result in improved health. They further argue that functioning and utilization are necessary but not sufficient conditions for attaining social and health improvements. As they observed, a high service level is important in order to minimize the need to use other sources as well. Many other features like sanitation, personal and environmental hygiene, economic conditions, nutrition as well as social and cultural customs and traditions, all influence the degree to which a facility would have an impact.

Worlanya (1984) assessed the relationship between sanitation and child mortality in Ghana based on data derived from the Ghana Supplementary Census Enquiry (a 5% stratified sample of the total population). The results showed that although better facilities such as piped water, water closets or private latrines are often associated with lower child mortality, the advantages of better sanitation facilities are severely limited when mothers are not educated. The study also showed that providing as little as one to six years of formal education results in considerable reduction in child mortality risks.

Fulkenmark (1982) made the observation that in order to attain the potential benefits of water supply improvements, it is necessary to achieve both an improvement of the quality of the water used and an increase in water quantity consumed by the population. Improving the quality but not the quantity may not yield the expected result. Similarly, improving the quantity but not the quality may not bring the desired result. Improvement in water quality has been emphasized as a means of reducing diarrhoeal diseases. This is because improved water quality at consumption will decrease the number of pathogens consumed, thereby impacting positively on health. Since transmission of the pathogens which cause diarrhoea is largely by the faecal-oral route, access to and appropriate use of greater

quantities of water for hygiene purposes, especially for hand washing, should reduce faecal-oral contamination and hence the transmission of diarrhoea. It is for this reason that Shier et al. (1996) pointed out that the transmission of diarrhoea should be decreased by both qualitative and quantitative improvements in water.

The incidence of diarrhoeal diseases has been most commonly used as an indicator of the health effects of water supply and sanitation. Although these diseases are associated with water, not all of them are waterborne. Most are spread by routes other than the contamination of drinking water by faeces. Some studies have failed to demonstrate any marked association between water quality and diarrhoeal disease. Feachem et al. (1976) reported that one could not demonstrate an association between the incidence of cholera and other diarrhoeas and the use of tubewells in Bangladesh.

Some studies have even found that bringing water sources substantially closer to, but not into, the house may not increase the volume of water used (Feachem et al., 1978; McLunkin, 1982). Thus, water consumption varies enormously in different parts of the world depending upon climate, cultural and social habits and economic conditions.

Victoria et al. (1998) examined the issue of water supply, sanitation and housing in relation to the risk of infant deaths from diarrhoea in metropolitan areas of Porto Alegre and Petotas in southern Brazil. Based on a logistic regression analysis, they observed that infants receiving untreated water were not at significantly higher risk than those receiving treated water were. This suggests that the beneficial effects of piped water might be related to easy availability of water rather than to its quality. The point draws one's attention to the fact that there are two principal justifications for providing good quality and easily accessible water supplies. The first is to improve accessibility to water, thereby increasing the quantity of water used and ultimately decreasing the transmission of water-washed diseases such as scabies, conjunctivitis and trachoma. The secondly is to improve the quality of water available, which should decrease the transmission of water-borne diseases such as schistosomiasis and Guinea worm (Feachem, 1977).

Having access to water within close range could reduce the risk of damage to the spine and of the early onset of arthritic diseases and offer protection

against hip damage (Page, 1996). Where women must walk long distances this may exacerbate malnourishment and also affect the quantity and quality of milk produced by lactating mothers (Dufault, 1988).

## Study Area

The Nkwanta District is located in the north-eastern section of the Volta Region between latitudes  $7^{\circ} 30' N$  and  $8^{\circ} 45' N$  and longitudes  $0^{\circ} 10' E$  and  $0^{\circ} 45' E$ . It shares boundaries with the Kete-Krachi District to the West, the Republic of Togo to the East, the Kadjebi District to the south and the Nanumba District to the North. Nkwanta District is the largest in terms of land area and the second fast growing district (after Akatsi District) in the Volta Region. The district has a land surface area of 3,863 square kilometres (1486.33 square miles). One percent of its land size is covered by part of the expanded Oti River to the west.

The district is generally characterized by a tropical climate, with dry and humid weather conditions in the northern and southern zones, respectively. Mean annual maximum temperature ranges between  $24^{\circ}C$  and  $39^{\circ}C$  while mean annual minimum temperatures are between  $11^{\circ}C$  and  $26^{\circ}C$ . January to April are the hottest months while December has the lowest temperature. The rainfall pattern in the district is seasonal. It is characterized by double maxima, from April/May to July, and from September to October in the southern part of the district. There is only one rainy season in the northern part of the district. Annual rainfall ranges between 922 and 1,874mm (36.3 - 73.8 inches). The important rivers in the district are the Kpasa, Bonakye, Sabu, Chai and Gikyebun. There are a number of other smaller rivers and streams spread over the entire district which serves as sources of domestic water supply for the majority of the population.

The 2000 Population and Housing Census puts the population of the district at 151276 people, made up of 74839 males and 76437 females. The range of economic activities in the district includes agriculture; wood processing, marketing and commercial transportation, tourism and small-scale domestic industries and tertiary activities. Fig. 1 shows the study area and the sampled area.

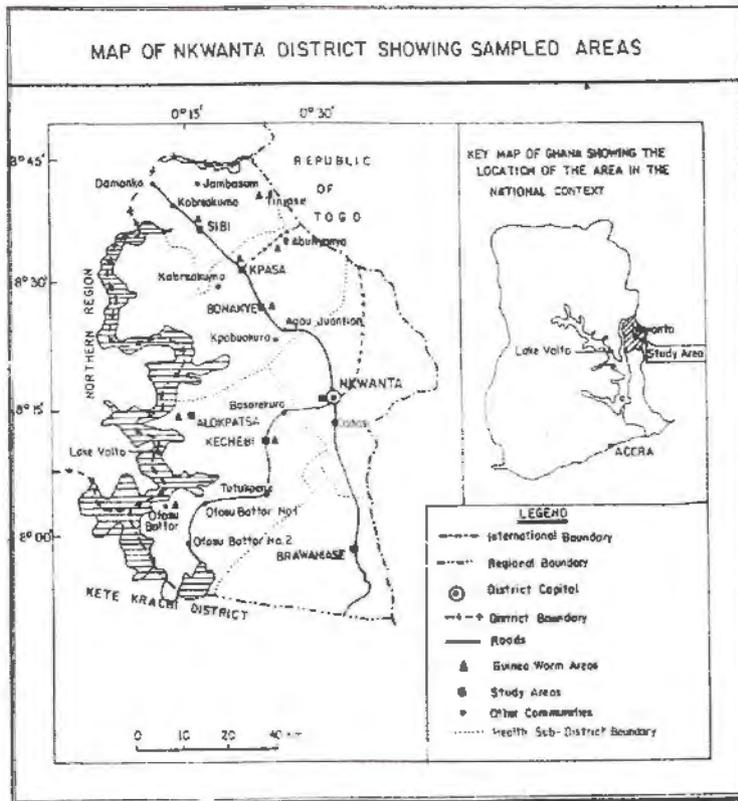


Fig. 1

## Methods

Two main sources of data were used in this research. These are primary and secondary sources. The research employed questionnaires, structured and unstructured interviews as well as focus group discussion to collect data from respondents. Target groups include households, healthcare providers, patients and officials of the District's Community Water supply and Sanitation division. In addition, direct observation of sanitary habits was done.

The whole district was divided into five principal zones, which coincided with the District's Health sub-districts, namely, Damanko, Kpasa, Nkwanta, Tutukpene and Brewniasse. The systematic random sampling

technique was used in selecting the various houses from which household heads were purposively selected for interview. Purposive sampling was also employed to obtain information from specific water, sanitation and health workers. A sample size of 200 respondents was selected from the eight different communities, making sure that no Health sub-district is left out. These communities were Sibi, Bonakye, Kekyeibi, Dadiase, Kpasa, Nkwanta, Tutukpene and Brewaniase. In addition, information was collected from officials of the District's Community-based Water Supply and Sanitation Division, Water Supply and Sanitation (WATSAN) committee members. Also targeted were the residents in the various communities visited as well as some officials of the WATSAN Board. Health Workers and patients from the sampled health institutions were not left out. In each health institution, every fourth patient who reported was selected for interview. Information from patients and health workers centred on diseases commonly reported.

Analytical techniques involved the use of simple descriptive statistics such as frequency distribution and percentages and inferential statistics such as chi-square. Cross-tabulation was used to show associations or relationships between water sources and diseases.

## **Results and Discussion**

### **Water supply: sources and access**

The 2000 Population and Housing Census indicates that 19.4% of the district's population obtain water from wells, 8.2% from boreholes, 2.9% from springs and rain, 5.5% from dugouts and 61.3% on rivers and streams. Only 2.3% have access to pipe-borne water, with the remaining 0.4% patronizing tanker services and other sources. It is clear that over 80% of the district's population obtain water from traditional sources and that most of such water is contaminated at source. This is slightly higher than the 78% obtained from this survey. Thus, there is no access to potable water in the district. In the rainy season, rivers like Gekyehun, Kpasa, Sihi and Bonakye become qualitatively degraded as wastes of all kinds including human excreta are carried in surface run-offs into them. Boreholes provided by some Non-governmental Organisations (NGOs) are important complementary sources to the natural sources of water, but most of them are broken down. Lindskog and Lundqvist (1989) assert that the

functioning and utilisation of a scheme will determine its service level. It is therefore essential that water schemes be designed in such a manner that the demand can be matched with a proper supply. This service level could be severely limited by rapid population growth and frequent breakdown of facilities. The risk of fetching water from unsafe sources will increase significantly if water supply is irregular or located far away.

Beyond a distance of one kilometre or more than 30 minutes total collection time, quantities of water in rural areas will be expected to further decrease to a bare minimum where only consumption needs can be met. In urban areas, where water supplies may be close but total collection times are very high, greater volumes may be collected that will support hygiene, although the overall impact on household poverty is significant (Aiga and Umenai, 2002). The research indicates that the majority of the inhabitants in the district still have to travel some distance away from their homes to obtain water. Only 2% of the respondents have in-house water supply and as such do not travel as others do. However, 18% cover a distance of less than 100 metres to obtain water while 20.5% walk a distance of between 100 to 500 metres. About 44% of the respondents walk a distance of over 500 metres to 1 kilometre, while 16% go beyond one kilometre. Apart from time spent traveling long distances to fetch water, considerable time is also spent at boreholes. Time spent varied considerably, but the survey reveals an average time of 45 minutes, far above the 30 minutes noted by Aiga and Umenai (2002). This was what one lady said in a focus group discussion at Alokpatsa:

‘During dry season, water becomes a scarce commodity. We sometimes have to spend hours to fetch water from borehole while for greater part of the season we travel long distances for river water. It is very tiring and frustrating’

The first priority therefore is to ensure that households have access to an improved water source within one kilometre (Howard and Bartram, (2003). This corresponds to the current definition of reasonable access used in assessing progress in global coverage with water supply and sanitation (WHO and UNICEF, 2000).

## Sanitation

The various excreta disposal systems identified in all the eight communities studied are household latrine (open-pit), household latrine (KVIP), household flush latrine, communal latrine (KVIP), communal latrine (open pit) and the free-range system. In the main, four types of excreta disposal systems have been identified. - Communal Latrine- Open Pit, Communal Latrine-KVIP, Household Latrine - Open Pit and Free Range. Only 28 (14%) of the respondents have in-house excreta disposal facilities and 172 (86%) use facilities outside the house (either communal latrine (KVIP), communal latrine (open pit) or the free-range method.

Of the 28 respondents who have toilet facilities in the house, 25% use the open pit type, 60.7% use KVIP and 14.3% use flush latrines. As Table 1 shows, the 14.3% of the respondents using the flush latrines come from Nkwanta. These respondents are those residing in government hungalows. Also, KVIP and open pit latrines are the dominant types of toilet facilities. Sibi and Bonakye are the only two settlements where all the respondents said they had no in-house toilet facility. Of the 172 respondents from the eight communities who had no facilities at the household level, about 6.4% of them use communal latrine — KVIP type, 68.9% use the free range system (where the bush is used) and 23.8% use communal latrines of the open pit type.

Table 1: Distribution of in-house Excreta Disposal Facilities by Settlements and Types

Settlement	TYPE OF FACILITY							
	Open Pit		KVIP		Flush Latrine		Total	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
<i>Nkwanta</i>	1	9.1	6	54.5	4	36.4	11	100.0
<i>Bonakye</i>	-	-	-	-	-	-	-	-
<i>Alokpatsa</i>	1	100.0	-	-	-	-	1	100.0
<i>Kecheibi</i>	1	20.0	4	80.0	-	-	5	100.0
<i>Diadiase</i>	1	100.0	-	-	-	-	1	100.0
<i>Sibi</i>	-	-	-	-	-	-	-	-
<i>Kpasa</i>	-	-	4	100.0	-	-	4	100.0
<i>Brewaniase</i>	3	50.0	3	50.0	-	-	6	100.0
<i>Total</i>	7	25.0	17	60.7	4	14.3	28	100.0

Of the 172 respondents from the eight communities who had no facilities at the household level, about 6.4% of them use communal latrine — KVIP type, 68.9% use the free range system (where the bush is used) and 23.8% use communal latrines of the open pit type (see Table 2)

**Table 2: Distribution of Excreta Disposal Systems among Household Respondents without in-house facilities by settlements and Types**

Settlements	TYPES OF FACILITY							
	Communal Latrine(KVIP)		Free-range		Communal Latrine (Open-pit)		Total	
	N	%	N	%	N	%	N	%
<i>Nkwanta</i>	11	37.9	18	62.1	-	-	29	100.0
<i>Bonakye</i>	-	-	20	100.0	-	-	20	100.0
<i>Alokpatsa</i>	-	-	1	7.1	13	92.9	14	100.0
<i>Kecheibi</i>	-	-	2	10.0	18	90.0	20	100.0
<i>Dadiase</i>	-	-	-	-	9	100.0	9	100.0
<i>Sibi</i>	-	-	30	100.0	-	-	30	100.0
<i>Kpasa</i>	-	-	26	100.0	-	-	26	100.0
<i>Brewaniase</i>	-	-	23	95.8	1	4.2	24	100.0
<i>Total</i>	11	6.4	120	69.8	41	23.8	172	100.0

For the general public, the risk of falling prey to diseases associated with insanitary conditions is high. The few public KVIP latrines are nasty, unsafe and pose a lot of discomfort to users and non-users. These conditions have partly conspired to propel many to resort to the free-range. Age-long beliefs such as the one which holds that defecating on somebody else's faeces would retard progress, a belief which is still pervasive in most of the communities, also explain why people still use free-range.

The household pit latrines are by no means better. They are neither safe nor comfortable. By their open nature, they carry perpetual flies during the day, which makes their usage uncomfortable for the users. Besides, faecal-oral transmission of diseases is likely. The 'free-range' system is the worst in terms of safety, as faecal matter finds its way ultimately into streams, rivers and other unprotected sources of water, thus polluting them.

## **Modes of Garbage disposal**

The survey that covered the eight communities identified household disposal points, community disposal points and indiscriminate disposal as the main systems. From the survey, 14.5% of the total respondents dispose of their garbage at the household disposal point, 65.5% at community disposal point while 20% dispose of their garbage indiscriminately. The various modes of garbage and waste water disposal are not ecologically friendly. Both household and community disposal points, where properly managed, may not pose any threat. However, where such systems are uncontrolled, as found in all the communities studied, then they pose a challenge. The situation is even more serious if one considers the fact that indiscriminate disposal of waste is the most dominant in the district. Conclusively, the systems of waste disposal in the study area present pollution risks to the general environment, especially to surface and ground water resources, which in turn pose a threat to health.

## **Domestic water supply, sanitation and health in Nkwanta District.**

There is a close relationship between the quality and quantity of water, hygienic practices and the health of individuals. Those who depend on unprotected sources of water and unsafe means of excreta disposal are more likely to be exposed to Guinea worm, diarrhoea, cholera and other diseases associated with water and sanitation. The research showed that households with high and multiple disease burdens are those whose main sources of water were traditional (e.g. rivers, streams). Lack of formal education has been identified to be a limiting factor to the advantages to be derived from the use of the boreholes provided. The borehole water at source is clean, but the quality of this water is compromised by the way it is transported from the source to destination. The dirty fetching pans, the dipping of hands in water during the fetching and transporting process and the nature of water storage facilities are sources of contamination of water in the district. In accord with Bennet et al. (1993), the possible sources of contamination is that buckets or pans used for fetching water from boreholes or standpoints are open, and these containers are also used for bathing and for other household chores.

## Domestic water supply and the guinea worm disease

Guinea worm disease (dracunculiasis) is a parasitic infection caused by the nematode *Dracunculus medinensis*. The infection manifests itself in one-meter-long thin white worms that emerge directly and slowly through the skin on any part of the body. People are infected by drinking water that contains tiny water fleas that have ingested immature forms of the parasite spewed into stagnant ponds from emerging adult worms. This infection is only transmitted by contaminated drinking water, and there is a one-year lag between infection and the emergence of the adult worm. Dracunculiasis has no vaccine or cure, and infection confers no immunity to reinfection.

Cases of Guinea worm disease are prevalent at Kpsa, Sibi, Bonakye and Alokpatsa. In the Guinea worm prone communities, not only is access to clean and reliable sources of water lacking, but also traditional sources of water supply are limited. Many of the communities depend on unsafe sources such as ponds, shallow wells, dams and streams which are known to be potentially unsafe. The seasonal variation in the volume of streams serving as sources of domestic water has significant implications for the cyclops density. Contamination occurs both at source and at home. Most households keep two kinds of water pond, well or river water which is usually contaminated, and borehole/tap water which is clean at source. The former is used for hygiene purposes, including basic needs for personal and domestic cleanliness, while the latter is used for consumption (drinking and cooking). Keeping two different kinds of water within the house rather compounds the problem. This is because it provides an avenue for contamination by dipping the same cup or bowl into barrels containing water of different quality.

Table 3 indicates that, 64 (32%) of the 200 respondents had guinea worm disease. Of the 155 respondents who obtained water from ponds, dams, wells and streams, 36.8% had Guinea worm while of those who depended on borehole, 15.6% had Guinea worm. Two hundred and sixty (260) cases of guinea worm victims were recorded and this was arrived at by actually counting the number of cases per house visited. In these areas, one came across victims with serious conditions (see Plates 1 and 2). The resulting pain incapacitates victims for periods averaging two to three months. This often constrains agricultural productivity and school attendance. As the

muscle tissue of the knee is damaged the victims become permanently crippled.

**Table 3: Guinea worm disease distribution among households by Main source of water**

<i>Source of water</i>	<i>Guinea worm Disease</i>		<i>Total</i>
	<i>Infection</i>	<i>No infection</i>	
<i>Borehole/pipe</i>	7 (15.6)	38 (84.4)	45 (100.0)
<i>Ponds/Streams/Dam/ Well</i>	57 (36.8)	98(63.2)	155 (100.0)
<i>Total</i>	64(32.0)	136 (68.0)	200 (100.0)

Chi-square = 7.21 Critical value = 3.841 Df = 1 Significant level = 0.05

The null hypothesis ( $H_0$ ) that there is no relationship between guinea worm infection and source of domestic water was tested. That is, the two variables are independent. The alternative hypothesis ( $H_A$ ) was that there is a relationship between guinea worm infection and source of domestic water. The chi-squared statistic ( $\chi^2$ ) was employed using information in Table 3. The decision rule was that at 0.05 level, the difference is significant if  $\chi^2$  with 1 degree of freedom is above the critical value. Since  $7.21(\chi^2 \text{ calculated}) > 3.841(\text{critical value})$ ,  $H_0$  is rejected and  $H_A$  accepted. Thus there is a significant relationship between guinea worm disease infection and source of domestic water supply. Those who consume water from ponds, wells, streams and other unwholesome sources tend to have higher guinea worm infection than those who use borehole or pipe-borne water.



**Plate 1:** A Guinea worm victim with a swollen knee.



**Plate 2:** A Guinea worm victim with rigid left limb.

### **Socio-cultural factors and the incidence of Guinea worm disease**

During the field survey, the question arose as to who is at risk of guinea worm infection. One or two people in a household, for instance, were infected with Guinea worm but not the others within the same household, even though they take water from the same source. One house is clean of visible pathology in terms of the guinea worm disease but the next house is infested. At Bonakye, for instance, a single house registered twelve cases of guinea worm infection but an adjoining house registered no single case. Formal education plays a role but is grossly inadequate in explaining the observed variations in diseases spatially and among socio-economic groups. Customs and beliefs of the different ethnic groups in the study area have a role to play. Most people in all the communities studied would not readily accept that water from their wells, ponds and rivers poses a potential health risk from pollution. The focus group discussions have demonstrated that people still have doubts about the connection between guinea worm disease and the water they drink. In apparent disagreement with the fact that such traditional sources are not safe, some interviewees responded in Twi that '*Ensuo yi na ye nananom num fritete*'. This means, 'This is the water that our forefathers drank from time immemorial'. To the majority, borehole water is not appealing due to its saline nature. It does not taste good and does not lather well with soap. In areas such as Sibi, Bonakye and Alokpaasa, where the guinea worm disease is still prevalent, some still hold the belief that the disease has spiritual underpinnings. This belief is still held by some people in all the endemic communities visited. This is what Salifu, a guinea worm victim in

Bonakye, had to say during a focus group discussion: *The disease we are suffering from is a punishment from the gods of the land and I am not sure it is from the water we drink. The gods of the land might have been offended. If the gods are pacified I think all will be over.* He continued: *Even health workers are not spared. If the gods are angry they know no bounds.* Such beliefs have undermined health programmes directed towards controlling the guinea worm menace. The result is the prevalence of water-borne and water-based diseases such as guinea-worm infections, cholera, diarrhoea and typhoid in some of the communities.

### **The guinea worm disease and social stigma**

The presence of social stigma against guinea worm victims was observed in the endemic communities such as Sibi, Alokpatsa and Bonakye where cases are high. This may cause serious psychological trauma. Since most people still attribute the disease to supernatural causes, people infected with the disease are often looked down upon by those not afflicted with the disease. People easily attributed the disease to punishment from gods because of some wrongdoing. Within the same community, those not infected would not like to associate with the infected. This is what Gado, a guinea worm victim had to say in an interview with him at Sibi: *Irok at me; I am rendered immobile. My wife and my two children are also infected. Some of our friends would not like to mingle with us because we are suffering from guinea worm disease. Even some close relatives, have abandoned us. We need some help.* This social stigmatisation often underlies the refusal of victims to report cases for treatment.

### **Water supply and diarrhoeal diseases among Children**

There is an obvious linkage between quality of water and incidence of diarrhoea. It is known that all the major infectious agents of diarrhoea are transmitted by the faecal-oral route, and all can be transmitted through contaminated water. In Table 4, 66.8% of those whose main source of water is traditional complain about diarrhoea among children. This represents 51% of the total number of respondents. However, of the 45 respondents whose main source of water is borehole/tap or non-traditional sources of water, 33.3% reported diarrhoea among children. This is 7.5% of the total number of respondents. Evidence from the field suggests that three types of water and excreta disposal improvements are necessary to reduce the ingestion of pathogens causing diarrhoea: improved, water

quality; increased water availability and quantity associated with better hygiene practices; and improved excreta disposal facilities. One lesson that can be learned from the above is that improving quality of water is a necessary but not a sufficient condition for reducing diarrhoeal infections to appreciable levels.

The null hypothesis ( $H_0$ ) that there is no association between diarrhoeal disease and domestic sources of water was also tested. The alternative hypothesis ( $H_A$ ) was that there is an association between diarrhoea and domestic sources of water. The chi-squared statistic ( $\chi^2$ ) was employed using information in Table 4. The decision rule was to reject the null hypothesis if the calculated chi-square is greater than the critical value. In other words, at 0.05 level, the relationship is significant if  $\chi^2$  calculated is above the critical value. Since  $15.15 > 3.841$ ,  $H_0$  is rejected and  $H_A$  accepted. The conclusion is that there is a significant association between diarrhoeal disease and the source of domestic water, with a higher number of cases in households without access to potable water. This means that the source of water relates to the incidence of diarrhoea.

**Table 4:** Diarrhoeal Cases among Households by main source of water

<i>Source of water</i>	<i>Diarrhoea</i>		<i>Total</i>
	<i>Present</i>	<i>Absent</i>	
<i>Borehole/pipe</i>	15 (33.3)	30 (66.7)	45 (100.0)
<i>Ponds/Streams/Dam/ Well</i>	102 (66.8)	53 (34.2)	155 (100.0)
<i>Total</i>	117 (58.5)	83 (41.5)	200 (100.0)

Chi-square = 15.15 Critical value = 3.841 Df = 1 Significant level = 0.05

### **Water sources and the incidence of skin diseases**

In the study area skin infections were observed at Sibi, Alokpatse, Kpasa and Bonakye, the areas with perennial water problems. Skin infection by its very nature was easily identified through direct observation, which was supplemented with a questionnaire survey. Eczema, yaws and skin rashes were directly observed and recorded during the field survey. Where no

observable case existed in a household, questionnaire was used to elicit information on the incidence of the disease. The distribution of responses regarding the presence or absence of the disease is indicated in Table 5.

Table 5: Skin Infection Distribution among Households indicated by main source of water.

<i>Skin Diseases</i>	<i>Borehole/pipe</i>	<i>Rivers/Streams/Dam/Well</i>	<i>Total</i>
<i>Present</i>	12 (26.7)	53 (34.2)	65 (32.5)
<i>Absent</i>	33 (73.3)	102 (65.8)	135 (67.5)
<i>Total</i>	45 (100.0)	155 (100.0)	200 (100)

The research found that the quantity of water, rather than quality used, explains the incidence of skin infections. Regular bathing is seen as having a direct relation with the ease with which people have access to water. Insufficient water is responsible for the reduced number of times people bath and wash their clothes, which predisposes them to various kinds of skin diseases. It is the quantity of water available for washing and bathing that significantly affects the skin. This does not however suggest that the quality of water used cannot cause skin infections. Dirty and contaminated water may contain pathogens which, when in contact with the skin, could cause skin infection. Since borehole water is not easily accessible, water from streams, rivers and other open sources is what the majority (78%) use for washing and bathing. Besides, people rarely use borehole water for washing and bathing, since they complain it does not lather readily with soap.

## Conclusion and recommendations

The majority of the inhabitants depend on unprotected ponds, dugouts, streams and rivers as their main sources of water supply, but most of these have been found to have a lower bacteriological quality at source compared to borehole water (Moe et al., 1991). Owing to lack of sanitation facilities such as latrines (both private and public), there is open air defecation around river courses, bush and streets. There are also no controlled dumping sites in the District, a situation which is evident in all the eight communities studied. This has been the main cause of

indiscriminate or uncontrolled dumping of refuse or wastes of all kinds. Besides, a number of settlements face acute or seasonal water shortages because most streams and rivers on which these communities depend dwindle greatly or dry up during the dry season. In the rainy season, the rivers become muddy and turbid. Streams become qualitatively degraded as wastes of all kinds including human excreta are carried in surface run-offs into them. A number of hand pumps/boreholes have been provided by some Non-Governmental Organizations (NGOs) to augment the natural sources of water. However, a number of these pumps have fallen into disrepair due to poor management, a phenomenon attributable to lack of needed skilled manpower and requisite material and financial resources. There is also evidence of abandonment and underutilization because such facilities were inappropriately sited

Thus the diseases associated with water and sanitation still constitute the most serious ones in view of the fact that they collectively exert by far the greatest health burden than any other causes of morbidity and mortality in Nkwanta district. Some of the direct health effects include Guinea worm infection, skin diseases and diarrhoea related diseases. Whereas Guinea worm and diarrhoea diseases have shown significant relationship with water sources, skin diseases have not. In addition to direct health effects of inadequate water supply on the population, there is an additional cost in time and energy expended in carrying water from the sources of supply to residential areas. This is particularly burdensome for drawers of water, most of whom are women and young daughters who have to travel several kilometres for water with negative implications for their labour productivity in all aspects of socio-economic activity.

The partial failure of water supply and sanitation programmes to address health problems is reflected in the high prevalence of diseases related to water and sanitation in the district. The top ten diseases in the district are still closely tied to inadequate water supply and insanitary personal, domestic and environmental practices. Guinea worm infections are still prevalent and have a debilitating effect on health and a negative impact on economic and social activities in the endemic areas. The socio-economic effects are devastating. Children miss school because they are immobile or are forced to work in the fields in place of their disabled elders. Farmers cannot manage their farms and women cannot care for their children. The emergence of guinea worm from a joint (child's knee) has caused complete

paralysis in some instances. All these present enormous challenges to the people in the district. It is recommended that:

1. More boreholes or other protected sources of water and toilet facilities should be provided through collaborative efforts between the Water Supply and Sanitation Agencies and the communities.
2. Boreholes and latrines should be sited within the reach of the majority of people in the community. This is because the observation made is that there has been gross under utilization of such essential facilities because they are not easily accessible.
3. The Community Water and Sanitation Agencies should use their expertise to choose appropriate places where the hydrological condition would ensure that boreholes continuously generate water for the community. This is necessary because some boreholes that were drilled have been abandoned due to the fact that they yield little or no water in the dry season. This situation therefore demands that before boreholes are drilled, more reliable hydro-geological surveys must be carried out.
4. Public education about the causal linkages between water quality and quantity and poor sanitary habits, on the one hand, and most of the diseases they suffer from, on the other should be intensified in the communities. For instance, Guinea worm disease should be seen as a water-based disease that is medically curable. The government, chiefs, opinion leaders and other stakeholders have a role to play in this direction.
5. For the success of water and sanitation programmes, an integrated approach is necessary. Poverty reduction through broad-based poverty reduction programmes; women's empowerment through formal education, among other things; basic education promotion; expanded health care and employment opportunities are critical.
6. More controlled dumping sites should be created and more refuse dump bins made available through the various agencies and the District Assembly. This would bring to an end the indiscriminate or uncontrolled dumping of refuse, as evident in most parts of the district. For a breakthrough, the project must, with the collaboration of District Assemblies, develop a set of bye-laws for the WATSAN Committees.

7. The cutting down of trees along the course of rivers and their catchment areas should also cease. It was observed that such activities accelerate the dwindling volume of most important rivers and streams in the study area. Their prevention can be achieved through public education. Tree planting along water courses should be embarked upon. Traditional leaders, the District Assembly, educational institutions and other stake-holders must get involved.

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