



## Prevalence of Buruli ulcer in parts of Jigawa State, Nigeria

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### Abstract

Buruli Ulcer is a chronic, necrotizing indolent disease. It is a neglected tropical disease caused by the environmental bacterium called *Mycobacterium ulcerans* which may affect the skin, tissues and bones. Its mode of transmission remain a challenge to public health. A hospital based study to determine the prevalence of Buruli ulcer in parts of Jigawa State Nigeria was conducted between December 2019 and September, 2021. The purposive sampling techniques was adopted and findings were subjected to patients across all age groups in both male and female gender. The result of this study has revealed negative results for the three hundred and eighty two (382) suspected patients for Buruli ulcer disease, using the Ziehl Nelsen staining technique. Questionnaires were administered to four hundred and eighty (480) respondents in the community, and responses from the questionnaire were used to determine Knowledge, Attitude, practices, perception and risk factors for Buruli ulcer in all the local governments of Jigawa State, where this research was conducted. Results from test analysis and responses generated from the questionnaire were reduced to percentages and presented on tables. Chi-square shows that there exist significant relationship between the socio-demographic characteristics of respondents and Knowledge, Attitude, perception, practices and risk factors for Buruli ulcer at 5 % probability ( $P \leq 0.05$ ). Further finding should be done with emphasis on sampling of clinical specimens from a community based study.

**Keywords:** Buruli Ulcer, Prevalence, Jigawa, Mycolactone, *Mycobacterium ulcerans*

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### Introduction

Buruli ulcer (BU) is a chronic, indolent, necrotizing cutaneous disease caused by the bacterium, *Mycobacterium ulcerans*, which is classified by the World Health Organization (WHO) as one of the skin related Neglected Tropical Diseases (NTDS) (Mitjà *et al.*, 2017, Yotsu *et al.*, 2018) <sup>[1,2]</sup>. The disease was first described by Robert Cook in Uganda in 1897 (Strickland, 2000) <sup>[3]</sup> and the etiological agent was characterized by MacCallum and others in Australia (MacCallum *et al.*, 1948) <sup>[4]</sup>. Since a great number of cases of the disease were identified in Buruli area of Uganda, it is referred to as Buruli ulcer (Clancy *et al.*, 1962) <sup>[5]</sup>. It is the third most common mycobacteriosis after tuberculosis and leprosy (Bratschi *et al.*, 2013). The infection leads to the destruction of skin and soft tissue, presenting as large ulcer usually on the limbs (Ukwaja *et al.*, 2016) <sup>[6]</sup>.

Clinically, Buruli ulcer starts with a papule, nodule, plaque, or edematous lesion that eventually progress to extensive skin ulceration. Remarkably given the extent of tissue loss, the lesion is usually painless or only with limited pain. Unlike other *Mycobacteria*, unique aspect of BU is that the pathology of the disease can be ascribed to its lipid-like and diffusible exotoxin, mycolactone and not the organism itself.

Due to the ugly appearance of the deformities it leaves, Buruli ulcer is greatly feared and stigmatized in the endemic areas, and is often attributed to witchcraft and curses (Stienstra *et al.*, 2002) <sup>[7]</sup>. Patients tend to be socially alienated. Since the treatment costs are extremely high, the appropriate medical care is not affordable for most local residents without financial support to either the health facilities or patients (Asiedu & Etuaful, 1998) <sup>[8]</sup>.

Buruli ulcer occurs in patchy foci in at least 27 countries in Africa, Asia, South America, and the western Pacific. The precise current distribution is not known (WHO, 2000) and the incidence is probably underestimated. The majority of the reported cases are from west and central Africa: Benin (Muelder and Nourou, 1990) <sup>[10]</sup>, Côte d'Ivoire (Marston *et al.*, 1995) <sup>[11]</sup>, Gabon (Burchard & Bierther, 1986) <sup>[12]</sup>, Ghana (Addo, 1995; Amofah *et al.*, 1998) <sup>[13]</sup>, Liberia (Monson *et al.*, 1984) <sup>[15]</sup>, Nigeria (Oluwasanmi *et al.*, 1976) <sup>[16]</sup>, Uganda, (The Uganda Buruli Group, 1971) and Zaire (Oluwasanmi *et al.*, 1976) <sup>[16]</sup>, Togo (Meyers *et al.*, 1996). Uganda (The Uganda Buruli Group, 1971) and Zaire (Meyers *et al.*, 1974). Since Bayley reported the first case of Buruli ulcer identified in Ghana in 1971 (Bayley, 1971) <sup>[18]</sup>, awareness of the public health importance of the disease has been increasing (Van der Warf *et al.*, 1989; Addy, 1995; Amofah *et al.*, 2002) <sup>[19, 20]</sup>.

The majority of cases are seen in West Africa and in other tropical countries; however, the disease has also been reported in countries with subtropical and temperate climates. Imported cases have been reported from non-endemic countries, and this calls for more awareness among healthcare practitioners globally. While antibiotic therapy is available and usually effective, patients with severe forms or delayed therapy could be left with life-long disabilities and deformities. Early detection and treatment is currently the only measure to prevent deleterious consequences, especially in a disease that often affects children. Yet several unanswered questions remain which would be key to controlling this disease, including identification of the route(s) of transmission and some aspects of its pathogenesis (Rie *et al.*, 2018) <sup>[21]</sup>. This research thus seeks to make findings on the prevalence of Buruli ulcer in parts of Jigawa State.

## Methodology

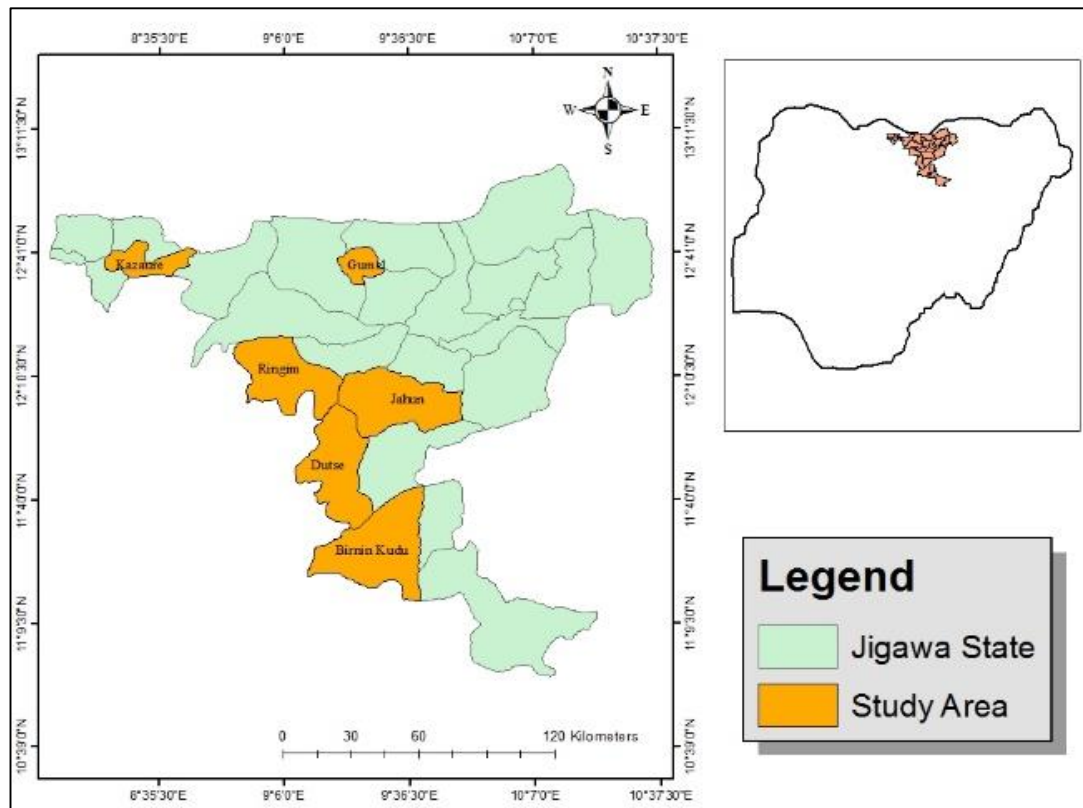
### Study design and study area

A cross sectional hospital based study was conducted. A representative samples from two (2) out of the three (3) senatorial districts was collected and analysed. The study adopts a prospective method and questionnaire was issued to

each of the candidate selected for the study in order to capture their demographic history. The sample for this study was collected from some selected secondary healthcare the two senatorial districts selected for this study was Jigawa south west and Jigawa North west senatorial districts. Six secondary health care facilities were selected for this studies and they include: General Hospital Dutse, General Hospital Brinin Kudu, General Hospital Jahun, Genral Hospital Ringim, General Hospital Gumel and General Hospital Kazaure.

Jigawa State was carved from Kano State on 27 August 1991 as one of the additional nine states by the then military government. The state is situated in the north-western region of the country between latitudes 11.00°N to 13.00°N and longitudes 8.00°E to 10.15°E, it has share borders with Katsina and Kano from the west, from the north east it share boarder with Yobe state and from the east is Bauchi state, the state share international border with Niger republic from the north. The state has two seasons, October - May is dry seasons while June-September is a rainy seasons with high temperature of about 42<sup>0</sup>c while the state experienced lower temperature during the rainy season with 10<sup>0</sup>c (Okereke, Tukur, Oginni, & Obonyo, 2015). According to the population census of 2006 the state is 8th in terms of population with the 2,215,897 (51%) as males and 2,132,752 (49%) as female (Commission, 2006) Jigawa State is a rural state with about 85% of its population live in rural environment. The Bade language is spoken in Guri LGA, the Warji language is spoken in Birnin Kudu LGA, and the Duwai language is spoken in Hadejia LGA. Major languages are Hausa and Fulani.

Regarding the health sector, the state has three tiers of health facilities, the tertiary health facilities which is under the jurisdiction of the federal government (With only one federal Medical Centre) and secondary health facilities which is under the supervision of the state government (The state has 16 general hospital and one specialist hospital) while the primary health care is under the jurisdiction of the local government (Dogara & Ocheje, 2016; Makinde *et al.*, 2018) <sup>[22, 30]</sup>. Due to the poverty nature of the state, there were less private health facilities in Jigawa state. The ministry of health and agency for Primary Health care are responsible for executing and formulating policies related to health in the state and also translating federal government health policies for implementation. It worth noting that the state now operate under one roof system which a primary health (centre) is expected to be provided in each ward of the state (Makinde *et al.*, 2018) <sup>[30]</sup>.



Source: GIS unit, Department of Environmental Management and Toxicology, FUD

Fig 1: Map Showing Study Area

### Ethical Approval

The study was conducted under human right ethical approval sought from Jigawa State Ministry of Health with reference number: MOH/SEC.3/S/819/I, prior to start. Study protocol was submitted for approval by the ministry. Permission was sought from the Medical Directors of all the six (6) hospitals where this research was conducted. Sample collection from the participants was conducted following verbal and documented informed consents by each of the participant.

### Sample Size

The study adopts the purposive or judgmental sampling techniques in choosing members of the population for this study. A total of Three hundred and Eighty two (382) skin related ulcer patients were screened. Samples were collected from December 2019 through September 2021. Questionnaire were also administered to a total of four hundred and eighty (480) respondents across the local governments captured in this study.

### Screening of Samples for the Detection of *Mycobacterium Ulcerans*

#### Methodology

Microscopic diagnoses by direct smear examination with Ziehl-Neelsen staining to detect the presence of acid-fast bacilli was done using the quantification of smears in accordance with the method locally used for the diagnosis of TB (WHO: *Diagnosis of Mycobacterium ulcerans Disease*, 2001).

1. Using a sterile swab stick, ulcerative lesion from suspected wound patient was collected and then smeared on a clean grease free slide using sterile technique.
2. The smear was allowed to air dry and it was heat fixed

3. by passing through an open flame
3. The smear was covered with the carbol fuchsin stain.
4. The stain was heated until vapour begin to rise for 5 minutes
5. The smear was washed with clean water.
6. 3% v/v acid alcohol was applied to the smear for 5 minutes in order to decolourise the smear to pale pink colour
7. The smear was rinsed with clean water
8. malachite green stain was applied to the smear and allow for 2 minutes
9. The stain was rinsed with clean water
10. Back of the slide was wiped to clean and was then place in the rack in order for the smear to air- dry
11. The smear was examine microscopically, using the 100 X oil immersion objective.

### Statistical Analysis

Results from the test analysis and data from questionnaires were reduced to percentages and presented on tables. Statistical analysis was done using SPSS version 22 software package. Chi Square ( $\chi^2$ ) analysis was used to test for significance. The statistical significance was determined at 5 % probability ( $P \leq 0.05$ ).

### Results

Three hundred and Eighty two (382) patients with skin related ulcer suspected to be Buruli ulcer were collected using sterile swab stick and screened by the Ziehl Neelsen Staining method for detection of *Mycobacterium species*. None of the patient samples appeared to be positive across board. This implies there is no Buruli Ulcer in parts of Jigawa state where

this study was conducted. The respondent's feedbacks on the administered questionnaire was used to determine knowledge, attitudes, perceptions and risk factors for Buruli Ulcer in this study. Four hundred and eighty (480) questionnaire were administered to respondents across the communities (six local government areas) captured in this study

The outcome of the prevalence study and the administered questionnaires can be seen in the tables below.

**Table 1:** Prevalence of Buruli Ulcer In Relation to Age Group

Age Group (Years)	Number Tested	Number of Positive	Percentage positive (%)
0 – 5	13	0	0
6 – 11	48	0	0
12 – 17	127	0	0
18 and Above	194	0	0
Total	382	0	0

**Table 2:** Prevalence of Buruli Ulcer Based on Gender

Gender	Number Tested	Number of Positive	Percentage Positive (%)
Male	265	0	0
Female	117	0	0
Total	382	0	0

**Table 3:** Prevalence of Buruli Ulcer Based on Health Facility

Health Facility	Number Tested	Number of Positive	Percentage Positive (%)
Brinin Kudu GH	67	0	0
Dutse GH	60	0	0
Gumel GH	60	0	0
Jahun GH	65	0	0
Kazaure GH	65	0	0
Ringim GH	65	0	0
<b>Total</b>	<b>382</b>	<b>0</b>	<b>0</b>

**Table 4:** Socio-Demographic Characteristics of Respondents from the Communities

Variable	Frequency	Percent (%)	Cumulative Percent
<b>Age (Years)</b>			
17-20	82	17.1	17.1
21-24	150	31.3	48.3
25 and Above	248	51.7	100.0
<b>Local Government Area</b>			
Dutse	80	16.7	16.7
Jahun	80	16.7	33.3
Brinin Kudu	80	16.7	50.0
Ringim	80	16.7	66.7
Kazaure	80	16.7	83.3
Gumel	80	16.7	100.0
<b>Gender</b>			
Male	352	73.3	73.3
Female	128	26.7	100.0
<b>Marital Status</b>			
Single	132	27.5	27.5
Married	334	69.6	97.1
Divorced	14	2.9	100.0
<b>Education</b>			
Primary	17	3.5	3.5
Secondary	178	37.1	40.6
Tertiary	208	43.3	84.0
Islamic EDU	77	16.0	100.0
<b>Occupation</b>			
Civil Servant	144	30.0	30.0
House Wife	48	10.0	40.0
Trader	166	34.6	74.6
Farmer	112	23.3	97.9
Fishermen	10	2.1	100.0
<b>Number of Years Spent in the Community</b>			
6-10	40	8.3	8.3
11-15	98	20.4	28.7
16-20	246	51.2	80.0
21 and Above	96	20.0	100.0

**Table 5:** Respondents Knowledge of BU from the Communities

Variable	Frequency	Percent (%)	Cumulative Percent
<b>Do you Know BU</b>			
Yes	376	78.3	78.3
No	104	21.7	100.0
<b>Local Name of BU</b>			
Cihon daji	285	59.4	59.4
Gyambo	115	24.0	83.3
Kankare	49	10.2	93.5

Kutirta	13	2.7	96.3
Don't know	18	3.8	100.0
<b>Etiology of BU</b>			
Contaminated water	72	15.0	15.0
Insect bite	80	16.7	31.7
Animal bite	22	4.6	36.3
Spirit	186	38.8	75.0
Don't know	120	25.0	100.0
<b>Is Bu a Health Problem in your Community</b>			
Yes	140	29.2	29.2
No	340	70.8	100.0
<b>Can BU be Transmitted from Person to Person</b>			
Yes	186	38.8	38.8
No	294	61.3	100.0
<b>Can BU be Cured</b>			
Yes	436	90.8	90.8
No	44	9.2	100.0
<b>If Yes What is the Correct Curative Measures</b>			
Orthodox medicine	160	33.3	33.3
Herbal medicine	196	40.8	74.2
Spiritual products	124	25.8	100.0

Table 6: Respondents Attitude towards BU Patients in the Community

Variable	Frequency	Percent (%)	Cumulative Percent
<b>Have you seen someone with Buruli Ulcer Before</b>			
Yes	416	86.7	86.7
No	64	13.3	100.0
<b>Do you think Buruli Ulcer Patients are regarded as normal People in the Society</b>			
Yes	78	16.3	16.3
No	402	83.8	100.0
<b>Where do infected Persons seek treatment for BU Disease</b>			
Hospital	56	11.7	11.7
Herbalist/native home care	402	83.8	95.4
Religious home	22	4.6	100.0
<b>Will you allow your children/family member interact freely with BU Patient</b>			
Yes	184	38.3	38.3
No	296	61.7	100.0
<b>Do you think there are Traditional or Superstitious Believe Attributed to Bu</b>			
Yes	458	95.4	95.4
No	22	4.6	100.0
<b>Do you think BU Patient should be allowed in School or Public Places</b>			
Yes	110	22.9	22.9
No	370	77.1	100.0

Table 7: Perception, Practices and Risk Factors Associated with Buruli Ulcer Disease in the Communities

Variable	Frequency	Percent (%)	Cumulative Percent
<b>What are your sources of water</b>			
Pipe borne water	218	45.4	45.4
River	8	1.7	47.1
Well	16	3.3	50.4
Hand pump/well	238	49.6	100.0
<b>Do you Participate in Activities such as swimming, fishing, Wading or Similar activities</b>			
Yes	162	33.8	33.8
No	318	66.3	100.0
<b>Are you residing close to water bodies or wetlands</b>			
Yes	150	31.3	31.3
No	330	68.8	100.0
<b>Do you Practice Irrigation or Artificial dam for related occupation</b>			
Yes	410	85.4	85.4
No	70	14.6	100.0
<b>Do you consider BU supernatural illness and not medical condition</b>			
Yes	416	86.7	86.7
No	64	13.3	100.0
<b>Do you use herbal remedies for the treatment of injuries like BU</b>			
Yes	472	98.3	98.3
No	8	1.7	100.0

If yes what type of herbal remedies			
Root herbs	46	9.6	9.6
Powdered leaves	104	21.7	31.3
Combination of herbs	260	54.2	85.4
Herbal ointment	70	14.6	100.0

**Table 8:** Relationship between Socio-demographic Characteristics of Respondents and Knowledge of Respondents on Buruli Ulcer

Variables	Chi-Square ( $X^2$ )	D.F	P-value	Decision
Age	94.474**	8	0.021	S
LGA	14.248	20	0.818	NS
Gender	41.363**	4	0.043	S
Marital Status	60.705**	8	0.014	S
Education	100.266**	12	0.039	S
Occupation	80.796**	16	0.018	S
Number of Year Spent in the Community	64.738**	12	0.009	S

Source: Field Survey, 2021

\*\*r is significant @ 0.05 level

Key: S: Significant, NS: Not Significant

**Table 9:** Relationship between Socio-demographic Characteristics of Respondents and Attitudes of Respondents towards Buruli Ulcer

Variables	Chi-Square ( $X^2$ )	D.F	P-value	Decision
Age	62.670**	8	0.016	S
LGA	32.257**	20	0.042	S
Gender	30.237**	4	0.006	S
Marital Status	56.873**	8	0.001	S
Education	101.053**	12	0.036	S
Occupation	415.281**	16	0.040	S
Number of Year Spent in the Community	143.241**	12	0.028	S

Source: Field Survey, 2021

\*\*r is significant @ 0.05 level

Key: S: Significant, NS: Not Significant

**Table 10:** Relationship between Socio-demographic Characteristics of Respondents and Perception, Practices and Risk factors of Respondents on Buruli Ulcer

Variables	Chi-Square ( $X^2$ )	D.F	P-value	Decision
Age	60.579	18	0.018	S
LGA	87.676	45	0.046	S
Gender	49.592	9	0.007	S
Marital Status	107.489	18	0.039	S
Education	132.657	27	0.041	S
Occupation	280.233	36	0.011	S
Number of Year Spent in the Community	168.869	27	0.015	S

Source: Field Survey, 2021

\*\*r is significant @ 0.05 level

Key: S: Significant, NS: Not Significant

## Discussion

This research reports the prevalence of Buruli Ulcer in parts of Jigawa State, with the view to also assess Knowledge, Attitude, Perception and risk factors for Buruli Ulcer Disease. Three Hundred and Eighty two (382) skin related Ulcer patients were screened for Buruli ulcer disease and the results were all negatives. This prevalence rate of 0% indicates that there is no BU in parts of Jigawa State, where this study was conducted. The result in this study differs with the crude prevalence of 18.7 per 100,000 in the study communities and much higher rate 41.4 per 100,000 in Ogoja (Ukwaja *et al.*,

2016) [6]. This study also agrees with one of the commonly held notions by health policymakers in Nigeria is that BU disease is not endemic in the country (Ukwaja *et al.*, 2016) [6]. However the result in this study is closely related to the number of cases from the following regions, Nkpo Hamida village, Igbo-Eze North Local Government Area of Enugu State (1 case); Iburu village, Ohaozora Local Government Area of Ebonyi State (1 case), Akoku village, Ikwo Local Government Area of Ebonyi State (1 case); Amazonze village, Nkanu East Local Government Area of Enugu State (1 case); Okro Mbokho village, Eastern obolo, Akwa Ibom State (1 case); Oron village, oron Local Government Area of Akwa Ibom State. (1 case); and (1 case) in Ugwu Tank, Awka South Local Government Area of Anambra State (Okechukwu *et al.*, 2007).

BCG is the only vaccine available for prevention of BU although there is conflicting reports on its effectiveness. Portales reported the protective effect of neonatal BCG vaccination against severe forms of BU disease (Portales *et al.*, 2004). The zero prevalence of BU in parts of Jigawa may be attributed to the administration of BCG vaccine as a component of routine immunization schedule. Case management with the use antibiotics in form combination therapy like daily intramuscular streptomycin and oral rifampicin for 8 weeks for all stages of BU disease may also be responsible for the zero prevalence.

Regarding the respondent's knowledge of BUD, 376 (78.3%) knew Buruli ulcer suggesting that many are aware of BUD in the study area, this is similar to a study by Charles *et al.*, 2019. Based on individual's opinion of the local names of Buruli ulcer, the respondents gave the following as the local names of Buruli ulcer; Cihon daji 285 (59.4%), Gyambo 115 (24.0%), Kankare 49(10.2%), Kutirta 13(2.7%) and don't know 18(3.8%). In respect of the etiology of Buruli ulcer disease, the following were captured; Contaminated water 72(15.0%), Insect bites 80(16.7%), Animal bites 22(4.6%), Spirit 186(38.8%) and don't know 120(25.0%). It was observed that 140(29.0%) accepted that Buruli ulcer is a health problem in their communities and 340(70.8%) stated that Buruli ulcer is not a health problem in their communities, this may relatively be a reason for the zero prevalence results obtained in this study. Regarding the respondent's knowledge on the transmissibility of the disease, 186(38.8%) revealed that the disease can be transmitted from person to person whereas 294(61.3%) revealed that the disease cannot be transmitted from person to person. Respondents knowledge on the curability of Buruli ulcer disease also gave that 436(90.8%) admit Buruli ulcer disease can be cured while 294(9.2%) disagree that Buruli ulcer cannot be cured. Respondents who agreed BUD is curable gave the following as the curative measures; orthodox medicine 160(33.3%), herbal medicine 196(40.8%) and spiritual approach 124(25.8%) as shown in Table 4.5. Based on these outcomes, respondents can be said to have poor knowledge of Buruli ulcer disease. The poor knowledge of the respondents from community study is not surprising because BU is not endemic in Jigawa State, this also in conformity with (Renzaho *et al.*, 2007) [24], who reported a high level of awareness of the

disease in an endemic area.

In respect of respondent's attitudes towards BU patients; it was revealed that 86.7% have seen someone with Buruli Ulcer Disease. The attitude of respondents towards BU patients from the community could be rated very poor, as majority of the respondents admits BU patient should seek treatment from Herbalist/Native home care (83.8%). Majority of the respondents (95.4%) also agree BU is attributed to superstitious beliefs as well as BU patient should not be allowed in school and public places, Table 4.6. This findings concur with the findings of Akoachere *et al.*, 2016.

Regarding perception, practices and risk factors associated with Buruli Ulcer Disease, this finding reveal (85.4%) of the respondents to have perceived Buruli Ulcer Disease not a medical condition but a supernatural illness. Table 4.7. The practices and risk factor seen in this study include (98.3%) admitting to the use of herbal remedies for the treatment of skin related injuries like BU and (85.4%) practicing irrigation or artificial dam for related occupation, Table 4.7.

On the basis of the respondent's knowledge of Buruli ulcer disease, there is a significant relationship between the socio-demographic characteristics of respondents and the knowledge of respondents on BU except for the local government area with a P-value greater than the critical p-value of 0.05 as seen in Table 4.8.

There also exist a significant relationship between the socio-demographic characteristics and the attitude, perception, practices and risk factors for BU, (Table 4.9, and Table 4.1.0).

### Conclusion

Findings made from this study reveal zero prevalence of Buruli Ulcer in the study areas. However, the research clearly indicates the huge gap in public awareness of BU disease in the study area which may be indirectly related to the zero prevalence of the disease. Although the outcome of the questionnaire survey shows participants had a high level of awareness of the disease, this study also revealed misconceptions about its etiology and transmission which may greatly influence treatment seeking behavior and the possibility of showcasing negative attitude and odd perception towards BU patients where it may exist. This could also expose them to infection. Proper community education is therefore needed to correct the misconceptions about BU in study areas for any public health intervention targeting disease eradication.

### Recommendation

In this study sampling for Buruli Ulcer Disease was centered to hospital based findings. More research should be conducted with emphasis on sampling from the community. Donor agencies should provide grants to support individuals having interest in neglected tropical disease such as Buruli Ulcer.

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