SCREENING FOR THE REEMERGENCE OF YAWS IN NIGERIA

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ABSTRACT

The objective of this study was to screen for re-emergence of yaws in Nigeria. Written informed consent and questionnaire were administered to residents in 32 communities within Adamawa state with climatic possible to support the growth of *Treponema pallidum pertenue*. Descriptive statistics were used for the frequency analysis while multiple linear regression was used to predict how well cases of yaws is explained by age, gender, occupation and use of antibiotics for the analytical epidemiological studies. From the questionnaire, those presumed to be cases of yaws were tested serologically with syphilis strip. A total of 461 individuals participated. Slightly more male (n = 265, 57.5%) were included than female (n = 196, 42.5%), and more of children (aged 15 and below, n = 343, 74.4%). Despite high presumptive cases of yaws (n = 297, 64.4%), only 3.7% (n = 17) was reactive to serological test strip. Quite a number of respondents (n = 198, 43.0%) used/using antibiotics especially with the onset of papule. There is a direct linear relationship between 'Presumptive case of yaws' with each of the independent variable (Age, Gender, Occupation and Use of antibiotics), however only those of 'Occupation' and 'Use of antibiotics' have significant relationship (p = 0.008 and p = 0.0001 respectively).

INTRODUCTION

Yaws is one of the common skin-related neglected tropical diseases (NTDs) that afflicts all human health[1]. Despite being eradicated in Nigeria since the 1950s, there possibly exists a benign transmission of yaws in the country, especially in Adamawa State, looking into the fact that the state is humid tropical region and borders countries such as Cameroon, where the disease was reported to have re-emerged[2]. There was reported 64 unconfirmed cases of yaws in the state [3]. Yaws is an infectious disease caused by a Gram negative, spiral-shaped bacterium called *Treponema pallidum pertenue*. This bacterium is closely related to other pathogenic subspecies of *Treponema pallidum*, among which include *Treponema pallidum pallidum*, *Treponema pallidum endemicum*, and *Treponema carateum*. They are morphologically and serologically identical[4], but can be differentiated by the clinical manifestations of their respective diseases[5], [6].

Indiscriminate use of antibiotics within and among populations and communities may not to be unconnected to the delay in establishing a confirmed case yaws in Nigeria. *Treponema pallidum pertenue* (the causative agent of yaws) is sensitive to cool and dryness and susceptible to benzylpenicillin[2]. Skin examination offers an opportunity to screen people and to identify multiple conditions in a single visit. An integrated approach in communities and schools can potentially reduce costs and cut down delays in diagnosis as well as promote skin health for all[1]. Yaws is transmitted by direct skin-to-skin, non-sexual contact with infectious lesions. The incidence of yaws skin lesions is higher in the wet season than in the dry season[7], high humidity promotes exuberant growth of papillomata and survival of treponemes in serous exudates, which increases infectiousness and transmission.

Since the eradication of yaws in the 1950s, re-emergence of the disease is yet to be established in Nigeria, despite confirmed re-emergence in neighbouring counties like Cameroon and Benin[2]. New eradication campaign is already ongoing in some countries such as Ghana[8]. Movement of people across these countries is a high risk factor to reintroduce the disease in Nigeria. The disease is mostly pronounce among farmers [3], children of less than 15 years of age and villages where there is poor personal and environmental sanitation[2]. About 75% of new cases are in individuals younger than 15 years while children aged 2–15 years are the main reservoir of infection[7], [9]. Therefore, these factors in addition to clinical signs and symptoms of the disease were used for the massive screening of yaws in the state. The overall objective of this exercise was to screen communities for re-emergence of yaws in Nigeria.

MATERIALS AND METHODS

The questionnaire

The questionnaire captured key clinical signs and symptoms of yaws, especially those differentiating it from syphilis – its closest counterpart. Thus, those respondents' questionnaires indicating possibility of yaws were blood sampled for serological test. The questionnaire consists of three sections; A. demographic data, B. potential clinical signs and symptoms of yaws and C. consideration for serological test. Data were collectedon demographics, including gender, ethnicity, religion, age, marital status, education achieved and occupation. Signs such as presence of papule, its characteristics like moist red base, yellow crust, associated fever, fever duration, papule association with raining season and method of treatment if any. Also considered is thehabit of antibiotics usage either for papule treatment or for any other reason and leisure activities to establish route of spread. It spreads by skin-to-skin contact [2]. Section C is assess by the research assistant based on symptoms observed in section B, whether it is presume yaws case, if yes, then blood was sampled for serology.

Prior to conducting the fieldwork, research assistants received training on how to approach and penetrate the community in addition to teamwork skills to work with the community assistant corps. They also received technical know-how on administering the questionnaire. The questionnaire was written in English Language, however, where necessary, it was explained in local language for proper information presentation. All data collected were carefully entered and analysed using IBM SPSS statistics software 21 (USA).

Data collection

This was a cross-sectional survey of some villages within Adamawa State that have characteristics of harbouring *Treponema pallidum sub-species pertenue* as earlier reported by Marks et al., (2015).A sample size of 376 was calculated using Cochran's formula, and then about 30% was considered for possible case of yaws among adult. A total of 32 village communities across 10 Local Government Areas within Adamawa State were considered. We calculated a sample size of 376 based on Cochran's formula, with a 95% confidence interval, error margin of 5%, and under 15 years as statistics (Obtained from the state census population of 2006) as the proportion of the population, and then about 30% was considered for possible case of yaws among adult. Thus, a total of 461 questionnaires were administered to individuals across the state.

Ethical approval

This study was reviewed and approved by the Adamawa State Ministry of Health Research Ethics Committee (Ref. no.:S/MoH/1141/I). Written informed consent forms were obtained from the respondents, their parents or representatives, because some of the respondents cannot read. However, their verbal consent was obtained from them. The data collection instrument for this study was a self-administered questionnaire, which was carefully filled and confirmed by a research assistant. Privacy and confidentiality of all information obtained were ensured both during and after the study process. Individuals were not identified in any publication or report base on this information. Information obtained was used strictly for the purpose of the research.

Serological test

Intravenously, approximately 2 ml of blood sample was collected from any respondent with suspected case of yaws disease. The blood sample as allowed to sediment in sterile heparinized tube and the plasma was used for serological test using VDRL strip kit.

Data analyses

Quantitative data were analysed with the use of descriptive statistics. Categorical variables were transformed to dummy variables for the analyses. Multiple linear regression was used to predict relationships between 'presumptive case' of yaws and demographic variables, including age, gender, level of education, occupation as well as use of antibiotics and also predict their effect on the presumption of yaws cases.

RESULTS

Background characteristics of respondents

A total of 461 individuals participated. Slightly more male (n = 265, 57.5%) were includedthan female (n = 196, 42.5%), and more of children (aged 15 and below, n = 343, 74.4%). Despite high presumptive cases of yaws (n = 297, 64.4%), only 3.7% (n = 17) was reactive to serological test strip. Quite a number of respondents (n = 198, 43.0%) used/using antibiotics especially with the onset of papule (Table 1).

Table 1: Demographic characteristics

S/N	Characteristics	Variable	Actual number (n)	Percentage (%)
1.	Gender	Male	265	557.5
		Female	196	42.5
2.	Age (Transformed)	Children (≤ 15)	343	74.4
		Adults	118	25.6
3.	Presumptive case	Yes	297	64.4
		No	164	35.6
4.	Serologically reactive	Yes	17	03.7
		No	381	82.6
		Not applicable (No symptoms)	63	13.7
5.	Occupation	Farmers	25	05.4
		Students	239	51.8
		Others	27	05.7
	(Civil servants, Business, House wives)			
		None	170	36.9

Prediction model

Although the model explains only 12.8% ($R^2 = 0.128$) variability in presumptive case of yaws per individual, overall the regression model is of good fit ($F_{(4, 442)} = 16.292$. $p = 0.0001$). There is a direct linear relationship between 'Presumptive case of yaws' with each of the independent variable (Age, Gender, Occupation and Use of antibiotics), however only those of 'Occupation' and 'Use of antibiotics' have significant relationship ($p = 0.008$ and $p = 0.0001$ respectively) (Table 2).

Regression model

Presumptive yaws case is predicted as = 0.602 + (0.313*antibiotic intake) + (0.037*age) + (0.025*gender) + (0.053*occupation)

Table 2: Potential factors predicting the possibility of yaws

Factors	Adjusted β	95% CL	t-test	P-value	VIF
Transformed Age	0.037	-0.065-0.139	0.710	0.478	1.060
Gender	0.025	-0.061-0.112	0.577	0.564	1.054
Transformed Occupation	0.053	0.014-0.092	2.685	0.008	1.131
Antibiotics Usage [a]	0.313	0.234-0.392	7.782	0.000	1.018

a. Predictors: (Constant), have you taken any antibiotic drug since the time you started to see papule/ulcer on your body? , Gender, Transformed age, Transformed occupation

Serologically reactive cases

Among the 17 individuals respondents found to be serologically reactive, 82.4% were children of age 15 and below. Those respondents with occupation 'None' constitute 64.7% of the population while slightly weight number to those respondents (n = 9, 52.9%) used/using antibiotics especially with the onset of papule (Table 3).

Table 3: Descriptive analysis of the yaws cases

S/N	Characteristics	Variable	Actual number (n)	Percentage (%)
1.	Gender	Male	8	47.1
		Female	9	52.9
2.	Age (Transformed)	Children (≤ 15)	14	82.4
		Adults	3	17.6
3.	Presumptive case	Yes	9	52.9
		No	8	47.1
4.	Serologically reactive	Yes	17	03.7
		No	381	82.6
		Not applicable (No symptoms)	63	13.7
5.	Occupation	Farmers	0	0
		Students	5	29.4
		Others	1	05.9
	(Civil servants, Business, House wives)			
		None	11	64.7

DISCUSSION

The collaboration between neglected tropical disease experts and dermatologists provide integrated approach in communities and schools so as to reduce delays in diagnosis, promote skin health for all as well as cut down cost (1). For researchers, this collaboration offers an opportunity to screen people and to identify multiple conditions in a single visit. There is a possibility that this is the first study that has explored communities in Nigeria for re-emergence of yaws and provides first line data on yaws screening in the country. There is every possibility to expect re-emergence of yaws in Nigeria, since it has been reported in many countries including those neighbouring Nigeria. It is well known that migration of people from yaws-endemic areas to other countries may introduce the disease (2).

In this study, massive community screening among villages/communities in Adamawa State was carried out which targeted residential areas so as to get maximum cooperation and full participation. It also gave an advantage to sample members of the same family and their close associate looking into direct contact, crowded environment etc, as modes of transmission of this disease. As with many other sub-Saharan African countries, few dermatologists exist in the state (10), therefore, curtailing skin diseases become a challenge. For that, the research designed questionnaires based on skin signs and symptoms of yaws to deal with the menace.

Skin diseases most commonly share similar signs and symptoms, which if extra care is not taken, mistaking one disease for another is very possible. Yaws is a disease caused by *Treponema pallidum pertenue;* therefore, it is reactive to treponemal serological kit (2). Here, we reported base on signs and symptoms, 297 (64.4%) presumptive cases but only 3.7% (n = 17) were serologically reactive. According to previously published accidentally encountered unconfirmed cases of yaws in Adamawa state, the disease is more pronounce among farmers (3). On the contrary, this study presents no serologically reactive case is found among farmers, despite high number of presumptive cases. The disease is rarely fatal, however, it can lead to chronic disfigurement and disability which in turn affect the patients' individual productivity and add to general economic burden.

Although, occupation explained 5.3% of case of yaws at a significant relationship (*p* = 0.008) (Table 2) and 64.7% of reactive cases were from those with occupation 'None'. This may not be unconnected to the fact that majority of the reactive cases are from children who are still under the care of their parents/guardians. Looking at Table 1, 51.8% of the whole respondents were students (Primary and Secondary Schools Pupils) who are yet to be responsible individuals.

One important characteristics of yaws reported in literatures is that, the disease is most common among children of less than 15 years of age (2), (11). This made the study to capture age as a critical variable that was collected raw and then transformed into 'children of age 15 and below' and 'adults' during the statistics analyses which revealed more reactive cases among children (n = 14, 82.4%). This conforms to literatures; however, it predicted only 3.7% of yaws case. Peak incidence occurs in children aged 6-10 years affecting both males and females with no race is exempted (12). This study also showed relatively equal number of male and female reactive cases with the least predictive value of 0.25%.

Treponema pallidum pertenue (the causative agent of yaws) is sensitive to cool and dryness and susceptible to benzylpenicillin (2).

The disease was eradicated in the 1950s by penicillin administration (13), (14), while azithromycin is currently being use for global eradication in endemic countries (8), (14), (15). Indiscriminate use of antibiotics within and among populations and communities may not to be unconnected to the delay in establishing a confirmed case yaws in Nigeria. This study presented that 'use of antibiotics' alone as a variable predicted a 31.3 % of presumptive case of yaws at a significant relationship (p = 0.0001). It may delay time of establishment, but it cannot prevent it, because it was found among the serologically reactive cases, the use of antibiotics, either for treatment of yaws like cases or for other reasons. In this study however, indiscriminate use or abuse of antibiotics can be regarded as a factor attributed to the low percentage (3.7%) of serologically reactive cases encountered. It was hypothesized by Michael Marks et al., (2015) that use of antibiotics with treponemocidal activity (such as penicillin and azithromycin) may account for delayed they observed in late stage manifestation of yaws.

During the course of or community visits, it was observed that the Adamawa State Primary Healthcare Development Agency (AD-SPHCDA) and the Adamawa State Ministry of Health (SMoH), through the local government's primary health care authority executive secretaries and community corps are well recognised in communities. So, they have the capacity to be used in further screening, diagnosis and subsequent treatment and prevention of spread of yaws in the communities and the health workers are also very interested to do so. Yotsu et al. (2018) reported significant benefit from studies conducted in Mali (17) and impoverished states of Mexico (18) that utilised healthcare providers/workers and provided one-day training on skin diseases.

Conclusion

This study confirms previously suggested associations between age, antibiotics and infection while also highlighting the need to confirm definite cases of yaws in Nigeria and suggest management/eradication by using health works from SMoH in conjunction AD-SPHCDA. It is hoped that the study provides important epidemiological information relevant for establishing re-emergence of yaws cases in Nigeria. In conclusion, to our knowledge, this study was first to screen yaws in Nigeria on a relatively large-scale.

Acknowledgment

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