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Information and other Factors Influencing Treatment Expenditures Incurred by Buruli Ulcer Sufferers in the Nsawam-Adoagyiri Municipality of Ghana

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We analyzed the factors influencing the treatment expenditures incurred by sufferers of Buruli ulcer disease in the Nsawam-Adoagyiri Municipality in the Eastern Region of Ghana using a random sampling survey. The factors analyzed in the study included the information about the disease available to the sufferers related to time and the stage of the disease that sufferers reported the disease to health clinics and hospitals. We showed that the factors that significantly influenced treatment expenditures included the income of the sufferer, early reporting of the disease to clinics, and the employment status of the sufferer. Higher-income people spent more money to treat the disease than those with lower incomes. People who were unemployed spent relatively money in treating the disease as compared to those who were employed. With increasing incomes, sufferers who reported the disease to clinics in the early stages of the disease, incurred relatively less costs compared to those of similar high-income group of sufferers who reported the disease to clinics at the ulcerative stage of the disease.

Keywords: Buruli ulcer, disease perceptions, Ghana, health economics, health expenditures, neglected tropical diseases, preventive medicine.

INTRODUCTION AND PROBLEM STATEMENT

Buruli ulcer disease is one of the 17 Neglected Tropical Diseases (NTD). These NTDs occur mainly in tropical and sub-tropical areas. According to the World Health Organization (WHO), there are no known cures although the ulcer can be fully treated at its nodal or early stage of development (WHO, 2000; WHO, 2012). The disease affects mostly the limbs and the trunk, starting as a painless swelling (called nodule) in the skin and causing severe deforming and debilitating ulcers if it is not detected and treated on time (Asiedu and Etuaful, 1998; Anaman and Aboagye, 2014). The disease is thought to be caused by an organism called 'Mycobacterium ulcerans'. The Mycobacterium ulceransis an environmental pathogen that is commonly associated with water and soil (Ross et al., 1997).

Scientific studies have shown that Mycobacterium ulcerans is found living freely in the environment and so the disease is believed to be contracted from the environment (WHO, 2012). However, it is a perception of many people in the endemic areas that, the disease arises from poor hygiene, drinking contaminated water from the rivers, having contact with other sufferers and could be sexually transmitted. The disease is thought to originate from an environment considered to be swampy and contains insects and worms. Others have also linked the disease to magical and religious factors like sorcery (Aujolat et al., 2003).The disease is known to cause human suffering to the point that they cannot go on normally with their daily activities without struggling to get through it all. Even though the disease can affect any part of the body, it is more often found on the extremities (especially the limbs) as compared to the other parts. The processes involved in getting the treatment and healing the wounds from the disease are time consuming and involve considerable money.

Our study area is the Nsawam-Adoagyiri Municipality (district), one of the major endemic areas of the disease in Ghana. Efforts by local and national authorities to reduce the prevalence of buruli ulcer in this area have been geared towards the treatment of reported cases. However, frequently the cases are often reported too late into the lifespan of the disease, where the disease may have already passed the pre-

ulcerative stage (the stage at which antibiotics can be used to suppress the ulcer from occurring). The disease also does not follow a particular trend and so may not be easily detected in its early stages. Many people end up with the severest of ulcers due to their ignorance and the perception they hold about the disease and show up too late at health centres for treatment. There has been relatively little work undertaken by governmental authorities on the education and sensitization about the disease, especially the provision of information related to the importance of early reporting of the disease and suspected symptoms and signs which may be related to the disease.

The main objective of the study is to analyze the determinants of treatment expenditures incurred by sufferers of the disease with emphasis on the role and importance of information related to the disease that is available to the sufferer. This paper is the companion of an earlier article

2.1. Information about a Disease as a Source of Market Failure in Health Markets

Economists argue that the free market system of production, consumption and exchange of goods and services can lead to non-optimal or "bad" outcomes for a society under several conditions, including the situations of inadequate and/or unbalanced information about the goods and services produced by markets (Anaman, 2014, pp. 16-18; Anaman and Aboagye, 2014, p.3). The resulting non-optimal outcomes are called "market failures" using jargons popularized by economists over the last 100 years. These market failures can be corrected by actions and programmes initiated by Community organizations (including traditional institutions related to extended family and clan lineages) and/or the State or government. Information market failures in medical and health service markets impose extra expenditures both on the sufferer of the disease and society in general. Information failures exist in various forms. The most common of information market failures is incomplete information related to the disease, its treatment and the ability of the medical personnel to treat the disease appropriately. This situation arises from the participants in the exchange of information concerning the production, consumption and distribution of goods and services not having full information concerning all the activities related to the exchange. Secondly, information failure exists when one participant in an economic exchange knows more than the other, a situation referred to as the problem of asymmetric or unbalanced information.

Nobel Prize Laureate in Economics Sciences, Professor Kenneth Arrow is one of the original economic researchers who dealt with information market failure in health markets. His works show that the lack of information about the quality of treatment of a disease and health services renders health markets highly imperfect illustrating a major source of market failures in health markets (Arrow, 1963). He refers to the condition of uncertainty where accurate information becomes a very valuable commodity and that, in many ways, medical markets are really markets for information, stating that where there is uncertainty, information or knowledge becomes an essential commodity and that information in the form of skilled care is precisely what is being bought from most physicians. Market failure in health markets can be illustrated with the demand and supply of services related to treatment of Buruli ulcer in Ghana. A person suffering from a disease such as Buruli ulcer seeks treatment from a particular provider who can be a traditional healer, Christian religious priest, hospital technician or doctor, according to what the person perceives is

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The rest of this paper is structured as follows: the next section deals with the review of the literature with emphasis of the role of information about a disease in relation to markets for medical goods and services. The methodology is then discussed in two parts; the first part describes the procedures used for the survey to elicit data from sufferers. The second part is concerned with the empirical estimation of a multiple regression model of treatment expenditures related to the disease. The results of the study are then reported followed by the conclusions and recommendations and the list of cited references.

2. LITERATURE REVIEW

the cause of the disease and where he/she is likely to get the most appropriate treatment. In this case, the patient is demanding treatment service while the caregiver is also supplying treatment service. This can be described as the market. With Buruli ulcer disease, both the patient and the caregiver do not have full information about the exact cause and cure of the disease; this situation represents a classic case of market failure related to lack of full information related to the medical or health service that is being exchanged between the consumer and the producer of the service.

When the patient reports the disease early to a qualified hospital or clinic, treatment can be effective as the level of damage is not, then extensive and can be halted with antibiotics even though medical personnel do not have full information about the cause of Buruli ulcer. This situation also represents an important case where the government or institutions can supply information to potential people at risk of the disease such that quick intervention by medical practitioners that can halt the damage caused by the disease. Without this information, patients may end up seeking all sorts of treatments from non-specialists or people who lack extensive knowledge about the disease. Hence, early reporting of the disease to the appropriate health centre and the treatment using antibiotics can correct the market failure of information. The most important decision a patient may make is from whom to get treatment recommendation and treatment. The problem of information market failure in medical markets also occurs when the physician is not that knowledgeable about the disease or is not able to correctly diagnose the problem in the first instance (Millenson, 2000). A classic practical case of the health experts at the hospital not being trained or equipped with the right methods of diagnosis for detecting this particular disease such as Buruli ulcer in its early stages. Even if the patient reports the disease or its symptoms early but the medical personnel are not sufficiently knowledgeable about the disease, and misdiagnosis occurs with the patient given the wrong treatment, negative health impacts occur. This is also a clear case of market failure due to the lack of knowledge of medical personnel about a disease.

This situation occurs sometimes in Ghana, where even better informed patients may believe the prescriptions offered by general medical personnel and continue to use inappropriate treatment options till the disease gets to an advanced stage and the patient then consults specialist health personnel. Particular mention is made of this possibility in the context of Buruli ulcer because information gathered during our study suggested that several cases that were initially reported to the main Nsawam General Hospital were misdiagnosed as common boils according to a hospital personnel who preferred

to remain unnamed. This could have either occurred due to inadequate information about the disease or lack of logistics in detecting the disease. In Selma Mushkin's publication "Toward a definition of Health Economics" she referred to how consumers' lack of information for quality of health services could inform their medical decisions and result in a market failure in medical markets (Mushkin, 1958). This publication also informs this study by drawing attention to the perceptions that may be held about the causes of certain diseases which inform the choices of medical attention that are sought for. In the case of Buruli ulcer disease, the sufferers of the disease may make choices to treat their diseases, according to the information available to them or not. The nature of the medical service itself may in fact initially reinforce the consumer's lack of knowledge about his/her purchases and impede a rational choice that could guide the allocation of resources.

Misinformation may lead to patients receiving too much or too little treatment; a situation that may exist due to imperfect consumer information about a physician or treatment quality (Phelps, 2000). In the case of a sufferer of the Buruli ulcer who patronizes the services of a traditional herbalist and where this traditional herbalist does not have adequate knowledge and information on the treatment of the disease, it is likely that the patient may not be properly treated causing the disease to develop into even more advanced stages.

2.2. Theoretical Analytical Framework

The demand for health care related to the treatment a disease is conceived by economists to be the *derived* demand for health (Anaman and Ibrahim, 2000; Anaman and Amin, 2005). This is because people demand health care mainly to improve their health and do not necessarily like to go through the painful processes involved in health care such as injections. The Buruli ulcer sufferer, like all consumers of health care, attempts to get as much health care as possible within the limits of his/her income or budgetary constraints and his/her requirements for other goods and services necessary for survival such as housing and food. As pointed out in the earlier section, the demand for health care related to Buruli ulcer also depends critically on the information or misinformation about the disease related to the time and the stage of the disease that the sufferer reports the symptoms to health clinics and hospitals.

As shown by Anaman and Aboagye (2014), in the particular study area, those people who were initially afflicted with the disease and promptly reported the cases to government health clinics and hospitals were successfully treated and did not suffer any permanent disabilities. Hence we argue that the expenditures, incurred by an adult disease sufferer, depend on his/her socioeconomic factors such as income, his/her employment status as some employers directly pay part of the medical expenses of their employees, and the level of information about the disease which is directly related to the stage that the disease has reached before it is reported to clinics and hospitals, and/or whether the disease is even reported to clinics and hospitals at all. An empirical model on health expenditures needs to capture key information, variables related to detection of the disease, the reporting of the disease to clinics and the ability of the sufferer to directly pay for the treatment services given his/her income and employment status.

3. METHODOLOGY

3.1. Survey Sampling and Administration Procedures

The survey area was in the Nsawam-Adoagyiri Municipality, a peri-urban area, which is one of the 216 local government districts in Ghana. It is situated about 30 kilometres from Accra, the capital city of Ghana, and serves as a major commuting centre for many people working in Accra. The municipality is considered an endemic area for the disease. Data were collected from two health centres namely Djankrom Health Centre and Nsawam Health Centre with the aid of the structured questionnaire over a period of six months from April to September 2014.

Weekly visits over a period of six months were made to the two health centres to have access to sufferers who had come in for treatment. Most sufferers visited the health centres only on the days when the epidemiologist was due to visit. Others who were still on the medical treatment of the antibiotics visited their health centres daily for injections and received antibiotics to treat the ulcer. These informed the choice of random sampling of sufferers. All patients who were present at the two health centres during each weekly visit were interviewed. Caution was taken so as not to interview the same respondent twice. Anaman and Aboagye (2014) provide details of the conduct of the survey and the methods used to comply with ethics, and the methods also used to interview non-sufferers of the disease.

3.2 Empirical Specification and Estimation of the Treatment Expenditures Model

Based on the theoretical framework developed earlier, a multiple regression model was developed to analyze the socioeconomic characteristics of respondents, including information variables that significantly influenced the level of treatment costs incurred by sufferers of the disease. The empirical model was as follows:

EXPENDITURE= C_o + C_1 SINCOME + C_2 UNEMPLOYED + C_3 EARLYREPORTING+ C_4 REPORTFIRSTTOCLINIC + C_5 CHRISTIAN + C_6 SINCOMEARLYREPORTING + U

where **EXPENDITURE** was the dependent variable and was the total treatment costs incurred by the sufferer at health centres over the previous 12 months before the survey.

SINCOME was the reported monthly income of the sufferer in Ghana Cedi. The hypothesis examined with respect to this variable was that higher-income people would incur more expenditure to improve their welfare by controlling the disease and reducing its health burden because of their ability to do so.

UNEMPLOYED was the unemployment status of the respondent with 1 representing unemployed persons and zero for respondents who were employed at the time of the survey. The relevant hypothesis was that, assuming all other things constant, unemployed people would spend less on treating the disease compared to those who were employed because they lacked the financial resources for treatment as compared to those gainfully employed.

EARLYREPORTING was an information dummy variable with 1 representing people who reported the disease to a health centre or hospital at the nodal or oedema stages when the

disease had not reached a very high advanced stage of destruction to the victim. This variable placed emphasis on how early detection and availability of information about the disease could affect the health outcomes of the sufferer. The hypothesis related to this variable was that early reporting of the disease to clinics led to more treatment expenditures, which would lead to the elimination of the disease and improved health outcome for the individual.

REPORTFIRSTTOCLINIC was a dummy variable with a value of 1 for those who reported the disease first to a clinic or hospital when they detected signs of the disease and zero for those who reported first to traditional herbalists and healers or engaged in self-medication. Reporting the symptoms of the disease first to a health centre or hospital could improve the chances of positive health outcomes and welfare of the sufferer through the reduction of overall costs of treatment based on the assumption of better diagnosis and treatment at health clinics and hospitals compared to the performance of traditional healers and self-medication.

CHRISTIAN was a dummy variable with the value of 1 assigned to those who indicated that they were adherents of the Christian religion and zero for those who considered themselves as strictly non-Christians. The Christians denoted here included those who had multiple religious beliefs such as combining Christianity with African traditional religious faith; multiple religious beliefs are widespread in Ghana. There was no a priori hypothesis for this variable.

SINCOMEEARLYREPORTING was the interaction term based on the product of the variables SINCOME and EARLYREPORTING. This variable measured the extent to which early reporting of the disease to health clinics and hospitals decreased expenditures on the disease as income increases. It would be expected that early reporting of the disease combined with the ability to pay for the costs of treating the disease would improve health incomes and reduce overall costs of treatment.

U was the error term initially assumed to have a zero mean and constant variance. The initial assumption of the error term was examined based on several diagnostic econometric tests required for the correct use of the ordinary least squares (OLS) method of estimation. These diagnostic tests are described in the results section of this paper.

4. RESULTS

4.1. Socio-economic Characteristics of Respondents

Table 1 provides a summary of the socioeconomic characteristics based on frequency analysis of the 43 sufferers who were interviewed for this study. As noted by Anaman and Aboagye (2014), 128 non-sufferers living in the communities of the sufferers and 22 government health and medical personnel were also interviewed about their perceptions of the disease in the larger study. There were 22 female sufferers and 21 male sufferers who provided information. In terms of marital status, the largest group of sufferers was those who were currently

married followed by those who were single and unmarried. About four out of five sufferers were Christians with the remainder being Muslims and adherents of traditional African religions. The vast majority of the sufferers had some formal education. Only about one in nine did not receive any formal education. However, most of those who had received formal education completed only basic schooling (up to junior secondary school and middle school).

The average age of the 43 sufferers was 35.4 years with the range from 15 to 83 (refer to Table 2). With an average monthly income of 71.8 Ghana cedis per month, the sufferers interviewed for this study could be described as largely in the low-income section of the general population. One Ghana Cedi was worth about 0.4 United States (US) dollar in September 2013, the time that the survey was completed. Hence the average monthly income was about 0.95 US dollar per day, below the 1.25 US dollar per day used by many countries including Ghana to measure absolute poverty line. Table 2 also shows that the average household size of the sufferer was 7.9 (ranging from 2 to 20). This average household size was higher than the national household average of size of 4.4 recorded for 2010 based on the 2010 Population and Housing Census (Ghana Statistical Service, 2013, p. 72). Based on the data, the sufferers generally came from lower-income, overcrowded and poorer households.

4.2. Results of Regression Analysis for Factors Influencing Total Treatment Expenditures Incurred by Sufferers of the Disease

The results of the multiple regression analysis of factors influencing the level of treatment expenditures incurred by sufferers of the disease are presented in Table 3. The overall power of the model was very high as measured by the 70.4% R^2 and the 64.1% adjusted R^2 with the statistical significance at the 0.000 level. The model was deemed to be correctly specified based on the Ramsey Reset test of specification (Ramsey, 1969), which had a p value of 0.174, which meant that the multiple regression model was adequately specified as the null hypothesis could not be rejected at the 5% level of significance used for this study. The error term was assessed as normally distributed based on the Kolmogorov-Smirnov test Kolmogorov, 1933; Smirnov, 1948). This meant that the estimated sample coefficients could be logically extrapolated to the larger (unknown) population. The test for homoscedasticity was based on a simple Langrange-Multiplier (LM) test of fitting the variance of the error term as a function of the square of the fitted dependent variable. The LM test showed that the error term was homoscedastic. Given the lack of statistical significance related to the problem of heteroscedasticity, the variance of the error term was deemed to be constant as per the initial assumption required for the use of OLS regression analysis. Finally, the variance inflation factors (VIF) of all the independent variables were very low (less than 2.0) and this result showed the absence of the problem of multicollinearity. As indicated by Gujarati (2003, p. 362), VIF values less than 10.0 do not pose any significant problem of multicollinearity. In conclusion, all the diagnostic tests reported in Table 3 confirmed a strong model that could be used for interpretative analysis and discussion.

Table 1: Summary socioeconomic characteristics of Buruli ulcer sufferers based on frequency analysis using percentages

Item/ group	Percentage
Gender	
➢ Male	51.2
➢ Female	48.8
Marital Status	
➢ Single	34.9
➢ Married	41.9
➢ Divorced	9.3
➢ Widowed	14.0
➢ Informal	0.0
Religious Affiliation	
➢ Christian	79.1
➢ Muslim	9.3
➢ Traditionalist	7.0
➢ Christian//Traditionalist	4.7
Educational Level	
➢ No formal education	11.6
➢ Primary school	39.5
➢ Junior secondary School	18.6
➢ Middle school	9.3
➢ Senior secondary school	20.9

Table 2: Summary of selected socioeconomic characteristics of Buruli ulcer disease sufferers based on averages

Item	Percentage
Age (years)	35.4 (15 to 83)
Personal monthly income in Ghana cedis (GHS)	71.8 (0 to 950)
Total number of people in the household	7.9 (2 to 20)
Number of children in the household	3.4 (1 to 15)

Note: The figures in the parentheses are the ranges.

Table 3: Results of the Estimated Multiple Regression Model of Factors Influencing the Level of Expenditures for Treating Buruli Ulcer Disease Incurred by Sufferers

Explanatory Variable	Parameter Estimate	Standardized Parameter Estimate	Student t Value	Probability level of significance	Variance Inflation Factor
CONSTANT	407.488	0.000	2.289	0.030*	0.000
SINCOME	1.925	0.809	7.253	0.000*	1.177
UNEMPLOYED	-467.552	-0.344	-3.191	0.003*	1.098
EARLYREPORTING	350.875	0.459	3.609	0.001*	1.530
REPORTFIRSTTOCLINIC	-117.518	-0.143	-1.282	0.210	1.182
CHRISTIAN	135.554	0.134	1.254	0.220	1.082
SINCOMEEARLYREPORTING	-2.941	-0.348	-2.781	0.010*	1.480

Notes on Table 3:
(1) The R^2 was 0.704 and adjusted R^2 was 0.641 and was statistically significant at the 0.000 level.
(2) The probability level of significance for correct specification of the model based on the Ramsey Reset test using the null hypothesis of adequate and proper specification of model was 0.174.
(3) The probability level of significance for normality of the error term based on the Kolmogorov-Smirnov test using the null hypothesis of normality of error term was 0.145.
(4) The probability level of significance for homoscedasticity based on the Langrange Multiplier (LM) test using the null hypothesis of homoscedasticity was 0.849.
(5) The asterisk (*) indicates that the parameter was statistically significant at the 5% confidence level used for the study.

The results of the analysis reported in Table 3 showed that all the six variables were statistically significant in influencing the variation in the dependent variable (EXPENDITURE) with the exception of REPORTFIRSTTOCLINIC and CHRISTIAN. However, the latter two variables had an absolute Student t value greater than 1.0 and hence could not be dropped from the model as this action would cause misspecification bias. As expected, higher treatment costs were incurred with the increasing incomes based on the positive and statistically significant parameter value for SINCOME. With the negative and significant parameter estimate of UNEMPLOYED, it meant that unemployed people spent less on treatment expenditures as compared to those people who were gainfully employed. This result could be due to the stability of income made possible through employment and possibly higher savings of employed people.

The interpretation of the negative and statistically significant parameter estimate for the SINCOMEEARLYREPORTING variable is that with increasing incomes, sufferers who reported the disease in clinics and hospitals in the early stages of the disease incurred relatively less costs compared to similar high-income group of people who reported the disease to clinics and hospitals at the ulcerative stage of the disease. Based on the standardized regression coefficient estimates reported in Table 3, the most important factor influencing the level of treatment expenditures incurred by sufferers was the income of the sufferer (SINCOME). This was followed by early reporting of the disease to health clinics and hospitals and followed in the third place by the combined interaction variable of SINCOME and EARLYREPORTING. Unemployment status was the fourth most influential variable followed by REPORTFIRSTTOCLINIC and CHRISTIAN.

5. CONCLUSION AND RECOMMENDATIONS

The main objective of this study was to analyze the factors influencing the treatment expenditures incurred by the sufferers of Buruli disease with emphasis placed on the availability information about the disease related to the time and stage of reporting of the disease for treatment at clinics and hospitals. We established that the major factors that significantly influenced treatment expenditures were the income of the sufferer, early reporting of the disease to clinics and hospitals, and the employment status of the sufferer. Higher-income people spent more money to treat the disease than those with lower incomes. People who were unemployed

spent relatively money in treating the disease as compared to those who were gainfully employed. With increasing incomes, sufferers who reported the disease to clinics and hospitals in the early stages of the disease incurred relatively less costs compared to similar high-income group of people who reported the disease to clinics and hospitals at the ulcerative stage of the disease.

Three recommendations easily flow from this study. The first is that information concerning the disease needs to be widely disseminated among sufferers and non-sufferers in various communities at risk from the disease. It is clear that early detection and reporting of the disease generally improves welfare and health outcomes of sufferers and reduce the overall costs of treating the disease as individual incomes rise. Hence the general population needs to be continuously advised to report suspicious boils and wounds that defy treatment quickly to clinics and hospitals. The government also needs to improve upon the facilities and manpower capacity of clinics and hospitals to ensure early detection, proper diagnosis and treatment of the disease. Second, the disease should be included in the list of diseases that are covered fully in terms of free treatment under the National Health Insurance Scheme of Ghana. The scheme introduced in 2003 has been useful in assisting poor people who could not fully pay for various health expenses as occurred during the era of privatized health care in Ghana during the structural adjustment program era from 1983 to 2003 which was undertaken by the Government of Ghana with assistance from the World Bank and the International Monetary Fund.

Third, it is clear from the study that people suffering from the disease who were not gainfully employed were not able to spend as much money in treating the disease as those who were gainfully employed. Hence sufferers who are unemployed should be included in the list of people covered under the Livelihood Empowerment against Poverty (LEAP) scheme of the Government of Ghana. The LEAP scheme involves direct transfer payment from the Government of Ghana to people considered very poor and living in poverty-stricken situations. Unemployed people who suffer from the Buruli disease need to be automatically included in the LEAP scheme to improve their welfare and increase their life expectancies. Healthy people constitute a healthy nation and thereby having the poor of any nation struck by such a disease is a worrying situation. The fact that there has not been any cure for the disease does not imply that it has to be neglected by the authorities responsible.

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