academicJournals

Vol. 5(10), pp. 402-409, October 2013
DOI: 10.5897/JPHE2013.0494
ISSN 2141-2316 ©2013 Academic Journals
http://www.academicjournals.org/JPHE

Journal of Public Health and Epidemiology

Full Length Research Paper

The buruli ulcer morbidity in the amansie West District of Ghana: A myth or a reality?

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Accepted 30 July, 2013

Although there is a lot of literature on the possible causes of Buruli ulcer (BU), no one is sure where the bacterium lives in the environment. It is also a mystery how the mycobacterium enters the human body, although it is clear the bacterium is unable to do so by itself. There is therefore a lot of myth about the disease epidemiology. This research has shown that the myth surrounding the cause of the disease and the origin of the disease pathogen has affected the treatment option sought by patients and the intervention strategies put in place by health expects in the Amansie West Distrct of Ghana. Whereas some patients in the Amansie west district associate the disease with witchcraft and magico-religious beliefs, the study showed that the disease is associated with aquatic environment that have been disturbed either through mining or intense agricultural activity. The aim of this paper is therefore to expand the frontiers of the argument by examining some of the predisposing factors and to identify the spatial pattern in the distribution of BU in the Amansie West District. The paper concludes that despite the myth, the disease causing organism thrives well in arsenic rich aquatic environment. However because of the widely rooted wrong perception, any attempt to manage the disease must first target the myth, in order to manage the reality.

Key words: Buruli ulcer, morbidity, myth, reality, mycobacterium ulcerans.

INTRODUCTION

One mysterious tropical disease whose epidemiology is yet to be unravelled is Buruli ulcer (BU) (Duker et al., 2006). Buruli ulcer, also known as Bairnsdale ulcer is a chronic, indolent, and necrotizing disease of the skin tissue caused by mycobacterium ulcerans (MU). The disease usually begins as a painless nodule or papule and may progress to massive skin ulceration (World Health Organization (WHO), 2012). The large number of cases and the complications associated with the disease as well as its long-term socio-economic impact could have a substantial effect on the national economy (Chauty, 2004). BU is a poorly understood disease that has emerged dramatically since the 1980s. The disease is mostly found in rural areas located near wetlands and slow-moving rivers, especially areas prone to flooding and that are often associated with rapid environmental change (Merrit et al., 2010). Unlike leprosy and tuberculosis, caused by the organism belonging to the same family as BU, which are characterized by person-to-person transmission, inoculation of mycobacterium ulcerans into the subcutaneous tissues likely occurs through environmental contact, although the mode of transmission is still not entirely clear (Merrit et al., 2010). The agent produces a potent toxin known as mycolactone, which destroys cells in the subcutaneous leading to the development of large skin ulcers (Noeske et al., 2004).

The incubation period, the time between infection with mycobacterium ulcerans and clinical presentation of Buruli ulcer, is usually under three months (Johnson et al., 2004). It affects any part of the body, but predominantly affects the limbs (Asiedu et al., 2000).

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Table 1. Trend of Buruli ulcer disease in the Ashanti region, 2008 to 2010.

Year	New	Recurrent	Clinical forms		
			Nodules	Ulcer	Others
2008	235	24	36	164	0
2009	177	15	22	125	46
2010 half year	251	5	72	180	47

Source: Ministry of Health, 2012.

About 70% of cases are in people under 15 years of age (Asiedu et al., 2000). The clinical features of Buruli ulcer have been clearly defined by the World Health Organization (Marston et al., 1995). It starts as a localized swelling in the skin that is typically painless and firm. It is referred to as a papule when the skin swelling is less than one centimetre in diameter, and a nodule when it is one to two centimetres in diameter, attached and under the skin (subcutaneous). It is called a plaque when the ulcer has irregular edges and is more than two centimetres in diameter (Amofah et al., 2002). These swellings develop into ulcers. The ulcers typically have undermined edges, which make the real size of the ulcer difficult to estimate visually. The base of the ulcer is filled with dead (necrotic) tissue. The skin adjacent to the lesion, and often an entire limb, may be swollen (Asiedu et al., 2000). Ulcers may remain small and heal without treatment, or may spread rapidly over large areas. Healing is slow, taking an average of four to six months, and often follows a course with shrinking of lesions followed by a further extension. Healing results in scars which are usually depressed and star shaped (Amofah et al., 2002). Death due to Buruli ulcer is rare. The disease may however, result in joint deformities (contractures) from excessive scarring, making movement at joints difficult. Loss of or severe damage to vital organs such as eyes, breast, or genitalia may occur.

Despite the advances in medical sciences, extensive public education and research on the treatment and control of the disease, the World Health Organization reports that incidence of Buruli ulcer disease in Africa has not seen significant reduction over the years. The total Buruli ulcer cases recorded globally in 2012 including that of Ghana was 5,076 with Africa being the worst affected region. Ghana is the second most endemic country with 1,048 Buruli ulcer case after Cote d'Ivoire, with 2,670 Buruli ulcer case (WHO, 2012). This by implication means that Ghana and Cote d'Ivoire contributed 73 percent of the world's incidence. Again, the Ghana Ministry of Health in their 2012 annual report shows the Ashanti Region accounting for over 60% of all cases (Table 1).

Table 1 show that higher number of cases is still being reported yearly with the commonest clinical form being ulcer. This might be due to the fact that patients do report for early treatment, hence the higher number of cases for the ulcerative stage. The report further suggests that the most affected district of the Ashanti Region is the Amansie West, with a prevalence of 151 cases per 100,000 inhabitants. There are uncertainties about the epidemiology of the disease. There are knowledge gaps about where the bacterium lives in the environment and how the mycobacterium enters the human body. Again, the high rate of re-occurrence has fuelled perception among endemic communities that the disease of spiritual origin. But is there a case for superstition in the disease epidemiology? What could be the factors that pre-dispose people to infection? Seeking answers to these and many other lingering questions is the objective of this study. The aim of this paper is therefore to highlight some of the perceived myth surrounding the causes of the disease and also discussing some of the real predisposing factors that affect the transmission and spread of the disease in the Amansie West District of Ghana.

METHODOLOGY

Study setting

The Amansie West District is located in the south-western part of Ashanti Region where the disease was first given public recognition and national documentation in Ghana. The District shares boundaries with the Amansie East District in the west, Atwima Mponua District in the east, Atwima Nwabiagya District in the north and Amansie Central in the South. The Amansie West District falls within latitudes 6° 35 and 6° 51 North and longitudes 1° 40 and 2° 05 West. The District covers an area of about 1,364 sq. km. and forms about 5.4 percent of the total land area of the Ashanti Region. The most endemic towns include Tontokrom Mpatuam, Manso Mem, Manso Atwere, Edubia, Watreso, Abore, Keniago, Essuowin, Ahwerewa and Datano (Amansie West District Assembly, 2004) (Figure 1).

The district is drained by the Oda and Offin rivers in the north with their tributaries such as the Pumpin, Emuuna and Jeni. These rivers have however been polluted by numerous mining activities in the district. A survey carried out by National Buruli Ulcer Programme further detected new foci of BU outside of the previously established endemic communities. The district level prevalence rate is 151 cases per 100,000 inhabitants and this is above the national rate of 22.7 cases per every 100,000 inhabitants (Ministry of Health, 2012). The treatment for Buruli ulcer disease in the study area is provided at the St Martin's hospital at Agroyesum which has specialized Buruli ulcer disease facilities following WHO treatment guidelines. The study area is populated by various segmented identity subgroups of Asantes and settler migrants from other parts of Ghana. These groups rely mainly on subsistence

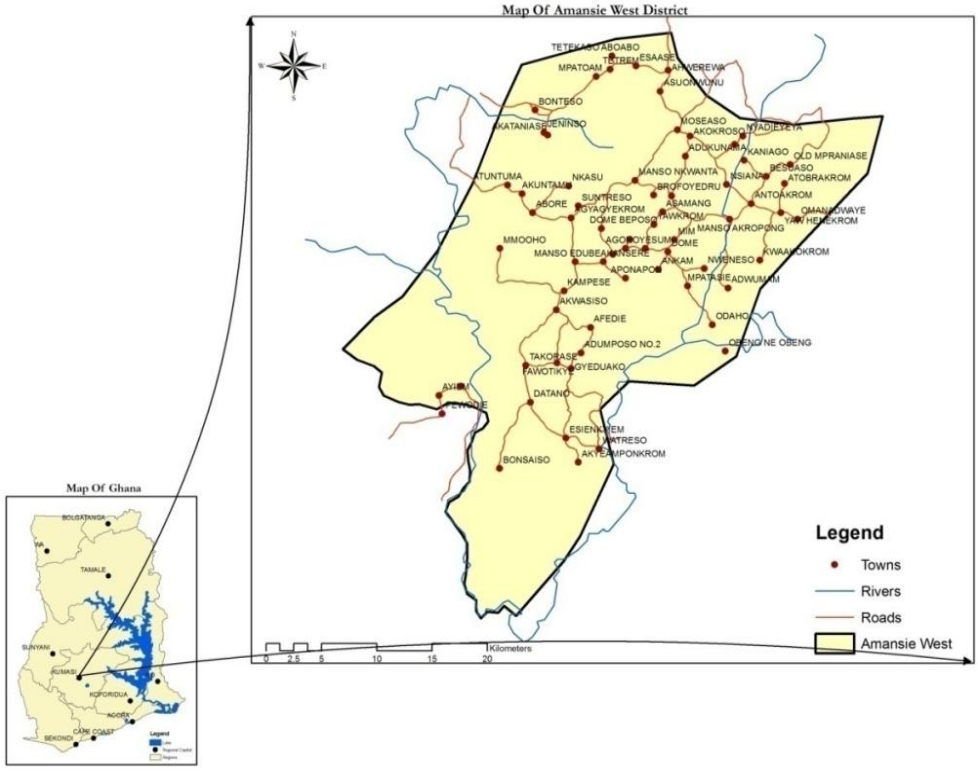

Figure 1. Map of the Amansie West District.

farming and artisanal small scale mining, commonly called 'Galamsey' for sustenance.

Research strategy

The research design consisted of a mixed methods study based on methodological triangulation, combining qualitative data from focused group discussion and quantitative data gathered using a standardized questionnaire. Data for the study was obtained from the three most endemic communities of Kaniago, Edubea and Watreso as well as the St Martin's Hospital where patient's hospital records were well documented, considering the focalized character of BU infection rates. The study population consisted of Buruli ulcer patients who were medically diagnosed with laboratory confirmation for BU and whose disease had reached both ulcerative and non ulcerative stage. Ulcerative and non ulcerative cases were based on clinical findings and confirmed by any two positives of Ziehl-Neelsen (ZN) test for acid fast bacilli, polymerase chain reaction (PCR), and histopathology (Roberts and Hirst, 1999).

Sampling

Sampling was purposive. Following the principle of gradual selection, informants were theoretically selected (in accordance with emerging results/theory) and categorized in relation to relevant criteria (such as gender, age, religion, ethnicity, locality, hospital or traditional treatment for BU, severerity of infection, functional disability, etc.) to allow for maximum variation. In addition, critical cases were continuously selected and analyzed. Snowball sampling (using participants to identify additional cases) was also used in order to increase respondents' confidence in the research team and consequently reduce response bias. In all, 185 participants were selected for the study.

Qualitative data

Qualitative data were gathered during the focus group discussions (FGD). The emphasis on qualitative data collection for the first strand of the study was required, given the exploratory nature of the first phase of research and the sensitive content of research questions related to traditional healing, the acceptability of hospital treatment and the possible mystical origin of the disease. Areas of interest to the researcher were analysis of factors related to patient satisfaction with biomedical treatment (including the doctor-patient relationship, practical and financial implications of hospitalization, the role of caregivers, etc.); on the perceived aetiology of BUD in relation to treatment choice; and on gaining an in-depth understanding of factors directly guiding treatment itineraries. Participant observation was an essential component of the field research as this facilitated in building up confidence with informants and in acquiring an in-depth understanding of more sensitive subjects such as sorcery involvement in the illness and healing processes. The observation of patients' daily activities provided an opportunity for reiterated informal conversations with key respondents, leading to some pivotal insights regarding the doctor-patient relationship, the importance of caregivers and the complexities of the disease's causality

Quantitative data

After the initial qualitative research strand, the study also used topographic map data which captured the geographic location of the study area where Buruli ulcer has been reported. Topographic map of the study area with a scale of 1:500000 obtained from the

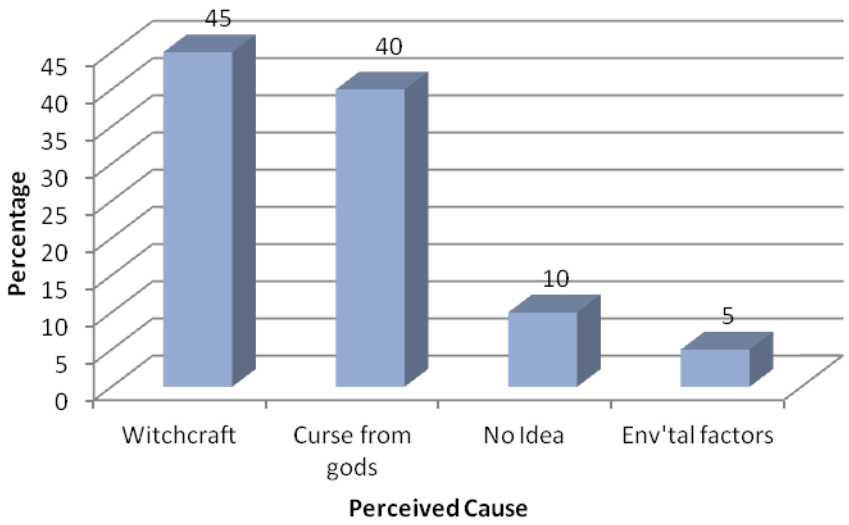

Figure 2. Perception of the causes of Buruli ulcer.

survey department, Accra was digitized using Arc GIS version 9.2. Initially, the map was geo-referenced by defining the X and Y coordinates of corner points of the map into a War Office Coordinate System. The boundary map of the study area was digitized as a polygon and communities as points. Reported cases of BU cases from 1999 to 2011 obtained from Amansie West District Assembly were entered as attribute of the point feature that is the settlements. The purpose was to establish the relationship between the prevalence of the disease and the physical.

RESULTS AND DISCUSSION

Buruli ulcer and superstition

Superstition is a widely held but unjustified belief in supernatural causation leading to certain consequences of an action or event or practice. The limited knowledge of the disease and socio-cultural beliefs and practices strongly influenced the perception of cause and health-seeking behaviours of people affected by BU. The success of any initiative to deal with health problems very much depends on recognition and health seeking behaviour of the people affected as it is often said that perceptions mould people's reactions to the world around them. The individual's health actions therefore need to be considered within the specific socio-cultural belief models which orient local definitions of health and illness (van de Graaf et al., 1999). On the score of this, respondents gave their perception on the causes of the disease (Figure 2).

The question on the possible causes of BU was posed to the infected and members in their household. The study found out that 45% attributed the causes to witch craft, 40% attributed the cause of the disease to curse from the gods of the land. On aggregate, 85% of respondents attributed the disease to supernatural sources. Among the reasons, the respondents believed that sufferers of the disease might have had an infraction against the social order by breaking the taboos and living contrary to the established norms of the society. In this case, the gods punished them through the disease infection. Secondly, the disease is frequently linked to casting of spells through theft and social misunderstandings among households.

Patients who were less than five years were believed to be paying for the wrongs committed by their fore fathers. 10% were not able to identify the cause of the disease in the community. Only 5% could link the disease to aquatic environment. This revealing trend of perception indicates the low level of awareness on the causes of the disease. It was therefore not surprising that majority of the infected persons did not seek the right medication. This also shows that the numerous public educations to explain the causes of the disease have not achieved their target. This wrong public perception is one of the reasons why many patients do not seek early treatment and only report for medical treatment at the ulcerative stage where it becomes expensive and difficult to treat. It is therefore important that this bad public perception is corrected in order to reduce the rate of spread of the disease in the community.

Risk to health, as an area of study, begun to receive attention in developing countries since the early years 2000 (WHO, 2004a). Until this period, social science theories and empirical data on perceptions of environmental risk focused almost exclusively on factors related to frequently occurring disagreements between the lay population and technical experts. In other words, when assessing the risks, experts placed emphasis on quantitative data, whereas citizens were much more likely to base their opinions on qualitative aspects, such as the nature and origin of the threat to which they are exposed,

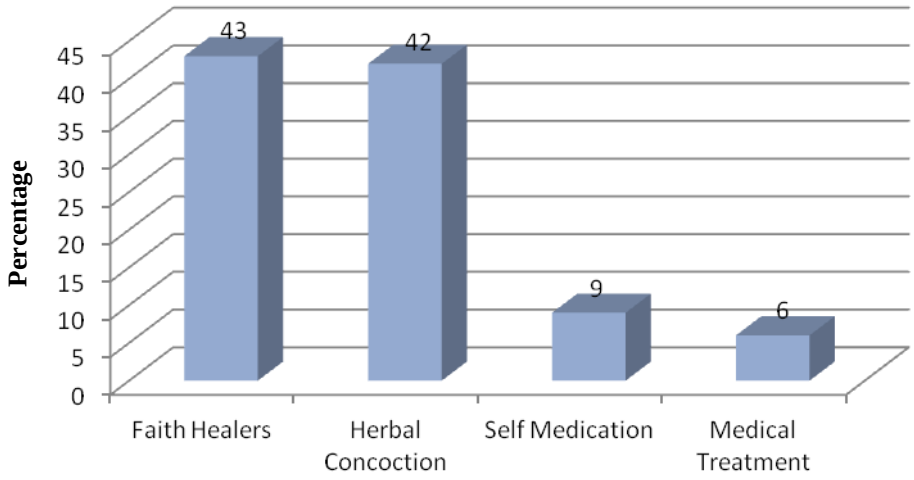

Figure 3. Treatment options sought by respondents.

usually involuntarily (Blake et al., 1995). To this end, a focus group discussion was organized to qualitatively engage the views of the respondents on the causes of the disease. One infected woman had this to say:

"*I do not understand how I got the disease because none of my family members have it even though we live in the same house, drink water from the same source and virtually share everything in common. Because am the only person infected, the family believe that it is the work of the evil spirits".*

This assertion was generally agreed by all. In a related development, a 34 year old male infected person also had this to say:

"I certainly believed that it is the work of the supernatural forces, my late grandfather told me that there was once a popular fetish priest in this village who wanted to marry my mother but our family members objected. The fetish priest cursed our family; it is believed that my sickness is the result".

The responses from the focus group discussions (FGD) indicate that there is a poorer understanding of the epidemiology of the disease. This dearth of understanding is a problem as it leads to stigmatization, social exclusion and lack of social integration. In some cases, its impact disproportionately affects girls and women, whose marriage prospects may diminish or who may be left vulnerable. Again, the lack of proper understanding on the cause of BU also influences the treatment option sought by patience.

The research revealed that about 43% of respondents depended on faith healers who were mostly fetish priests or pastors of faith based churches, 42% said they use herbal concoction and 9% could not be specific as they were on self medication. This meant that over 90% of respondents did not seek treatment from biomedical facilities Figure 3. This figure correspond to the over 80% who blamed the cause of the disease to magico-spiritual factors. The implication here is that the perception of cause influenced the treatment sought by the infected. For this reason, it is important that any attempt to encourage early report and treatment should first focus on working on their perception.

The myth surrounding the cause also leads to serious stigmatization as patients are regarded as unclean. Stigma is the reaction of society towards people with certain characteristics (for example, a deformity or an ulcer) which are perceived as abnormal and undesirable; the result is that such people are deprived of the same social inclusion and human right as are enjoyed by others. Fear, devaluation, and social inequality can also be a response to the physical deformities and scars that remain after medical and surgical treatment of the disease. These physical signs visually mark the individual and depart from societal standards of beauty. The disease may be viewed as a sign of a curse, or a punishment for some sin committed. Deformities may also lead many to believe that the person is unable to participate in activities and normal family, educational, and community life. These people may be viewed as a burden to themselves, their families, and their community. In another focus group discussion, one woman had this to say:

"*My husband has divorced me because his family believes that there is witchcraft in my family that is why I am suffering from the diseases".*

A focus group discussion was carried out to find out the extent of stigmatization in the communities under study. A middle aged woman at Tontokrom had this to say:

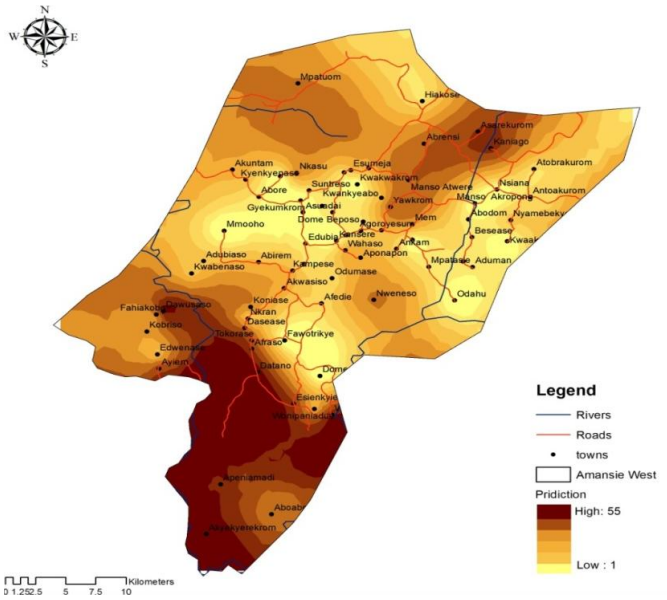

Figure 4. Map of the estimated risk of BU disease in Amansie West by Ordinary kriging

"I have been ejected from my room .in the family house that I use to occupy because they think my ulcer is as a result of the activities of the witchcraft".

All sorts of bad names are given and in the event, one may voluntarily vacate the community for fear of being stigmatized. This therefore leads to psychological stress in the patients, as they most often feel embarrassed.

The reality

Using basically geospatial analysis, findings from this research indicated that the disease causing organism may be associated with aquatic environment. Geospatial analysis of the study area showed that the risk was higher in the southern portion and especially closer to the confluence of the two major rivers, the Offin and Oda Rivers. This portion is also noted for intensive artisenal mining and agricultural activities. In addition,the area has very poor social infrastructure especially good drinking water and health facilities, thus compounding the problem (Figure 4).

The results of the study indicates that Buruli ulcer endemicity is associted with aquactic environments that have been disturbed either through minig or irrigation. The central portion of the risk map (Figure 4) which is devoid of rivers showed light colours whereas the southern part of the map which had the two major rivers are thick coloured. A lot of authors have reported the association of the disease with an aquatic habitat. Veitch et al. (1997) reported a large outbreak of the disease on Philips Island, Australia and associated the source of infection to an irrigation which lay in the midst of the cluster of cases. Number of cases been reported from the community reduced after the irrigation site was modified and limited from the public. Scot et al. (2004) noted that cases of Buruli ulcer are associated with tropical wetlands of West and Central Africa, and cases have increased rapidly in these areas since the 1980's, particularly after irrigation and dam construction. Travis (1999) also noted that people living near slow-running waters are more likely to contract the disfiguring disease Buruli ulcer.

Merit et al. (2004) also reported the re-emergence of the disease among people who live/or work close to wetlands, especially slow-flowing (riverine) or stagnant water bodies (marshes, swamps), often created as a result of some form of human environmental disturbances. Bayley (1971) reported cases of the disease along the tributaries of Densu River in the Ga North District of Ghana. James et al. (2003) in Benin also identified three risk areas according to origin of patients reporting at hospitals with Buruli ulcer and noted that most of them were coming from Laguna areas of coastal Benin, marshy inland areas where market crops and rice are cultivated, and river valleys areas. Portaels et al. (1999) reported that re-emergence of the disease in some developing countries may be related to environmental and socio-economic factors like deforestation leading to increased flooding, population expansion without improved agricultural techniques, thus putting more people at a risk of contracting the disease.

Apart from associating aquatic environment with BU infection, it was also observed that high levels of Arsenic (As) concentrations prevail in such environment and this could cause BU occurrence to increase. The eastern and western portion of the Amansie West District, which accounts for most of the BU cases in Ghana, happens to have the highest levels of (As), possibly released into rivers, lakes and ground water by intensive gold mining and agricultural activities. Figure 5 shows the distribution of (As) in the district. The figure indicates that the concentration of (As) corresponds to the two areas drained by the rivers Offin and Oda (portions shown in deep red). These two areas co-incidentally have the highest cases of BU in the district (Figure 5).

This large range of spatial autocorrelation in arsenic concentration model shows a better spatial structure which may be speculated to be related to exposure of arsenic through mining activities into drainage where inhabitants use this water for their everyday activities. Human activities in the Amansie West District have elevated arsenic contamination in the environment (Bell and Broemeling, 2000). High levels of arsenic in drinking water have been detected in most parts of the district, with concentrations frequently exceeding the World Health Organization guideline contaminant level (MCL) of 10 µg/L (Smedley et al., 2002). Some of the human activities that have adversely affected the environment are mining, waste disposal, indiscriminate use of

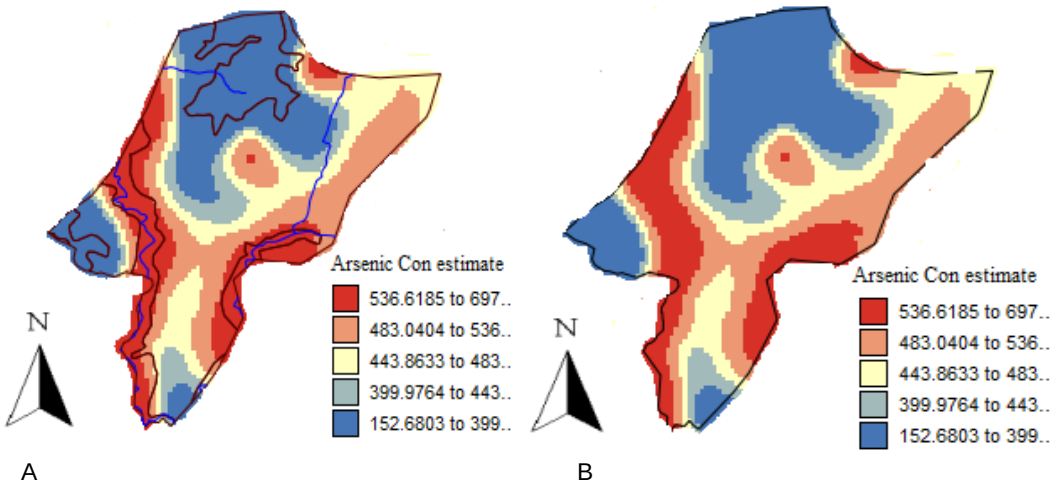

Figure 5. Maps of arsenic concentration on district boundary (A) and Arsenic concentration on the district soil map with the two main rivers; (B) both created by Simple Kriging with local mean.

fertilizers, pesticides, herbicides, manufacturing and chemical spillage.

A similar report was made by Jahan et al. (2002) that in the state of Victoria (Australia), mining of gold had caused an estimated 30,000 tonnes of arsenic to be redistributed to the surface across the landscape through erosion into streams and rivers. Hence, arsenic accumulates in soil, contaminates both surface water and groundwater WHO (2012), is taken up by plants and is then entrenched in mammalian/insectivore food chain (Green et al., 2001).

Arsenic occurs naturally in groundwater from dissolution of arsenic-bearing mineral constituents in underground aquifers, with concentrations typically ranging from < 1 to 1000 µg/L. Elevated levels of arsenic are a cause for concern because arsenic is associated with a number of adverse health outcomes, including several types of cancer, vascular diseases, dermatological ailments, diabetes, respiratory diseases, cognitive decline, and infant mortality (Chen et al., 1995). Mobilization of arsenic from geological formations into groundwater is driven by a host of biogeochemical and hydrologic factors. These factors include sediment mineralogy, well depth, microbial oxidation or reduction of arsenic, competing elemental species for sorption sites, groundwater recharge, groundwater flow path, and presence of fractures in bedrock formations (Smedley et al., 2002).

CONCLUSION

The research has revealed that despite the progress registered in recent years in research and educating the general public on the possible cause of the disease, major gaps still remain unabridged. The reservoirs of mycobacterium ulcerans, its mode of transmission to humans and immune-pathogenesis are still poorly understood. Currently, there is still a wide perception that the disease is cursed by supernatural powers. Again the treatment options discourage patients from reporting early; and no available treatment can prevent recurrence. There is therefore the need for endemic communities to intensify control activities and accelerate research. The priority is to disabuse the minds of patients of the perceived 'mythism' of the disease and to encourage early detection and case-management in the absence of a vaccine. Basic research is needed to understand the biology and epidemiology of the causative agent of this emerging disease. By better understanding the specific water-body systems and how human land-use disturbances affect the ecological interactions associated with Buruli ulcer, scientists will be able to provide the missing epidemiological links necessary to unravel the mysteries of this emerging disease.

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