Incidence of Malaria: a comparative study among HIV sero-positive and HIV sero-negative persons in Plateau State.

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Abstract

Objective: Malaria and HIV/AIDS are two of the most common infections in sub-saharan Africa, an increased prevalence of malaria and increased parasite density in HIV- infected individuals could lead to increased malaria transmission affecting both HIV- positive and – negative individuals. The study aimed to determine and compare the incidence of malaria among HIV sero-positive and sero-negative persons in Plateau State.

Methods: A comparative cross sectional study conducted among HIV sero-positive and sero-negative persons in 2012 using quantitative method of data collection to determine the incidence of malaria.

Result: A total 84 respondents each participated in this study per group. The mean age of HIV sero-positive respondents was 33.9 ± 11.5 years while that of HIV sero- negative respondents was 36.0 ± 9.6 years which was comparable ($T = 1.34$; $df = 166$; $P = 0.184$). The incidence of malaria was 35.7% among the HIV sero-positive respondents as against 22.6% among the HIV sero-negative respondents ($x^2 = 3.49$; $P = 0.062$).

Conclusion: This study has demonstrated a higher incidence of malaria among HIV sero-positive person as compared to HIV sero negative individuals though not statistically significant.

Key words: Assessment, malaria, incidence, HIV sero-positive and negative

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Incidence du paludisme: une étude comparative entre les personnes séro-positives et séro-négatives dans l'Etat du Plateau.

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Résumé

Objectif: le paludisme et le VIH / SIDA sont deux des infections les plus courantes en Afrique subsaharienne, une prévalence accrue du paludisme et de la densité parasitaire augmenté dans infectés par le VIH des individus pourraient conduire à une augmentation de la transmission du paludisme affectant à la fois positifs et au VIH - les personnes négatives. L'étude visait à déterminer et comparer l'incidence du paludisme chez les personnes VIH-positives et séro-négative dans séro l'Etat du Plateau.

Méthodes: Une étude en coupe transversale comparative menée auprès de personnes séro-positives et séronégatifs en 2012 en utilisant la méthode quantitative de la collecte de données pour déterminer l'incidence du paludisme.

Résultat: Un total de 84 répondants chacun participé à cette étude par groupe. L'âge moyen des répondants de séropositivité était de $33,9 \pm 11,5$ années alors que celle des répondants négatifs de VIH a été de $36,0 \pm 9,6$ ans, ce qui est comparable (T = 1,34; df = 166; P = 0,184). L'incidence du paludisme était de 35,7% chez les répondants positifs du VIH, contre 22,6% chez les répondants négatif de la pandémie du VIH (de c 2 = 3,49; P = 0,062).

Conclusion: Cette étude a démontré une incidence plus élevée du paludisme chez les personnes séropositifs pour le VIH par rapport aux individus négatifs de VIH mais pas statistiquement significatives.

Mots clés: Évaluation, le paludisme, l'incidence, séro-positif et négatif

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INTRODUCTION

Malaria and HIV/AIDS are two of the most common infections in sub-Sahara Africa, an increased prevalence of malaria and parasite density in HIV- infected individuals could lead to increased malaria transmission in HIV- positive individuals (1,2).There are an estimated 40 million people infected with HIV with an annual mortality of three million (3). Moreover, there are over 500 million clinical malaria infections every year with more than a million deaths (3). Both infections are concentrated and overlapping in sub-Saharan Africa. Malaria and HIV are the two most common public health problems in sub-Saharan Africa with sheer consequences on health and productivity (3). Hence, this study was conducted to determine the incidence of malaria among HIV sero-positive and sero-negative persons accessing health care in a secondary health institution in Plateau State.

MATERIALS AND METHODS

Study Area: This is study was conducted in Seventh Day Adventist Hospital Jengre, Bassa LGA of Plateau state. Plateau State is located in North Central Zone of Nigeria. With an area of 26,899 square kilometres, the State has an estimated population of 3.2 million (4,5). It is bounded by Bauchi State to the Northeast, Kaduna State in to the Northwest, Nassarawa State to the Southwest and Taraba State to the Southeast. Plateau State has 17 Local Government Areas (LGAs) and 3 senatorial zones (4). There are a total of forty (40) health facilities offering HIV/AIDS treatment, care and support services in Plateau State of which 21 are secondary health facilities across all the 17 LGAs, 16 primary health facilities and 3 tertiary health facilities (4). Seventh Day Adventist (SDA) Hospital Jengre is one of the 21 secondary health facilities providing HIV/AIDS treatment, care and support services (4).

Study site: Seventh Day Adventist hospital is a mission hospital established in 1947 with current bed capacity of 75 and staff strength of 70 (6). It is a secondary health care institution which offers specialist and general medical care. The service units in the hospital are the Outpatient Department (OPD), Emergency Unit and comprehensive HIV/AIDS care unit. The hospital has a wide network of clients particularly in the northern part of the country (6). Seventh Day Adventist Hospital Jengre commenced provision of comprehensive HIV/AIDS services supported by APIN in the year 2004 with a total of 563 adults on Anti Retroviral Therapy (ART) as at the time of this study (6). The ART clinic runs on once a week (every Tuesday) while the OPD runs every day of the week except Saturdays (6).

Study Population: The study population comprised of HIV sero-positive persons receiving HIV/AIDS treatment, care and support services in Seventh Day Adventist Hospital Jengre as well as HIV sero-negative persons accessing medical care in the OPD of the hospital.

Study Design: This was a comparative cross sectional study conducted among HIV sero-positive and HV sero-negative persons using quantitative method of data collection in 2012.

Inclusion and Exclusion Criteria: HIV sero-positive persons who were 18 years and above residing in Bassa LGA who had been enrolled into adult ARV programme for twelve weeks and above and had commenced ARVs with no history of use of anti-malaria medication within the last one month were included in this study. While HIV sero-positive persons below 18 years of age residing outside Bassa LGA who had been enrolled into ARV programme for less than 12 weeks and had not commenced ARVs with history of use of anti-malaria medication within the last one month were excluded from the study. Twelve weeks was used as one of the criteria because the respondents would have made three consecutive visits to the hospital since enrollment and the respondents' contact would have been established by the hospital's home based care team.

Similarly, HIV sero-negative persons who were 18 years and above attending the OPD of Seventh Day Adventist Hospital for medical care residing Bassa LGA with no history of use of anti-malaria medication within the last one

month and with no known history of diabetes Mellitus (DM) were included in the study while HIV sero-negative persons below 18 years of age residing outside Bassa LGA with history of use of anti-malaria medication within the last one month and known history of DM were excluded from the study.

Sample Size Determination: The sample size was calculated using standard acceptable formula for a comparative study (7).

$$n = \frac{[2(Z + Z)^2 Pq]}{(d)^2}$$

Where   n is the minimum sample size

   Z is Standard normal deviate at 95% confidence interval which 1.96

   Z   is the statistical power of the test at 80% which is 0.84

$$P = \frac{p_1 + p_2}{2}$$

Where p_1 is the proportion of PLHIV with malaria parasitemia from a previous study which was 33.3% (8).

   p_2 is the of proportion of HIV negative respondent with malaria parasitemia from the same previous study which was 10.6% (8).

   q is 1-P

   d is $p_1 - p_2$

A minimum sample size of 84 per group was obtained after adjusting for possible non response and incomplete response.

Sampling Technique: A multi-stage sampling technique was used in selection of the LGA as well as the health facilities for this study.
Stage I
From the list of seventeen LGAs in Plateau State, Bassa LGAs was selected by balloting using simple random sampling technique.
Stage II
SDA Hospital was selected from the list of 3 secondary health facilities providing HIV/AIDS treatment, care and support services in Bassa LGA of Plateau State using simple random sampling technique by balloting.
Stage III
A list of 290 PLHIV who met the inclusion

criteria was drawn from the monthly clinic booking register of all the 563 clients accessing HIV/AIDS treatment care and support services at Seventh-Day Adventist Hospital. A computer generated table of random numbers using WINPEPI statistical software was used to select of 84 participants from the 290 eligible respondents.

   Similarly, a list of 125 HIV sero-negative persons who had met the inclusion criteria was drawn from the weekly booking clinic register of 194 clients who had attended the OPD 2 consecutive weeks prior to the commencement of the study. A computer generated table of random numbers using WINPEPI statistical software was used to select 84 participants from the 125 eligible respondents. The booking of these 194 clients was done by the attending physicians following the request of the principal researcher during the advocacy visit to the hospital requesting that all adult clients attended to in the OPD two consecutive weeks after the advocacy visit requiring follow up be booked for Wednesday of the third week for recruitment into the study.

Preparation for Data Collection: Advocacy visit was paid to the Medical Director and the management of the Seventh Day Adventist Hospital Jengre to solicit for the hospital's support. Four resident doctors from the Department of Community Medicine Jos University Teaching Hospital (JUTH) were trained as research assistants to aid with the administration of questionnaires. The tool of data collection was pre-tested in a secondary health in another LGA of the state. This helped in making appropriate corrections where necessary. All the 84 participants selected from the OPD had group counseling for HIV/AIDS Testing conducted by the counseling unit of the hospital with option of opting out of the HIV Counseling and Testing (HCT). HIV test was then done to ascertain their HIV status and all the 84 participants tested negative. The HIV testing for the respondents was done using Determine test kits (RDT) following the national guideline for HIV testing. Fasting blood sugar as a screening for DM was also conducted on all the 84 respondents using

glucometer device.

Ethical Consideration: Anonymity and confidentiality of the information obtained was assured and maintained. Ethical clearance was obtained from Ethical Review Committee of JUTH, Jos.

Data Collection Instrument: A semi – structured interviewer administered questionnaire was used to obtain information from the participants. This has two sections;
Section I: Bio-data – This comprised information on sex, age, highest level of education, marital status, religion, ethnicity and occupation of the participants.
Section II: Laboratory investigation – The assessment for the presence of plasmodium antigen among the participants was documented in this section duly authenticated by the attending laboratory scientist.

Data Collection: Four trained research assistants participated in the data collection after a detailed explanation as to the purpose of the study was given to all the eligible respondents and verbal as well as written informed consent was obtained from each subject before the administration of the questionnaire.

The laboratory investigation for the presence of plasmodium antigen detection was conducted using Rapid Diagnostic Test kits (RDTs) by two laboratory scientists from the public health laboratory of the Department of Community Medicine JUTH. RDT provided a more accurate result than presumptive diagnosis and could be used at any chosen location. RDTs gave results in about 15 minutes and so anti-malaria treatment was instituted promptly for the patients with positive RDT result. Artemisinin based anti-malaria was provided free for the respondents with positive result to RDT.

Data Analysis: Data analysis was done using Epi info™ statistical software package version 3.5.4 developed by CDC 1600 Clifton Rd. Atlanta, GA 30333 USA. Chi square statistical test was used to compare the incidence of malaria in the two groups and binary logistics regression was used to identify factor predicting incidence of malaria. Fisher's exact test was to correct for continuity where chi square statistical test was not valid. A 95% confidence level was used for the study and a $P < 0.05$ was considered statistically significant.

RESULT

A total of 168 respondents participated in this study, 84 HIV sero-positive and 84 sero – negative respondents respectively. The age range of the respondents in this study was $18 - 67$ years. The mean age of HIV sero-positive respondents was 33.9 ± 11.5 years while that of HIV sero-negative respondents was 36.0 ± 9.6 years which was comparable (T = 1.34; df = 166; P = 0.184). Sixty six (75.0%) and 60 (71.4%) of the HIV sero-positive and sero-negative respondents respectively were females. More than half (63.3%) of the HIV sero-positive respondents were married while 21 (25.0%) were widows. However, among the HIV sero-negative persons, 72 (85.7%) were married with only 6 (7.1%) as widows. Primary level of education had the highest frequency in the HIV sero-positive group with 39 (46.4%) while in the HIV sero-negative group secondary level of education accounted for 28 (33.3%). [Table 1]

The incidence of malaria was 35.7% among the HIV sero-positive respondents as against 22.6% among the HIV sero-negative respondents. This variation in incidence of malaria between these groups was not statistically significant ($x^2 = 3.49$; P = 0.062). [Table 2]

HIV status of the respondents was found to have statistically significant association with incidence of malaria as respondents with HIV sero-positive status having three time chance of developing malaria as against respondents with HIV sero-negative status (Odds ratio = 2.7; 95% CI = 1.0892; P = 0.0318) . Furthermore, widows in this study were least likely to have malaria when compared to others statuses of marriage (Odds ratio = 0.24; 95% CI = 0.0676 – 0.8789; P = 0.0310) [Table 3]

DISCUSSION

The respondents in this study were in the age range of 18 – 67 years in both groups. The findings of this study were similar to that of a study done in Beira Mozambique (9). Other studies conducted in Cameroon, Ethiopia and Uganda had findings showing age similarities with what was obtained in this study (10,11,12). This study had a more female respondents in both groups which is in agreement with findings of studies done in Nigeria, Cameroon, and Ethiopia which also had majority of the respondents as female (8,10,11,13).

Most of the respondents in both groups were married with about a quarter of the HIV sero-positive respondents being widows. This may be due to the fact that HIV infection might have caused high mortality among the partners of the HIV sero-positive respondents. A similar study conducted in Uganda among PLHIV also revealed that more than half of the respondents were widows (12) The similarity of this study with the Ugandan study further buttresses the fact that HIV/AIDS might have been responsible for the high mortality among the partners of the respondents.

The incidence of malaria was found to be higher in HIV sero-positive group compared to HIV sero-negative group. Although, this study could not ascertain the inherent biological and environmental factors responsible for this variation however, other similar studies conducted had reported higher incidences of malaria among HIV infected persons as compared to HIV negative persons (8,13,14,15,16). However, a Mozambican study reported a contrary result showing that the incidence of malaria was slightly lower among HIV infected persons as compared to HIV negative respondents (9). This higher incidence of malaria among HIV infected persons as seen in this study and other similar studies could be due to the effect of HIV infection on the immune system of the person due to its weakened ability to respond to the presence of Plasmodium species invasion thereby increasing the vulnerability to malaria. HIV sero-positive status was found to be associated with incidence of malaria while marital status (widows) had least likelihood of developing malaria in this study. Other Nigerian study reported finds different from what was obtained in this study as age and sex were found to have significant association with incidence of malaria (13).

Limitations of the study: The study could not compare the CD4 count and the incidence of malaria among the respondents in both groups as well as rule out other causes of immune-supresion other than DM among HIV negative respondents. It therefore opined that further studies will be conducted as follow up to this in the nearest future.

CONCLUSION

This study has demonstrated the variation in incidence of malaria in relation to HIV/AIDS status of the respondents however, it is opined that more studies should be conducted to establish if any biological and environment factors responsible for this variation.

Conflict of Interest: Authors declared that there was no conflict of interest

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Table1: Socio - demographic data of the respondents at baseline

Characteristics	HIV sero-positive (n = 84)		HIV sero-negative (n = 84)		x^2	df	P-value
	Freq	%	Freq	%			
Age group(yrs)							
18 – 27	30	35.7	20	23.8			
28 – 37	33	39.3	33	39.3			
38 – 47	9	10.7	19	22.6	7.17	4	0.127
48 – 57	6	7.1	9	10.7			
58 – 67	6	7.1	3	3.6			
Sex							
Female	66	75.0	60	71.4			
Male	18	21.4	24	28.6	1.14	1	0.285
Religion							
Christianity	68	81.0	72	85.7			
Islam	16	19.0	12	14.3	0.69	1	0.408
Marital status							
Single	9	10.7	6	7.1			
Married	54	64.3	72	85.7	11.51	2	0.003
Widowed	21	25.0	6	7.1			
Highest level of education							
No formal education	24	28.5	27	32.1			
Primary	39	46.4	24	28.6	11.29	3	0.010
Secondary	12	14.3	28	33.3			
Tertiary	9	10.7	5	6.0			
Occupation							
Artisan	21	25.0	16	19.1			
Civil Servant	6	7.1	9	10.7			
Farming	21	25.0	23	27.4			
Teaching	6	7.1	4	4.8	2.36	5	0.797
Trading	21	25.0	25	29.8			
Unemployed	9	10.7	7	8.3			

*= Fisher's exact

Table 2: Incidence of malaria

RDT result	HIV sero-positive		HIV sero-negative		x^2	df	P value
	Freq	%	Freq	%			
Positive	30	35.7	19	22.6			
Negative	54	64.3	65	77.4	3.49	1	0.062
Total	84	100.0	84	100.0			

Table 3: Factors associated with incidence of malaria

Factors	Odds ratio	95% Confidence Interval	P-value
Age			
28 – 37	0.4736	0.1565 – 1.4327	0.1857
38 – 47	0.8400	0.1893 – 3.7280	0.8186
48 – 57	0.6490	0.1247 – 3.3780	0.6075
58 – 67	0.5814	0.0883 – 3.8255	0.5726
18 – 27	1	-	-
Sex			
Male	1.0159	0.3565 – 2.8948	0.9765
Female	1	-	-
Marital status			
Single	0.6789	0.1143 – 4.0314	0.6700
Widowed	0.2437	0.0676 – 0.8789	0.0310
Married	1	-	-
Educational status			
Primary	0.4907	0.1771 – 1.3595	0.1709
Secondary	0.3782	0.1026 – 1.3936	0.1440
Tertiary	0.3732	0.0640 – 2.1776	0.2734
No formal education	1	-	-
Occupation			
Civil servant	1.4492	– 0.3116 6.7411	0.6361
Farming	1.3237	– 0.3233 5.4191	0.6966
Teaching	1.3169	– 0.1214 14.2906	0.8210
Trading	1.7728	– 0.4856 6.4717	0.3861
Unemployed	0.4751	– 4.4041 0.0513	0.5124
Artisan	1	-	-
HIV status			
Sero-positive	2.6637	0.3565 – 2.8948	0.9765
Sero-negative	1	-	-