

Research

Perception and incidence of Buruli ulcer in Ogun State, South West Nigeria: intensive epidemiological survey and public health intervention recommended



Patricia Ihuaku Otuh^{1,2,&}, Festus Olukayode Soyinka³, Bamidele Nyemike Ogunro^{1,2}, Victor Akinseye², Elebe Emmanuel Nwezza⁴, Adebola Olubunmi Iseoluwa-Adelokiki³, Olanike Kudirat Adeyemo¹

¹Department of Veterinary Public Health and Preventive Medicine, University Of Ibadan, Ibadan, Oyo state, Nigeria, ²Veterinary Teaching Hospital, University of Ibadan, Ibadan, Oyo State, Nigeria, ³Ogun State Tuberculosis, Leprosy and Buruli Ulcer Control Programme, Ministry of Health, Abeokuta, Ogun State, Nigeria, ⁴Department of Mathematics/Computer Science/Statistics and informatics, Federal University Ndufu Alike Ikwo, Ebonyi State, Nigeria

[&]Corresponding author: Patricia Ihuaku Otuh, Department of Veterinary Public Health and Preventive Medicine, University of Ibadan, Ibadan, Nigeria

Key words: Buruli ulcer, Mycobacterium ulcerans, Epidemiology, Neglected tropical disease, Rural population, Nigeria

Received: 21/06/2016 - Accepted: 13/02/2018 - Published: 22/03/2018

Abstract

Introduction: Buruli ulcer (BU) is a highly ranked neglected tropical disease (NTD) of global health importance with increasing incidence in sub-Saharan Africa yet there is paucity of information on the epidemiology of BU in Nigeria. Incidentally, highly BU endemic Benin Republic shares proximity with Nigeria. This study was carried out to establish presence of BU and ascertain the level of BU perception among rural populace in Ogun State, south-west Nigeria. **Methods:** Secondary data (2009-2012) on incidence of BU was collected from a reference hospital. A cross-sectional survey using structured questionnaire administered to rural people and healthcare practitioners was conducted in three purposively chosen Local Government Areas (LGAs) in Ogun State based on unpublished reports of BU presence. **Results:** Data collected revealed 27 hospital confirmed BU cases between 2009-2012 across four LGAs (Obafemi Owode, Abeokuta North, Yewa North and Yewa South) while 14%(21/150) chronic ulcers (suspected to be BU) were discovered during the cross-sectional survey carried out in Odeda, Yewa South and North LGAs. Healthcare practitioners 63.6% (42/66) and 54.7% (82/150) rural people demonstrated poor level of BU perception respectively. **Conclusion:** This study provides evidence that BU exists in Ogun State and evaluates the poor perception that the affected rural populace has on the disease. This pilot study presents baseline information on BU in a rural setting in Ogun State South-west Nigeria hence the vital need for prompt public health involvement and further research on the epidemiology of BU.

Pan African Medical Journal. 2018;29:166. doi:10.11604/pamj.2018.29.166.10110

This article is available online at: <http://www.panafrican-med-journal.com/content/article/29/166/full/>

© Patricia Ihuaku Otuh et al. The Pan African Medical Journal - ISSN 1937-8688. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/2.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Introduction

Buruli ulcer (BU) is an emerging tropical disease predominant in West Africa, affecting mostly rural populace who most times are quite ignorant of the disease. The BU is a very devastating disease of humans and animals caused by an environmental non-tuberculous mycobacterium (NTM), *Mycobacterium ulcerans* [1-5]. Children under the age of fifteen years have been found to be commonly affected by this highly rated neglected tropical disease (NTD) inflicting huge impact in form of deformities, functional limitations and social stigma on them when assessed by disability-adjusted life years, DALYs [6-9]. Increased morbidity due to extensive necrosis of the skin, subcutaneous tissues, bones involvement and varying degrees of contracture on BU patients is very common and compounded with inadequate or no access to health care services in rural settings, all contributing to the lowest possible standard of living among affected people [2,10-13]. The global health concern for BU as revealed by WHO classification of NTD shows that BU is a top ranking emerging NTD [14]. Although BU is noted as the third most common mycobacteriosis, some communities in the sub-Saharan Africa are recording incidence surpassing Tuberculosis and Leprosy [7,10,15-17]. The causative agent *M. ulcerans* has affinity for aquatic areas; rivers, streams, farmlands, irrigated areas, where majority of the rural poor conduct several livelihood activities ranging from farming, fishing to fetching water for domestic purposes [1,10,18-24].

Despite increased geographical spread of Buruli ulcer in sub-Saharan Africa especially in West Africa, there is dearth of information on epidemiology of the disease in Nigeria when compared with some of West African countries: Ghana, Benin Republic, Togo, and Cameroon [7,10,25-27]. Previous reports on BU in Nigeria have always been focused on clinical cases recorded either by hospital presentation or as a result of active case searches [16,28-31]. The epidemiology of BU is very important due to its yet to be unraveled mode of transmission which also hampers efforts to prevent and control the disease [10,20,21,32,33]. Consequently, information on the perception of BU disease among the most predisposed rural populace is very vital in achieving the meaningful goals of finding out the prevalence of BU which is uncertain in most endemic countries, encouraging early reporting by affected people and ensuring prompt treatment thereby preventing the extensive devastating effects of BU [20,34,35]. The objectives of this study were therefore to establish the presence of BU and BU perception

by people living in rural susceptible villages in Odeda, Yewa North and Yewa South Local Government Areas of Ogun State which shares close boundary with Benin Republic; a BU epicenter. The outcome of this study serves as evidence based guideline for policy formulation in the health sector of Ogun state and Nigeria at large which should be geared towards implementation and provision of prompt medical assistance to alleviate the anguish suffered by BU patients. In addition this work provides preliminary information for further research into the epidemiology of *Mycobacterium ulcerans* in Nigeria.

Methods

Study location

This study was undertaken in Ogun state, one of the six states in the south west geo-political zone of Nigeria. It is bordered by the highly populous Lagos state to the south, Oyo and Osun states to the north, Ondo state to the east and Republic of Benin to the west. It has an estimated population of 3,751,140 according to the 2006 population census and covers a land mass of 16,762 square kilometers. The state is located on the geographical grid reference of 6.90980N and 3.25840E [36]. Three local government areas (Odeda, Yewa South and Yewa North) were purposively selected for this study based on previous unpublished report of BU presence.

Study design

Secondary data collection was first carried out at the Hansen's disease center Iberekodo, Abeokuta North Local Government Area of Ogun State. Information on BU patients presented to the facility between 2009 and 2012 was retrieved from the hospital record. The number of patients and their corresponding communities of residence were noted. This was followed by a descriptive observational study from January to October 2013 involving cross-sectional survey which adopted the administration of structured questionnaire to consenting respondents in the three local government areas (Odeda, Yewa North and Yewa South). Two categories of respondents were recruited; the rural people comprising adult males and females and the health care practitioners made up of community healthcare workers (CHW), nurses and medical doctors. Information gathered were, socio-demographic variables including local government area, gender,

level of education, age, class of health facility and duration on the job. The perception level was based on responses of the respondents to questions relating to awareness on BU, its causative agent, forms of BU presentation, possible ways of exposure, treatability, methods/modes of treatment and attitude towards BU patients. The responses were scored on a scale of 1 to 6 with scores ranging from 1-3 regarded as poor perception and 4-6 as good perception.

Data analysis

Data were analyzed using SPSS ® (Statistical Package for Social Sciences) version 20. Socio-demographic variables were summarized using descriptive statistics. The Sign-test for non-parametric data was used to analyze the socio demographic predictors of BU perception among the rural people and healthcare practitioners. Significance was set at $p \leq 0.05$.

Results

Buruli ulcer presence in Ogun State

The hospital record of Hansen's disease center Iberekodo located in Abeokuta North LGA revealed cases of BU presented to the facility between 2009 and 2012. The patients were from four different LGAs; Yewa South, Yewa North, Obafemi Owode and Abeokuta North. A total of 27 BU cases were presented within the 4year period. Of the total number of cases presented; 44.4% (12/27) was in 2009; 22.2% (6/27) in 2010; 3.7% (1/27) in 2011 and 29.6% (8/27) in 2012. Yewa South LGA had the highest number of BU cases 59.3% in three years (2009, 2010 and 2012) with no case in 2011 while Yewa North LGA with 29.6% of the BU recorded had cases in all the four years. Only one BU case was from Obafemi Owode LGA in 2009 and 2cases were from Abeokuta south LGA in 2012. During the cross-sectional survey conducted in the study location, a total of 21 cases (14%) presenting with varying degrees of unhealed ulcers with close tallying with BU case definition were discovered (Figure 1). Yewa south recorded the highest number (9), followed by Odeda (7) and Yewa north (5). The duration of the ulcers ranged from 1-35years and majority were located on the lower extremity but only one case was found at the back.

The outcome of cross-sectional survey

A total of one hundred and fifty (150) respondents from the rural people category participated in the study across the three LGAs purposively selected for this study. Odeda, Yewa South and Yewa North LGAs respectively had 33, 59 and 58 respondents. In healthcare practitioners' category 66 participants were involved in the survey. The distribution of the various respondents; community healthcare workers (CHW), nurses and medical doctors were as follows respectively: Odeda LGA-17, 11, and 5; Yewa North LGA-14, 6, 2 and Yewa South LGA-2, 8, 1.

Buruli ulcer perception

54.7% of the total respondents had poor level of BU perception among the rural people who participated in the survey. However Yewa South LGA had the best BU perception (33/68=48.5%) while Yewa North had the least level of BU perception (37/82=45.1%). More than half of the respondents were males (65.3%) despite this the male respondents had poorer BU perception than the females. 57/98 (58.2%) males had poor perception whereas 27/52(51.9%) of the females had good perception. People with formal education with the exception of tertiary level and the uneducated all had poor level of BU perception. 30% of respondents within the age bracket of 30-39 displayed the poorest BU perception within the age demography. Perception of respondents towards BU indicated significant association with all the demographic predictors as revealed in Table 1. Among the 66 respondents in the healthcare practitioner's category 63.5 % had poor BU perception. In the class of healthcare facility, the secondary healthcare facility workers presented a better level of BU perception than the primary healthcare facility counterpart. Healthcare practitioners working in the primary healthcare facilities had 54.6% of poor perception. The younger healthcare practitioners demonstrated a higher level of good perception than the older practitioners. There is significant association between BU perception and all the socio-demographic variables (LGA, class of health facility and duration on the job) as shown in Table 2.

Discussion

Difficulty in unraveling the mode of transmission of *M. ulcerans* the causative agent of Buruli ulcer creates a huge obstacle in proffering

actual preventive and control strategies for this debilitating disease ravaging impoverished population in sub-Saharan Africa [37, 38]. To achieve these phenomenal feat, in-depth epidemiological studies on BU is of paramount importance most especially in the endemic West African region [7, 21, 33]. The population at risk has enormous part to play in providing relevant information on the disease which will enable researchers to be well equipped with essential information central for positive findings. This study therefore ascertained the level of acuity of the people inhabiting the locations in Ogun with evidence of having BU patients and which shares close geographical proximity with the highly endemic Benin Republic [26,39]. Our study established the presence and level of BU cases presented to the Hansen's disease centre; a referral facility which provided an insight on the probable locations for further epidemiological investigation, this is in line with work carried out by Taban *et al.*; Owusu and Adamba [7, 37] in Cameroon and Ghana respectively who employed cross-sectional studies on the basis of retrospective studies in BU health district facilities. Our study revealed the trend and annual distribution of BU disease in Ogun state from 2009-2012 bringing to the fore that the highest BU cases were most prevalent (59.3%) in Yewa South. According to the hospital reports BU case search was conducted proceeding this period which must have enlightened the rural people to understand the importance of seeking medical help. Several studies involving active BU case search have been successful in Nigeria and in some African countries towards epidemiology and molecular studies of BU disease [16, 24, 29, 30]. The focal distribution of BU was also highlighted in this study which is in line with findings from previous reports from some West African countries [38, 40]. The cross-sectional survey involving questionnaire administration yielded results from the study location with the highest number of BU patients emanating from Yewa South LGA hence tallying with the report from the hospital records. This may not be unconnected with the close proximity that this LGA shares with highly endemic Benin Republic. Reports have it that many BU patients from Nigeria access medical help from neighbouring countries [40]. Odeda LGA had no previous BU report but are susceptible on account of the predisposing risk factor of culpable aquatic environments situated within the communities. There is there possibility of Odeda becoming new BU foci. Majority of the ulcers were located on the lower extremity in accordance with previous reports [16, 32] attributing this to probably the ease of contact with risk factors.

People living in Yewa South and Yewa North LGAs were more willing to participate in the survey perhaps because there were BU patients

within these localities. However in the healthcare practitioner category, more well-disposed respondents were encountered in Odeda LGA. The closeness of this LGA to Ibadan; a peri-urban city must have been the reason associated to this, as healthcare service delivery seems more accessible. This study equally highlighted increased number of CHCW revealing their impact on rural health care delivery thereby affirming previous studies carried out in Republic of Benin and in sub-Saharan Africa [41-43]. There was generalised evidence of poor perception across the study area, pointing to the high level of ignorance on BU among the rural populace. Majority attributed occurrence of BU to witchcraft, spiritual attack, ancestral curse and affliction by "ofa" hence the believe that only appeasing the gods, certain sacrifices, traditional healing and deliverances can remedy BU. The availability of free BU treatment opportunity was only known by few healthcare practitioners and some BU patients who had received prior treatment. Women were more knowledgeable, most likely because they bear most of the burden suffered by BU patients directly [43-45]. Although CHCW contributed immensely to the care of BU patients they still had poor perception on BU most likely because of their low level of education. From this study, education of both rural populace and healthcare providers cannot be over emphasized.

Conclusion

Globally Buruli ulcer disease has assumed a great health concern because of the severe pain, disfigurement and harsh economic burden on affected people. Efforts are on to discover the exact mode of transmission, extent of spread through geographical mapping, rapid diagnostic techniques which will easily be accessible in the rural areas and for more national sustainable surveillance. Population studies are very important in understanding peculiar diseases inherent in a population. Information on such diseases from the affected people offers very important direction mostly to researchers. Ascertaining the perception of people from this study on BU has provided a vital overview on the knowledge of BU exhibited by these communities; which were fundamentally wrong. Majority of the people affected did not believe that BU is treatable; many believed that witchcraft was the cause and many more did not know that treatment was free. This study has thrown more light on these grey areas and will subsequently spur many to access medical help early to forestall extensive consequences. It is therefore recommended that the Government of Ogun state should increase

efforts to strengthen the public health department to undertake intensive and extensive epidemiological studies on BU in all LGAs of the state as this will help in establishing the prevalence of BU in the state. The federal ministry of health equally should have an extended plan of conducting national survey on BU across Nigeria to ascertain the status of Buruli ulcer in Nigeria.

What is known about this topic

- Buruli ulcer is a neglected tropical disease highly endemic in West Africa;
- Close proximity to aquatic environment is a risk factor.

What this study adds

- This study provides probable level of BU endemicity and the level of BU perception by the population (rural populace) highly at risk in Ogun state;
- It also promotes essential aspect of increasing awareness on BU especially among the population at risk.

Competing interests

Authors declare no competing interests.

Authors' contributions

Conception and design: Patricia Ihuaku Otuh, Olanike Kudirat Adeyemo and Festus Olukayode Soyinka. Data collection and field work: Patricia Ihuaku Otuh, Bamidele Nyemike Ogunro, Festus Olukayode Soyinka and Adebola Olubunmi Iseoluwa-Adelokiki. Data Analysis: Elebe Emmanuel Nwezza, Victor Akinseye, Patricia Ihuaku Otuh and Bamidele Nyemike Ogunro. Manuscript Preparation: Patricia Ihuaku Otuh. Review of final draft: Olanike Kudirat Adeyemo, Patricia Ihuaku Otuh, Victor Akinseye, Elebe Emmanuel Nwezza, Bamidele Nyemike Ogunro, Festus Olukayode Soyinka and Adebola Olubunmi Iseoluwa-Adelokiki. All the authors read and approved the final manuscript.

Acknowledgments

Authors acknowledge the warm and receptive audience granted by all the villagers within the communities of the study location. The

various supervisors of the Tb/leprosy/BU programme in the Odeda, Yewa North and Yewa South of Ogun state were all helpful in facilitating the survey.

Tables and figure

Table 1: Socio-demographic predictors of Buruli ulcer perception among rural people

Table 2: Socio-demographic predictors of perception of healthcare practitioners towards Buruli ulcer

Figure 1: Buruli ulcer cases found during the cross-sectional survey

References

1. Stinear T, Davies JK, Jenkin GA, Portaels F. A Simple PCR method for rapid genotype analysis of Mycobacterium Ulcerans. *J Clin Microbiol.* 2000 Apr;38(4):1482-7. **PubMed | Google Scholar**
2. Portaels F, Silva MT, Meyers WM. Buruli ulcer. *Clin Dermatol.* 2009 May;27(3):291-305. **PubMed | Google Scholar**
3. Portaels F, Chemlal K, Elsen P, Johnson PD, Hayman JA, Hibble J et al. Mycobacterium ulcerans in wild animals. *Rev Sci Tech Int Off Epizoot.* 2001;20(1):252-264. **Google Scholar**
4. Fyfe JAM, Lavender CJ, Handasyde KA, Legione AR, O'Brien CR, Stinear TP et al. A Major Role for Mammals in the Ecology of Mycobacterium ulcerans. *PLoS Negl Trop Dis.* 2010 Aug 10;4(8):e791. **PubMed | Google Scholar**
5. van Zyl A, Daniel J, Wayne J, McCowan C, Malik R, Jelfs P et al. Mycobacterium ulcerans infections in two horses in south-eastern Australia. *Aust Vet J.* 2010 Mar;88(3):101-6. **PubMed | Google Scholar**
6. Seddoh A, Onyze A, Gyapong JO, Holt J, Bundy D. Towards an investment case for neglected tropical diseases. *Lancet.* 2013;9908:1898-1955. **PubMed | Google Scholar**

7. Tabah EN, Nsagha DS, Bissek A-CZ-K, Njamnshi AK, Bratschi MW, Pluschke G et al. Buruli ulcer in Cameroon: the development and impact of the National Control Programme. *PLOS Negl Trop Dis.* 2016;10(1):e0004224. **PubMed | Google Scholar**
8. Agbenorku P, Edusei A, Agbenorku M, Diby T, Nyador E, Nyamuame G et al. Buruli-ulcer induced disability in Ghana: a study at apomase in the Ashanti Region. *Plast Surg Int.* 2012;2012:1-7. **PubMed | Google Scholar**
9. Owusu-Sekyere E, Kwame O-A, Nkuah JK. Perceptions and attitudes: the challenge of managing Buruli ulcer morbidity in Ghana. *Int J Sci.* 2013;2:15-24. **Google Scholar**
10. Sopoh GE, Barogui YT, Johnson RC, Dossou AD, Makoutodé M, Anagonou SY et al. Family relationship, Water Contact and Occurrence of Buruli Ulcer in Benin. *PLoS Negl Trop Dis.* 2010 Jul 13;4(7):e746. **PubMed | Google Scholar**
11. Van der Werf T, Stienstra Y, Johnson R, Phillips R, Adjei O, Fleischer B et al. Mycobacterium ulcerans disease. *Bull World Health Organ.* 2005;83:785-91. **PubMed | Google Scholar**
12. Walsh DS, Portaels F, Meyers WM. Buruli ulcer (Mycobacterium ulcerans infection). *Trans R Soc Trop Med Hyg.* 2008 Oct;102(10):969-78. **PubMed | Google Scholar**
13. Duker A, Portaels F, Hale M. Pathways of Mycobacterium ulcerans infection: a review. *Environ Int.* 2006;32:567-73. **PubMed | Google Scholar**
14. WHO. Health Observatory (GHO), Buruli ulcer: situation and trends. 2013. Accessed on 21 June 2016
15. Huang GKL, Johnson PD. Epidemiology and management of Buruli ulcer. *Expert Rev Anti Infect Ther.* 2014 Jul;12(7):855-65. **Google Scholar**
16. Ukwaja KN, Meka AO, Chukwuka A, Asiedu KB, Huber KL, Eddyani M et al. Buruli ulcer in Nigeria: results of a pilot case study in three rural districts. *Infect Dis Poverty. Infectious Diseases of Poverty.* 2016;5:39. **PubMed | Google Scholar**
17. Junghanss T, Johnson RC, Pluschke G. Mycobacterium ulcerans disease In: Hotez PJ, Junghanss T, Kang G, Lallo D, White NJ, Farrar J (Eds). *Manson' s tropical diseases.* 2014; 23rd Edition, Saunders, Edinburg.
18. Portaels F, Meyers WM, Ablordey A, Castro AG, Chemlal K, de Rijk P et al. First Cultivation and Characterization of Mycobacterium ulcerans from the Environment. *PLoS Negl Trop Dis.* 2008 Mar 26;2(3):e178. **PubMed | Google Scholar**
19. Williamson HR, Benbow ME, Nguyen KD, Beachboard DC, Kimbirauskas RK, McIntosh MD et al. Distribution of Mycobacterium ulcerans in Buruli Ulcer Endemic and Non-Endemic Aquatic Sites in Ghana. *PLoS Negl Trop Dis.* 2008 Mar 26;2(3):e205. **PubMed | Google Scholar**
20. Asiedu K, Scherpbier R, Raviglione M. Buruli ulcer. *Mycobacterium Ulcerans.* 2000; 9-12. **Google Scholar**
21. Merritt RW, Walker ED, Small PLC, Wallace JR, Johnson PDR, Benbow ME et al. Ecology and Transmission of Buruli Ulcer Disease: A Systematic Review. *PLoS Negl Trop Dis.* 2010 Dec 14;4(12):e911. **PubMed | Google Scholar**
22. Debacker M, Steunou C, Zinsou C, Guedenon A, et al. Risk Factors for Buruli ulcer in Benin. *Emerg Infect Dis.* 2006;9(12):1325-31. **PubMed | Google Scholar**
23. Merritt RW, Benbow ME, Small PL. Unraveling an emerging disease associated with disturbed aquatic environments: the case of Buruli ulcer. *Front Ecol Environ.* 2005;3(6):323-331. **Google Scholar**
24. Ebenezer Owusu-Sekyere. The buruli ulcer morbidity in the amansie West District of Ghana: a myth or a reality? *Journal of Public Health and Epidemiology.* October 2013; 5(10): 402-409. **Google Scholar**
25. Narh CA, Mosi L, Quaye C, Dassi C, Konan DO, Tay SCK et al. Source tracking mycobacterium ulcerans infections in the Ashanti Region, Ghana. *PLoS Negl Trop Dis.* 2015 Jan 22;9(1):e0003437. **PubMed | Google Scholar**

26. Campbell LP, Finley AO, Benbow ME, Gronseth J, Small P, Johnson RC et al. Spatial Analysis of Anthropogenic Landscape Disturbance and Buruli Ulcer Disease in Benin. *PLoS Negl Trop Dis*. 2015 Oct 16;9(10):e0004123. **PubMed | Google Scholar**
27. Mosi L, Williamson H, Wallace JR, Merritt RW, Small PLC. Persistent Association of mycobacterium ulcerans with West African Predaceous Insects of the Family Belostomatidae. *Appl Environ Microbiol*. 2008 Nov 15;74(22):7036-42. **PubMed | Google Scholar**
28. Aigoro N, Oloko M, Popoola M, Soyinka F. Buruli ulcer: a case report from South-West, Nigeria Nigerian Hospital. *Niger Hosp Pract*. 2010; 5(3-4). **PubMed | Google Scholar**
29. Chukwuekezie O, Ampadu E, Sopoh G, Dossou A, Tiendrebeogo A, Sadiq L et al. Buruli Ulcer, Nigeria. *Emerg Infect Dis*. 2007;13(5):783. **PubMed | Google Scholar**
30. Oluwasanmi J, Solanke T, Olurin E. Mycobacterium ulcerans (Buruli) skin ulceration in Nigeria?. *Am J Trop Med Hyg*. 1976;25(1):122-8. **PubMed | Google Scholar**
31. Gray H, Kingma S, Kok S. Mycobacterial skin ulcers in Nigeria. *Trans R Soc Trop Med Hyg*. 1967;61:712-714. **PubMed | Google Scholar**
32. Marsollier L, Robert R, Aubry J, Saint Andre J, Kouakou H, Legras P et al. Aquatic insects as a vector for Mycobacterium ulcerans. *Appl Environ Microbiol*. 2002;68(9):4623-8. **PubMed | Google Scholar**
33. Amofah G, Bonsu F, Tetteh C, Okrah J, Asamoah K, Asiedu K et al. Buruli ulcer in Ghana: results of a national case search. *Emerg Infect Dis*. 2002;8(2):167-170. **PubMed | Google Scholar**
34. Phanzu DM, Ablordey A, Imposo DB, Lefevre L, Mahema RL, Suykerbuyk P et al. Edematous Mycobacterium ulcerans Infection (Buruli Ulcer) on the Face: A Case Report. *Am J Trop Med Hyg*. 2007;77(6):1099-103. **PubMed | Google Scholar**
35. World Health Organisation. Resolution WHA57.1 Surveillance and control of Mycobacterium ulcerans disease (Buruli ulcer). WHO; 2004.
36. Ogun State. Ogun State Nigeria (Overview, History and summary Information). 2016. Accessed on 21 June 2016
37. Owusu AY, Adamba C. Household perceptions, treatment-seeking behaviors and health outcomes for Buruli ulcer disease in a Peri-Urban District in Ghana. *Adv Appl Sociol*. 2012;2(3):179-86. **PubMed | Google Scholar**
38. Noeske J, Kuaban C, Rondini S, Sorlin P, Ciaffi L, Mbuqbaw J et al. Buruli ulcer disease in Cameroon rediscovered. *Am J Trop Med Hyg*. 2004;70(5):520-6. **PubMed | Google Scholar**
39. Sopoh GE, Johnson RC, Anagonou SY, Barogui YT, Dossou AD, Houézo JG, Phanzu DM, Tente BH, Meyers WM, Portaels F. Buruli ulcer prevalence and altitude, Benin. *Med Trop Mars*. 2010;70:379-83. **PubMed | Google Scholar**
40. Marion E, Carolan K, Adeye A, Kempf M, Chauty A, Marsollier L. Buruli ulcer in South Western Nigeria: a retrospective cohort study of patients treated in Benin. *PLoS Negl Trop Dis*. 2015 Jan 8;9(1):e3443. **PubMed | Google Scholar**
41. Ackumey M. Local perceptions of Buruli ulcer in the Ga district, Greater Accra Region. University of Ghana. 2002. (Cited 2016 Jun 7). **Google Scholar**
42. Barogui YT, Sopoh GE, Johnson RC, de Zeeuw J, Dossou AD, Houezo JG et al. Contribution of the community health volunteers in the control of Buruli ulcer in Bénin. *PLoS Negl Trop Dis*. 2014 Oct 2; 8(10): e3200. **PubMed | Google Scholar**
43. Vouking MZ, Tamo VC, Mbuagbaw L. The impact of community health workers (CHWs) on Buruli ulcer in sub-Saharan Africa: a systematic review. *Pan Afr Med J*. 2013 May 10; 15: 19. **PubMed | Google Scholar**
44. Pluschke G, Röltgen K. Epidemiology and disease burden of Buruli ulcer: a review. *Res Rep Trop Med*. 16 November 2015; 2015(6): 59-73. **Google Scholar**

45. Phanzu DM, Suykerbuyk P, Saunderson P, Lukanu PN, Minuku J-BM, Imposo DBB et al. Burden of Mycobacterium ulcerans disease (Buruli ulcer) and the underreporting ratio in the territory of Songololo, Democratic Republic of Congo. PLoS Negl Trop Dis. 2013;7(12):e2563. [Google Scholar](#)

Table 1: Socio-demographic predictors of BU perception among rural people

CATEGORY		Good Perception		Poor Perception		Confidence interval	P-value
		Frequency (n ⁺)	%	Frequency (n ⁺)	%		
LGA	Odeda	14	9.3	19	12.7	0.000-.020	0.007 ⁺⁺
	Yewa North	21	14.0	38	25.3		
	Yewa South	33	22.0	26	17.3		
Gender	Male	41	27.3	57	38.0	0.000-.020	0.000 ⁺⁺
	Female	27	18.0	25	16.7		
Education level	No education	14	9.3	17	11.3	0.000-.020	0.000 ⁺⁺
	Primary	21	14.0	31	20.7		
	Secondary	21	14.0	24	16.0		
	Tertiary	12	8.0	10	6.7		
Age	20-29	16	10.7	8	5.3	0.000-.020	0.000 ⁺⁺
	30-39	23	15.3	45	30.0		
	40-49	19	12.7	20	13.3		
	>50	10	6.7	9	6.0		

+n = number of respondents, ++ = significant

Table 2: Socio-demographic predictors of BU perception among healthcare practitioners

CATEGORY		Good Perception		Poor Perception		Confidence interval	P-value
		Frequency (n ⁺)	%	Frequency (n ⁺)	%		
LGA	Odeda	11	16.7	22	33.3	0.000 - 0.049	0.000 ⁺⁺
	Yewa North	5	7.6	6	9.1		
	Yewa South	8	12.1	14	21.2		
CLASS OF HEALTH FACILIT	Primary	16	24.2	36	54.6	0.000 - 0.049	0.000 ⁺⁺
	Secondary	8	12.1	6	9.1		
DURATION ON THE JOB(YEARS)	1-5	17	25.8	10	15.2	0.000 - 0.049	0.017 ⁺⁺
	6-10	2	3.0	8	12.1		
	11-20	2	3.0	12	18.2		
	> 20	3	4.5	12	18.2		

+ n = number of respondents, ++ = significant



Figure 1: Buruli ulcer cases found during the cross-sectional survey