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Factors enhancing the control of Buruli ulcer in the Bomfa communities, Ghana

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ABSTRACT

This study examines factors that may enhance the control and holistic treatment of Buruli ulcer in an endemic area of the Ashanti Region in Ghana. A total of 189 Buruli ulcer patients from the Bomfa sub-district were treated at the Global Evangelical Mission Hospital, Apromase – Ashanti, Ghana, from January to December 2005. Diagnosis was based on clinical findings and confirmed by any two positives of Ziehl-Neelson test for acid fast bacilli, polymerase chain reaction and histopathology. Children up to age 14 made up 43.4% of the cases; male: female ratio was 3:2. The mean duration of hospitalization was 77 days and hospital stay was significantly correlated with the time spent at home with the disease prior to admission; also, 76.7% of the cases were late ulcers. Of the 189 patients, 145 (i.e. 76.7%) were treated with antibiotics and surgery which involved excision, skin grafting with or without contracture release. A follow-up survey after the introduction of the psychosocial approach recorded fewer (85) new Buruli ulcer (BU) cases of which, the majority (78.8%, 67) were nodules and only 21.2% (18) were ulcers. Health education plays a major role in the holistic treatment of BU. This paper proposes a further study in other endemic areas on the treatment of BU with emphasis on psychosocial approach for holistic treatment.

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1. Introduction

The third most common mycobacterial disease of non-immunocompromised humans, after tuberculosis (TB) and leprosy, is Buruli ulcer (BU). It is caused by *Mycobacterium ulcerans* and often leads to massive destruction of the skin followed by debilitating deformities.¹ The increasing number of cases in West Africa has raised serious health

concerns.² The first suspected case of BU in Ghana was reported at the Korle-Bu Teaching Hospital in Accra in 1971;¹ the disease is found predominantly in the Ashanti Region. The management of BU is difficult, treatment costs are high, and complications of the disease are frequently severe. Costs of treatment could pose a serious challenge to a struggling rural economy and its health system given the growing number of cases and current control strategies.³

Buruli ulcer frequently occurs near water: slow flowing rivers, ponds, swamps and lakes; cases have also occurred following flooding. Activities that take place near water, such as farming, are risk factors, and wearing protective

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clothing appears to reduce the risk of the disease.⁴ The reason for the growing spread of BU remains unclear. Unlike TB, there is no evidence to suggest that infection with the human immunodeficiency virus (HIV) predisposes individuals to BU infection. There is also no evidence that the disease can be transmitted from person to person and there is little seasonal variation in the incidence of the disease.^{5,6}

Buruli ulcer disease is associated with typical rural villages such as those in the Bomfa sub-district of Ejisu-Juaben District Assembly in the Ashanti Region of Ghana.⁷ The disease typically affects impoverished inhabitants, primarily children, in remote areas where medical services are unavailable or too expensive.⁸ These villages are inhabited mainly by subsistence farmers, 'the poorest of the poor' and are separated from each other by thick forests.⁹ It is therefore difficult for these sparsely populated villages to come together for developmental projects to improve their health services. Such projects depend on government implementation.

Though BU has been declared an epidemic in the Ashanti Region of Ghana, not all dwellers in the hinter lands such as those in the Bomfa sub-district have access to treatment.¹⁰ In addition, most of the communities have few access roads so inhabitants are isolated from the cities where they could seek medical attention.

Since most of the local people are farmers low prices for farm products affect their financial status hence rendering the rural inhabitants financially poor.

Water supplies are generally from unprotected sources. The local people think that good health has nothing to do with personal hygiene (author, personal communication). It is common to find a family of ten using only one sleeping area in the home. Buruli ulcer has therefore become common in this area.

Problems include the high incidence of BU, the recurrence of the disease in some patients, the mode of treatment they are being given and the less than ideal conditions in hospital if they ever get there. The questions posed in this paper are: is there any socio-economic influence on patients as far as the treatment of BU is concerned? Is biomedical treatment alone adequate or is there a societal responsibility towards BU patients? The findings from the study may be helpful in the search for solutions that could be applied more broadly in Ashanti Region and other parts of Ghana, and beyond.

This paper seeks to identify effective ways of treating the disease among rural endemic people. In the first year of the study, it became clear that BU patients could not be treated in isolation of their environment. A study was therefore conducted using a 'Patients In-take and Engagement Form' to examine other factors that could enhance the total treatment of the patients and improve disease control in the area.

2. Materials and methods

2.1. Study setting

The population of Bomfa and its immediate environs (altogether known as Bomfa sub-district in the

Ejisu-Juaben Assembly) is 21 924. Children (0–14 years) and aged persons (>60 years) form about 16.5% and 5.6% of the total population respectively. Bomfa is about 36 km southeast of Ejisu, its district capital town, and about 10 km northwest of Konongo which is the district capital of the nearby Ashanti-Akim North District. The main occupation in the communities is farming and most of the communities have no access roads to the cities. For proximity, most patients from Bomfa patronize Konongo Government Hospital rather than going to Ejisu Government Hospital. There are four primary health care facilities in the Bomfa sub-district, namely Bomfa Health Centre at Bomfa, Agyenkwa Clinic at Hwereso, the Adventist (SDA) Clinic at Nobewam and Huttel Health Centre at Buamadumase; these units do not yet have the infrastructure to diagnose and treat BU. Many inhabitants of these communities are settlers from other parts of Ghana such as the Volta Region and the Northern Region, as well as from neighbouring countries such as the Republic of Togo.

2.2. Treatment center

The Global Evangelical Mission (GEM) Hospital is located at Apromase, a village about 10 km southwest of Ejisu and about 12 km southeast of Kumasi. The hospital has 35 beds, headed by a consultant plastic surgeon and owned by the Global Evangelical Church with its headquarters in Accra, the capital city of Ghana.

2.3. Problems encountered

The choosing of a specific area for the study took some time because there were many sub-districts in the various districts in the Ashanti Region that equally needed help. Case detection required dedication and was very time consuming. Patients were transported in vehicles to Apromase which is far from Bomfa sub-district. Maintenance of patients at the hospital was a financial burden, as most were subsistence farmers. GEM Hospital was still under construction and could not support the patients with catering services.

2.4. Data collection and analysis

The study took place during 2005, from January to December. Ethical clearance was approved by the Ejisu-Juaben District Health Directorate. A team of 10 locally-trained and motivated volunteers was engaged three times a week in case detection by organizing home based visits to the various communities in the Bomfa sub-district. Another team was established at the GEM Hospital for weekly health education and training visits to members of the community and volunteers in the sub-district, and to bring identified cases to the hospital for treatment.

'Consent' and 'Patients In-take and Engagement Forms' were filled in at the beginning of the medical intervention. The 'Patients In-take and Engagement Form' contains the patient's demographic information and other relevant information for the studies. A patient was considered for the study when he/she had a laboratory confirmation for BU and consented to be involved in the study. Diagnosis of

BU for both ulcerated and non-ulcerated cases was based on clinical findings and confirmed by any two positives of Ziehl-Neelson (ZN) test for acid fast bacilli, polymerase chain reaction (PCR) and histopathology. Biopsy samples were taken for all non-ulcerated BU cases for confirmatory analysis. Observations were made by the team to take note of the environment and the lifestyle of the patients. Data collected were analyzed, and results displayed in tables and graphs using SPSS version 15.0 (SPSS, Inc., Chicago, IL, USA).

2.5. Type of treatment

All treatments during the study were performed at the GEM Hospital by two doctors, namely a consultant plastic surgeon and a surgical resident, and supported by clinical nurses, a medical assistant and other medical support staff. According to current WHO guidelines, recommended treatment of BU is surgery combined with chemotherapy (a combination of rifampicin and streptomycin/amikacin for eight weeks as a first-line) and physiotherapy, as described by Lehman et al.¹¹ and Agbenorku et al.¹² All the patients were given antibiotics, streptomycin and rifampicin, for eight weeks; no side effects were reported. Any BU nodules and plaque were excised, while patients with ulcers had debridement and skin-grafting. Nineteen of the ulcers also had contractures released. Forty-four patients (38 with nodules and six with plaque) had single operations; 145 patients had multiple surgical interventions. In all, 353 procedures were done on the 189 patients. None needed amputation.¹³ The only recurrence was an ulcerated case in a 26 year old man, at a different part of the body (left lower limbs) confirmed positive by both ZN and PCR techniques. There was no sign of antibiotic resistance and the lesion was treated with a combination of surgery and chemotherapy with a successful outcome.

2.6. Health education and follow-up

Personnel from the GEM Health Education Unit visited the sub-district on a weekly basis for six months and fortnightly for another six months (since the number of cases reduced) to educate the communities on personal hygiene, wearing of protective boots and clothes when going to farms or along the river side, and for early detection of BU disease. Volunteers from the Bomfa communities were also trained and motivated by the Health Education Unit to assist people in the early detection of the disease and to advise them on the benefits of early treatment of BU.

After discharge from the hospital, patients were monitored for two years, in order to evaluate the effect of the psychosocial interventions included in the study.

3. Results

A total of 189 BU patients were recruited in the Bomfa sub-district, for the study. For the purpose of this work, 'Consent' and 'Patients In-take and Engagement Forms' were filled in for the patients. Recurrence of BU was identified in only one patient (a 26 year old man who had late ulcer) out of the 189 patients studied. Only a few (3.2%, 6) of the patients had travelled outside of the study area

Table 1

Marital status and occupation of patients (n = 189)

Marital Status	No.	Occupation
Single	101	Student/Pupil
Married	44	Farming/Petty trading
Divorced	25	Farming/Petty trading
Widower/Widow	19	Farming/Petty trading

Petty trading: traders who sell a small quantity of items; in this study, selling farm products

during the follow up period. Laboratory confirmation of the BU cases, recorded a higher sensitivity for PCR (100%, 189) and histopathology (97.4%, 184), while, ZN had a relatively low (77.3%, 146) sensitivity. Also, 66.7% (126) of the patients had lesions on their lower limbs and 26.7% (51) on the upper limbs. In six cases the lesion was on the trunk and in six in the perineum. No case was recorded with lesions in the head and neck region. Table 1 shows the marital status and employment status of the patients.

Figure 1 shows a ratio of 3:2 for males and females respectively. Only 63 (33.3%) patients were in the productive age group (15–59 years). This categorization helps in looking at the socio-economic status of patients and their ability to pay for services rendered them, as well as their ability to look after themselves. It is clear that among the inhabitants of Bomfa sub-district children are more vulnerable to BU infection.

Table 2 shows the clinical features and treatment of the patients: 76.7% (145) out the 189 patients who were diagnosed with BU were treated with antibiotics and surgery which involved excision and skin grafting, with or without contracture release. Hence, late ulcer (according to WHO grading) alone accounted for a larger proportion (76.7%, 145) of the cases. There were few (38, 20.1%) nodules and only six patients (3.2%) with plaques, which were excised; these patients were also given antibiotics.

The Spearman's analysis was performed under a significance level of 0.05. The correlation is said to be significant when it ranges from +1 to -1. When an analysis is 0 (zero), it means there is no correlation between the parameters involved. Duration of hospital stay was clearly correlated with the time spent at home prior to admission: Spearman's rank correlation coefficient was 0.64 (95% CI 0.36–0.81).

Table 3 gives details of patients identified in the study area during the subsequent year, the follow-up period, after counseling and health education activities had been instituted. The majority (78.8%, 67) of the cases presented with early-stage disease, which was easily treated and required only a short hospital stay.

4. Discussion

4.1. The impact of Buruli ulcer treatment on the socio-economic status of the patient and their family

An individual's socio-economic status or position is determined by their level of education or the kind of employment they engage in for livelihood. These and other economic factors tell whether one belongs to the upper, middle or lower class of income earners in a stratified

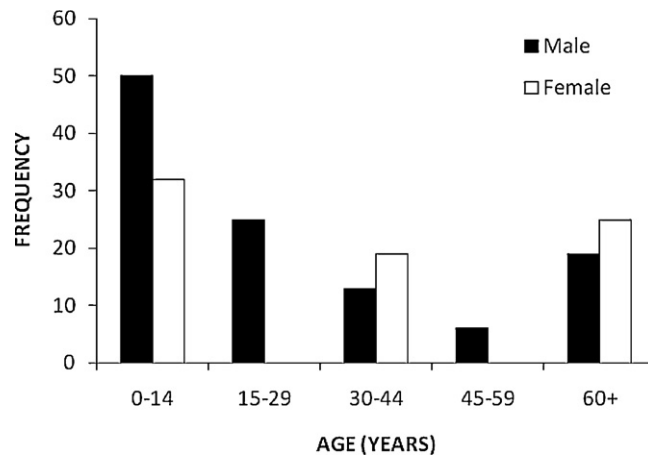


Figure 1. Age and gender distribution of Buruli ulcer patients ($n = 189$).

Table 2

Buruli ulcer patients' medical history ($n = 189$)

Stage at presentation	Lesion size, cm	No.	Mean duration of treatment at home ^a Days (range)	Treatment given	Mean hospital stay Days (range)
Late ulcer	6–10	38	195 (56–369)	AB + EX + SG	87 (41–159)
	10–20	76	264 (117–377)	AB + EX + SG ^b	89 (58–139)
	>20	31	242 (56–369)	AB + EX + SG + RC ^c	103 (66–159)
Nodule	1–2	38	24 (7–56)	AB + EX + SG + RC ^c	18 (8–36)
Plaque	3–5	6	28	AB + EX	19

Treatment given: AB: Antibiotics; EX: Excision; SG: Skin Graft; RC: Release of contracture.

^a Prior to admission; ^b69 patients; ^c7 patients; ^d19 patients; ^e12 patients.

society such as Ghana.^{14,15} Table 1 indicates that the patients in this cohort were either subsistence farmers or petty traders (traders who sell a small quantity of items; in this study, selling farm products). Economically this places them in the class of low income earners as they are only able to feed themselves and their dependants. In addition, a majority of patients (121, 64.0%) can be classified as dependants (children and aged).

Productive workers often have to leave their farm land to become care-takers of their hospitalized dependants. Already low income earners, having to provide food at the hospital and also back at home for the rest of the family becomes a major problem for the care-taker who should have been working on his/her farm. It is for this reason that many delayed seeking medical attention. Ironically, the longer they stayed at home the more they prolonged their hospitalization period as shown in Table 2, which eventually left them the 'the poorest of the poor'.

Table 3

New Buruli ulcer cases recorded during one year of the follow-up period ($n = 85$)

Stage at presentation	Lesion size, cm	No.	Mean duration of treatment at home ^a Days (range)	Treatment given	Mean hospital stay Days (range)
Nodule	1–2	67	13 (9–18)	AB + EX	18 (8–28)
Late ulcer	6–10	11	131 (122–140)	AB + EX + SG	65 (58–71)
	10–20	7	138 (136–140)	AB + EX + SG	68 (65–71)

^a Prior to admission; Treatment given: AB: Antibiotics; EX: Excision; SG: Skin graft.

4.2. Could Buruli ulcer be considered a cycle?

Two major approaches to disease treatment – the biomedical, and the biomedical plus psychosocial approach – will be looked at to explain and answer the above question.

4.2.1. The biomedical approach

The diagnosis, stage and type of treatment of BU (as shown in Table 2) summarizes this approach. It is an approach that sees specific biological factors (such as germs) as the cause of illness. Treatment therefore focuses on how to kill the germs and deal with other biological problems, for example, skin-grafting to deal with the loss of skin caused by ulceration. Other risk factors for infection are of less concern in this approach. Patients are treated in isolation of the environment where they contracted the disease.

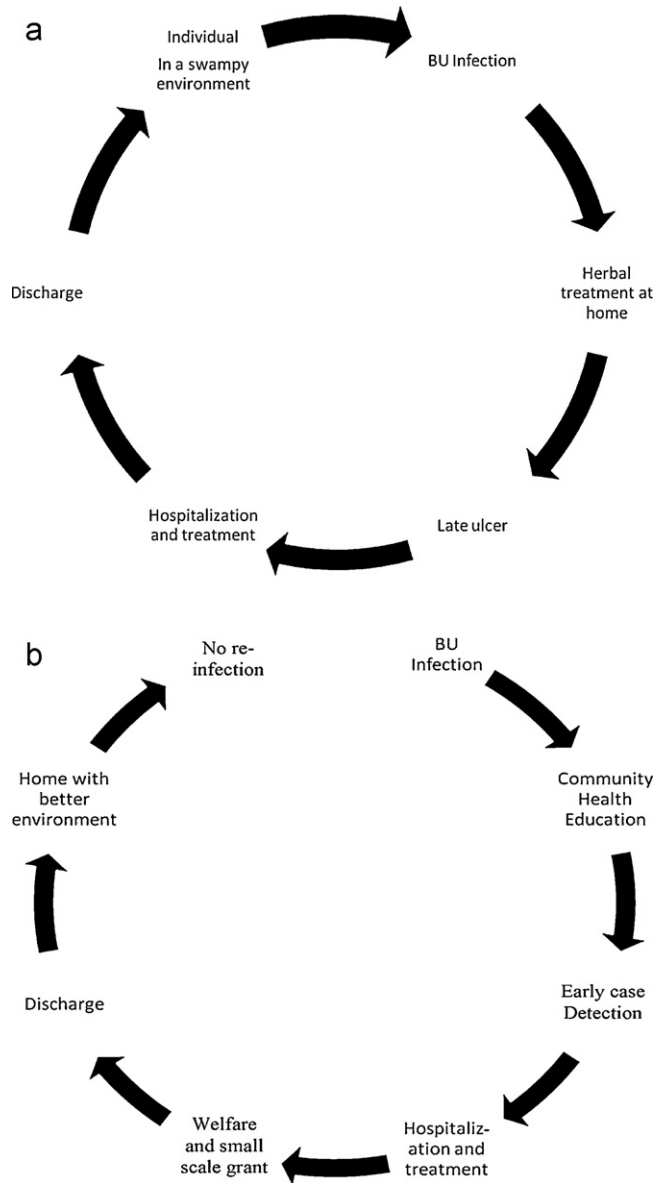


Figure 2. (a) The biomedical approach and the Buruli ulcer cycle. (b) Biomedical plus psychosocial approach and Buruli ulcer cycle.

With this treatment approach, BU infection could be seen as a cycle (Figure 2a). Buruli ulcer mostly affects people living in swampy areas with poor hygiene conditions. When the disease is treated using the biomedical approach only, patients are treated with antibiotics and surgery, but after discharge from the hospital go back to the same environment where they contracted the infection; the possibility of recurrence cannot be ruled out. Had the environment and the living conditions of the patients been considered as part of the treatment, it may have been possible to reduce the risk of future infections. The suggestion is that the environment and living conditions of people living in swampy, poverty stricken areas plays an important role in the development of BU disease.

In terms of treatment, surgical debridement was the standard treatment for *M. ulcerans* infection until WHO issued provisional guidelines in 2004 recommending treatment with antimicrobial drugs (streptomycin and rifampicin) in addition to surgery. These recommendations were based on observational studies and a small pilot study with microbiological endpoints.¹⁶

Lehman et al.¹¹ reported that the 6th WHO Advisory Committee on Buruli ulcer recommended directly observed treatment with the combination of rifampicin and streptomycin, administered daily for 8 weeks. The study of Chauty et al., in 2007, concludes that the WHO-recommended streptomycin–rifampicin combination is highly efficacious for treating *M. ulcerans* disease. Chemotherapy alone was successful in achieving a cure in

47% of cases and was particularly effective against ulcers of less than 5 cm in diameter.¹⁷ In our study, most (76.7%) of the patients were at the late ulcerative stage, thus ulcer diameters were larger than 5 cm making surgery was inevitable. The few nodules and plaques were excised and patients were given antibiotics.

4.2.2. Biomedical plus psychosocial approach

This approach brings a holistic method to the treatment of disease. The remote and immediate causes of the disease are targeted. This means that the patient is not treated in isolation from their environment. It is hypothesized that the transmission of BU disease is associated with human activities in or around aquatic environments.¹⁸ It has as its major aim the total and permanent cure of a patient. The biomedical approach as discussed in section 4.2.1. takes care of the pathological aspects of the disease, while the psychosocial aspect of the treatment concentrates on the economic, psychological and social aspects of the patient's life.

The cycle of BU infection can only be broken through the adoption of the combination of the biomedical and psychosocial approaches (Figure 2b). The role of health education in this project was multifold, as follow-up results from Table 3 illustrates: it assisted in the early case search and detection as well as helping patients to fit back into society after hospitalization. The health seeking behaviour determinants and stigma study of Mulder et al. reveals that factors causing delay in presenting to hospital were the use of traditional medicine before presenting at the treatment centre; costs and duration of admission; disease considered not serious enough; witchcraft perceived as the cause of disease; and fear of treatment, which patients expected to be amputation.¹⁹ In the psychosocial study of BU patients in southern Benin by Aujoulat et al. it was confirmed that most people are reluctant to seek treatment at health care centres. They are unclear about the origin of the disease (environmental factors or sorcery) and treatment is considered devastating, expensive and ineffective in some cases.²⁰ The introduction of health education in our study, helped alleviate factors as reported by the above study.²⁰ This should then be given equal attention as a mode of treatment, as are the surgery and antibiotics used, since its role in the treatment of BU is crucial. It helps patients with some level of knowledge on transmission of BU disease in terms of association of human activities in or around aquatic environments.¹⁸ Hence, they practice good personal hygiene; and when a household acquires this knowledge, though in the same geographical area, their environment is changed. They therefore go back to the same house under different living conditions, reducing the possibility of recurrence or the infection of another person. Health education also informs them of the benefits of a balanced diet with adequate protein, which is lacking, especially in most infected children, and helps in the building of a strong immune system and wound healing.

Through early and active case finding, the disease is detected at the nodular stage which makes treatment easier than when detected at the late ulcer stage (Table 3). The hospitalization period of the patient is also reduced, thus

having much less impact on the socio-economic status of the patient, since care-takers of BU patients would spend fewer days away from their livelihoods. Days spent by patients and care-takers are shown in Table 2. During the follow up-period, home based visits were coupled with health education enabling a reduction in the number of BU cases. Patients who were not captured in the study then sought medical attention themselves (Table 3). There is a clear relationship, indicating that efforts to ensure early case detection would be worthwhile.

Patient integration back into the community could be seen as the last stage of treatment for BU patients. Being 'the poorest of the poor' after a long period of hospitalization the treated patient needs economic empowerment in order not to return to a worse environment. This is where the poverty alleviation fund, when well distributed by the Government of Ghana, could reach rural areas where BU is common. Small scale grants could also be given to buy goods such as tractors and weedicides, and protective boots and clothes to minimize contact with infected soil, water and help prevent insect bites. This will encourage modern farming and improve living conditions. Figure 2b explains the BU cycle and the intervention role played by health education, early case detection and the proper distribution of the poverty alleviation fund.

As cases are detected earlier by infected individuals and their relatives, decentralization of antibiotic treatment to the primary health care units in endemic areas will be an important development in the treatment of BU. This is the next step in reducing the burden of the disease in the affected communities.

To conclude, in the attempt to identify the factors enhancing the control of BU in an endemic area, this paper has been able to establish the following: surgery and antibiotics play a major role in the control of BU; the socio-economic status of patients has a direct influence on the treatment of BU; total treatment of BU patients cannot be done in isolation of their environment where health education and early case detection are essential; the BU infection is a cycle in most endemic areas, with reference to the biomedical approach practiced as shown in Figure 2a. This cycle can be broken more easily if a psychosocial approach is included; decentralization of treatment is a long-term goal; further studies with the proposed psychosocial approach are required, in different BU endemic areas.

Authors' contributions: PA, PS and MA designed the study protocol; PA, MA, PS and AA, carried out the community sensitization and clinical assessment; PA, LT, PS and AA carried out the surgical operations; PA, MA, LT and PS did the analysis and interpretation of study data. PA, PS, MA and AA drafted the manuscript. All authors read and approved the final manuscript. PA and MA are guarantors of the paper.

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