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Evaluation of the factors that contribute to high prevalence of malaria in HIV Patients in Bushenyi District, Uganda

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ABSTRACT

Malaria remains the single main cause of ill health and death among HIV/AIDS patients in resource-poor countries worldwide. Malaria still remains a challenging infection affecting the lives of several HIV-infected persons in Uganda. Statistics from the Ministry of Health show that malaria is still the leading cause of death in Uganda, accounting for over 27% of deaths. Malaria prevalence in HIV-positive patients in Kyamuhunga Health Centre III is thought to be at 7.8% of the HIV-positive patients attending the clinic on a daily basis. This study therefore aimed at assessing the factors contributing to the high prevalence of malaria among HIV-positive patients attending the HIV Clinic at Kyamuhunga Health Centre III in Bushenyi District. The study covered a sample of eighty (80) respondents to gather primary data. A simple random sampling method was used to gather responses from patients. Questionnaires and an interview guide were used as data collection tools. Results indicated that the majority of the participants were female patients and malaria was dominant among HIV-positive patients aged 38-47 years. It was noted that the odds of having malaria also increased among patients with lower levels of education. It was also noted that more odds of having malaria were found among the majority of patients who were farmers and unemployed participants. Malaria infection was acquired with repeated exposure to malaria parasites especially for patients who did not use insecticide treated mosquito nets. It is noted that HIV-positive patients with malaria greatly acquired unbalanced immunity with relatively low CD4+ cell count and unbalanced hemoglobin levels, greatly affected by body pain and weakness, fever, headache, and variety issues of vomiting. Paracetamol, use of treated mosquito nets, clinical examination, and patient follow-up was shown to provide a beneficial effect in preventing malaria infection among HIV-positive patients. In conclusion, malaria infection is acquired from repeated exposure to malaria parasites especially for patients who did not use Treated mosquito nets which increased the susceptibility to new malaria infections among HIV-positive patients. The researcher, therefore, recommends that comprehensive health education, antiretroviral therapy, and malaria preventive materials such as insecticide-treated bed nets should be provided to reduce the prevalence of malaria among HIV-positive patients.

Keywords: Malaria, HIV patients, Treated mosquito nets, Antiretroviral therapy.

INTRODUCTION

Malaria is a life-threatening disease caused by parasites that are transmitted to people through the bites of infected female Anopheles mosquitoes [1-5]. It is a parasitic infection that attacks a person's red blood cells [4-8]. Malaria is one of the leading causes of death worldwide, especially in the developing world among young children and pregnant women [9-12]. It is estimated that 500 million clinical cases and about 3 million deaths occur every year due to malaria, with 90% of such deaths occurring in Sub-Saharan Africa [7-15]. Infections of HIV and malaria are among the two most important global health problems in developing countries [11-16]. Malaria is a protozoan disease caused by parasites called the genus

Plasmodium. It is the leading cause of death in children under the age of 5 years and pregnant women in developing countries [17-21]. HIV/AIDS is also one of the most destructive epidemics the world has ever witnessed [22-25]. HIV stands for human immunodeficiency virus; it is a virus that attacks the immune system, the body's natural defense system [25-30]. Without a strong immune system, the body has trouble fighting off disease [4]. Malaria and HIV infections are major public health problems in many parts of the world. Both infections kill millions of people each year with a disproportionately heavy burden on Africa, India, Southeast Asia, and South America [26-28]. Because of the high prevalence of HIV and malaria in sub-Saharan Africa, co-infections are common. Notwithstanding the public huge health burden presented by these two infections, their interaction is still not completely understood [31-36]. The geographic overlap between HIV-1 infection and malaria shows that particularly in eastern and southern Africa, has caused concern since the 1980s [36-40]. The degree of interaction between HIV-1 infection and malaria emerged during 1999–2009 and has been extensively reviewed for both nonpregnant and pregnant adult women [40-45]. As the number of malaria and HIV co-infection increased, it has become apparent that anti-retroviral drugs interact with the few anti-malaria drugs in use, complicating treatment efforts for both infections [46-50]. Malaria and HIV co-infection also result in interactions that adversely affect the outcome of both conditions, especially among pregnant women and infants born to HIV-infected mothers [50-56].

Statement of Problem

Statistics from the Ministry of Health [35] show that malaria is still the leading cause of death in Uganda, accounting for over 27% of deaths. Between 25 and 40% of outpatient visits at health facilities in the country are for malaria. For Ugandan children, pregnant women, the elderly, and HIV-positive individuals, malaria is the primary cause of death [36]. Further to this, a number of researchers have reported the negative effect of malaria on HIV-positive patients [37]. Malaria contributes to a temporary increase in viral load among HIV-infected people which may worsen clinical disease and increase mother-to-child transmission and transmission in adults [27]. Upon examining patients' register books at Kyamuhunga Health Centre III, 7.8% of HIV-positive patients who attend the clinic on a daily basis are co-infected with malaria [38], however, there is a dearth of information on the collective impact of HIV-malaria co-infection on the hemoglobin levels in the general population. Although malaria and HIV are major causes of morbidity and mortality in Uganda, the burden of malaria-HIV co-infection in the Bushenyi District is not well documented. The researcher, therefore, is interested in studying the factors contributing to the prevalence of malaria among HIV-positive patients in Kyamuhunga Health Centre III in Bushenyi District and determining approaches to treat and prevent the prevalence of malaria among HIV-positive patients.

Aim of the Study

To assess the factors contributing to the high prevalence of malaria among HIV patients attending the HIV Clinic at Kyamuhunga Health Centre III in Bushenyi District.

Specific Objectives of the Study

- To examine the factors associated with malaria infections in HIV-positive patients attending HIV Clinic at Kyamuhunga Health Centre III in Bushenyi District.
- To find out the effect of malaria on HIV- positive patients attending HIV Clinic at Kyamuhunga Health Centre III in Bushenyi District.
- To assess the treatment and prevention measures that can be put in place to control the prevalence of malaria among HIV-positive Patients.

Research Questions

- What factors are associated with malaria infections in HIV Positive patients attending HIV Clinic at Kyamuhunga Health Centre III in Bushenyi District?
- What is the effect of malaria on HIV-positive patients attending the HIV

Clinic at Kyamuhunga Health Centre III in Bushenyi District?

- What treatment and prevention measures have been put in place to control the prevalence of malaria among HIV- positive Patients?

Justification of the Study

Previous epidemiological and biomedical studies conducted tended to be characterized by a single disease approach. However, HIV-infected patients who are already faced with poverty, discrimination, and other forms of violence in rural areas remain an understudied group. Accordingly, the burden of malaria-HIV co-infection in Bushenyi District is not well documented yet HIV-positive patients are at heightened risk of malaria, and various infectious diseases [39]. Therefore, this study focused on establishing the factors contributing to the prevalence of malaria among HIV patients attending the HIV Clinic at Kyamuhunga Health Centre III in Bushenyi District.

METHODOLOGY

Research Design

This study was a cross-sectional, descriptive study designed to investigate malaria prevalence among HIV+ patients. This research design was chosen because it helped the researcher to study the phenomenon among different respondents at a single point in time. The design was selected because it was a method of investigation in which data was got from selected blood samples whose response representation respectively gave a clue to the views of the population.

Area of Study

The study was conducted at Kyamuhunga Health Centre III in Bushenyi District. Bushenyi district in South Western Uganda is bordered by Kasese District to the north, Kamwenge District and Ibanda District to the northeast, Mbarara District to the east and the south-east, Ntungamo District to the south, Rukungiri District to the southwest and the Democratic Republic of the Congo to the west. The district is made up of twelve sub-counties of Bushenyi D, Bitooma, Ibaare, Bushenyi E, Bushenyi C, Kyabugimbi, Bushenyi A, Kyeizooba, and Ruhumuro, together with Central Division, a parish in Kyamuhunga Sub-county. Bushenyi lies between 00N and 0046 are of the equator and 29041//E and 30030' east of Greenwich. It has: a population of 738,355, (51.7% are females and 48.3% are males); an altitude of 2400-3660 feet above sea level and methe ans annual maximum temperature is 22.5-300C. Bushenyi district was selected because malaria was one of the diseases that were still the leading cause of health problems in the area [40].

Study Population

Patients diagnosed with HIV/AIDS infection and seeking treatment at the HIV Clinic at Kyamuhunga Health Centre III were the source population for the study. The study enrolled HIV patients aged 18 years and above.

Sample Size Determination

The sample size was determined using the binomial model to estimate the confidence interval (CI). The HIV prevalence in the Bushenyi district is known to be less than 25% so the malaria prevalence in the area which is higher is used to estimate the minimum sample size needed to achieve enough statistical power. Malaria prevalence in HIV+ positive patients in Kyamuhunga Health Centre III was thought to be at 7.8% of the HIV+ patients attending the clinic on a daily basis [38]. The sample size was calculated with a 95% and precision level of 5%:

$$n_o = \frac{Z_a P q}{d^2}$$

In the equation below, n is the sample size, z is the critical value of the standard normal distribution at the 5% level (1.96), p is the estimated malaria prevalence in HIV + patients (0.78), $q = 1 - p$, and d is the precision level. The sample size of 80 respondents was covered for the study.

$$n_o = \frac{Z_a P q}{d^2}$$

$$n = \frac{0.05 \times 0.78}{(1-0.78)2}$$

$$n = \frac{0.039}{0.0484}$$ n= 80 Respondents.

Definition of Study Variables

Dependent Variable

Prevalence of Malaria is a dependent variable; Malaria is a serious and sometimes fatal disease caused by a parasite called genus Plasmodium that commonly infects a certain type of mosquito that feeds on humans. People who get malaria are typically very sick with high fevers, shaking chills, and flu-like illnesses.

Independent Variable

HIV is an independent variable; HIV is a virus that attacks the immune system, which is our body's natural defense against illness. The virus destroys a type of white blood cell in the immune system called a T-helper cell, and makes copies of itself inside these cells. T-helper cells are also referred to as CD4 cells.

Sampling Procedure

HIV-positive participants (females and males) aged between 18 and above years were randomly sampled for the study. A simple random sampling method was used to target respondents. This was achieved by making members count from 1 to 2 and those that counted 2 were enrolled in the study until a total desired number was achieved.

Inclusion Criteria

The study included HIV-infected male and female adult patients aged 18 years and above receiving HIV care and treatment services at Kyamuhunga Health Centre III. These patients were duly registered into the HIV care and treatment program in the hospital and had willful consent by signing consent forms to participate in the study.

Exclusion Criteria

Patients who did not consent to participate in the study were not interfered with irrespective of their routine care at the hospital.

Research Instruments

Questionnaires were administered to patients who were present at Kyamuhunga Health Centre III. Gloves, prickers, and slides were used to get blood samples to test for malaria parasites while vacationers and syringes were used to get blood samples to test for HB level and CD4 count. An interview guide was also used among eligible patients who were not willing to fill in the questionnaires.

Data Collection

An approval letter from the research supervisor and the Uganda Nurses and Midwives Examination Board was secured to grant the researcher permission to collect data. The researcher introduced this letter to the clinical officers who informed the patients of the presence of the researcher and the intended aim of his presence. Patients were given a consent form for which they explained the benefits of participating in the study. The patients were informed that the study was voluntary and that whoever was not willing to participate would be excused.

Data Management

This involved checking the questionnaire for completeness and improperly filled questionnaires sorted. Complete filled questionnaires were kept in the cupboard for safety and confidentiality and were later taken for analysis. Quality was maintained through aseptic sample collection, processing, and analysis using standard parasitology methods. The quality of samples used was only non-haemolysed blood samples. Positive and negative controls were used to test the functionality of each batch of malaria test strips before being used for malaria testing. Data collection and analysis were done using up-to-date statistical packages. All questions in the questionnaire were coded for easy analysis.

Data Analysis

Data was exported to SPSS Windows version 16.0 for analysis and Microsoft Excel program and was presented in form of graphs, tables, and pie-charts for easy interpretation.

Ethical Considerations

An approval letter from the School of Nursing Kampala International University granted the researcher permission to collect data. Also, permission was sought from the clinic officer before starting the study. The participants were explained about the study. The explanation was limited to the benefits of the results and the responsibilities of the participants in the study. Confidentiality was ensured using identification codes not names and only the responses were availed in the results.

RESULTS

Demographic Characteristics of the Respondents

The demographic characteristics of respondents included gender, age, marital status, educational level, and occupation; the results according to the analysis are presented as shown in Table 1 below and 2 below on page 22.

Table 1: Background information of respondents (N=80)

Variables	Frequency	Percentage (%)
Gender of respondents		
Male	36	45
Female	44	55
Total	**80**	**100**
Age range		
18-27	08	10
28-37	12	15
38-47	36	45
48-57	13	17
58 and above	11	13
Total	**80**	**100**
Marital status		
Single	15	18
Married	41	52
Divorced	08	10
Widowed	16	20
Total	**80**	**100**

Source: Field data, 2017

Results presented in Table 1 indicate that the study comprised of majority 44 females (55%) and the least 36 (45%) were males. The majority of the patients 36 (45%) were in the age brackets of 38-47 years with female preponderance and the least 08(10%) were in the age brackets of 18-27 years.

Table 2: Showing the Education Status and Occupation of Respondents

Variables	Frequency (n)	Percentage (%)
Educational Status		
No Formal Education	17	22
Some Primary Education	04	05
Completed primary	24	30
Completed secondary	28	35
Completed tertiary	07	08
Total	**80**	**100**
Occupation		
Civil Servant	08	10
Farmer	29	37
Business	17	22
Housewife	11	13
Student	07	08
Un-employed	08	10
Total	**80**	**100**

Source: Field data, 2017

Out of the targeted respondents, the majority 28(35%) of the patients affirmed to have completed secondary education while the least 04(5%) revealed that they had acquired some primary education. It was further noted that the majority of the respondents 29 (37%) were farmers while the least 08(10%) were civil servants.

Factors Associated with Malaria Infections in HIV Positive Patients Attending HIV Clinic at Kyamuhunga Health Centre III in Bushenyi District.

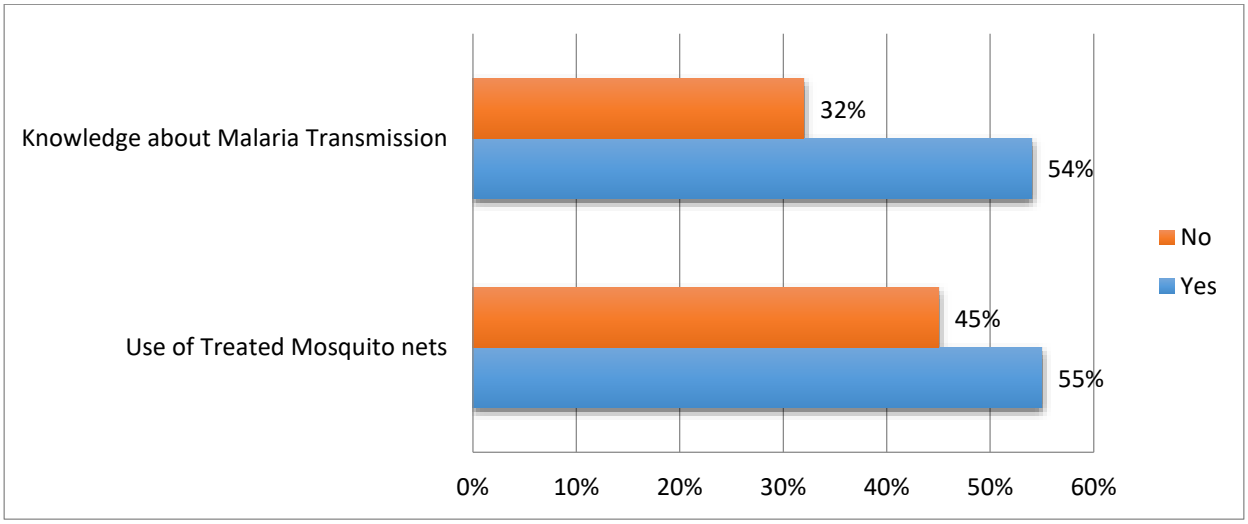


Figure 1: Showing factors associated with malaria infection among HIV+ patients (N=80)
Source: Field data, 2017

Results presented in Table 2 indicate that the majority of the patients 44(55%) slept under treated mosquito nets while the least 36(45%) never slept under treated mosquito nets. From the table 2above knowledge about malaria transmission,

out of all participants (N= 80) interviewed on malaria transmission and prevention, the majority 54(68%) out of 80 participants claimed to have some knowledge about malaria transmission while the least 26(32%) had no knowledge about malaria transmission. Out of the 54 (68%) of the respondents with knowledge about how malaria is transmitted, 33 (42%) claimed that malaria could be transmitted from an infected person to a healthy person and the rest 21(26%) claimed that either malaria cannot be transmitted from person to person or they had no idea at all.

Table 3: CD4 Count of participants (N=80)

CD4 Count	Frequency (f)	Percentage (%)
<200	51	63
200-349	29	37
350-499	00	00
≥ 500	00	00
Total	**80**	**100**

Source: Field data, 2017

Analysis of CD4 was based on results of the most current CD4 count measurements carried out on patients enrolled in this study. Of 80 respondents, 51(63%) had a CD4* cell count less than 200 cells/L, and 29(37%) were in 200-350 cells/L.

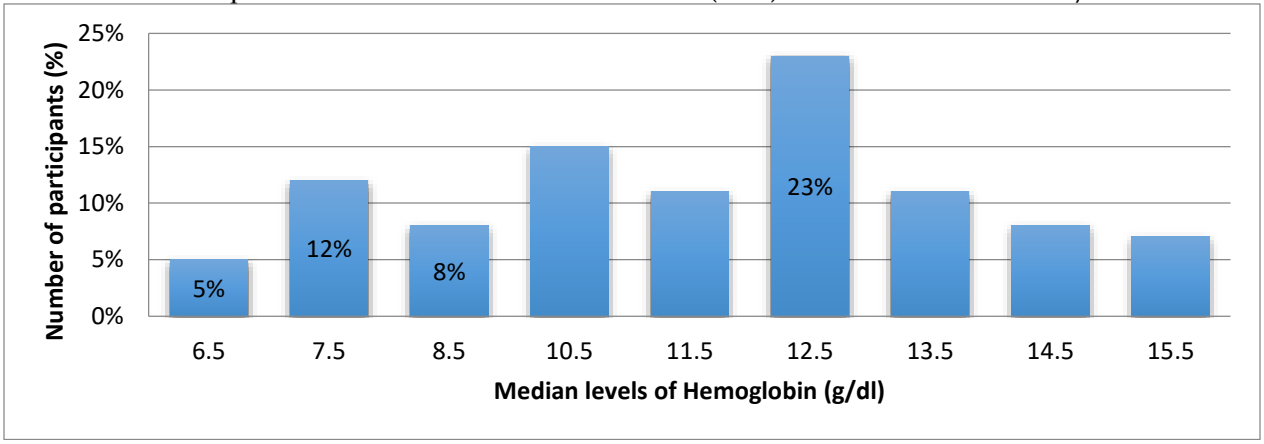


Figure 2: Hemoglobin levels (N=80)
Source: Field data, 2017

Further details are reported Hemoglobin level of patients (participants) Hemoglobin (Hb) concentration levels of the patients ranged between 6.5 and 15.5 g/dl with the majority 18(23%) of patients having Hb levels in the range of 12.5-12.9 g/d. Malaria parasites were unlikely to be seen in those with normal hemoglobin levels (>10.5 g/dl).

The Effect of Malaria on HIV+ patients attending HIV Clinic at Kyamuhunga Health Centre III in Bushenyi District.

Participants were asked to reveal the type of complaints they had during the time of the study at the clinic. The findings are presented as shown in Figure 3.

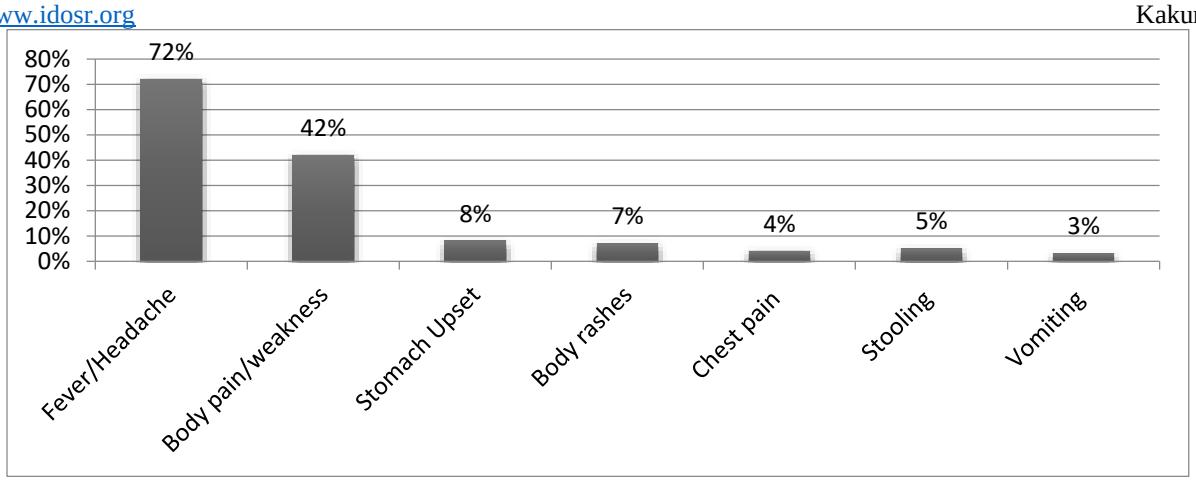
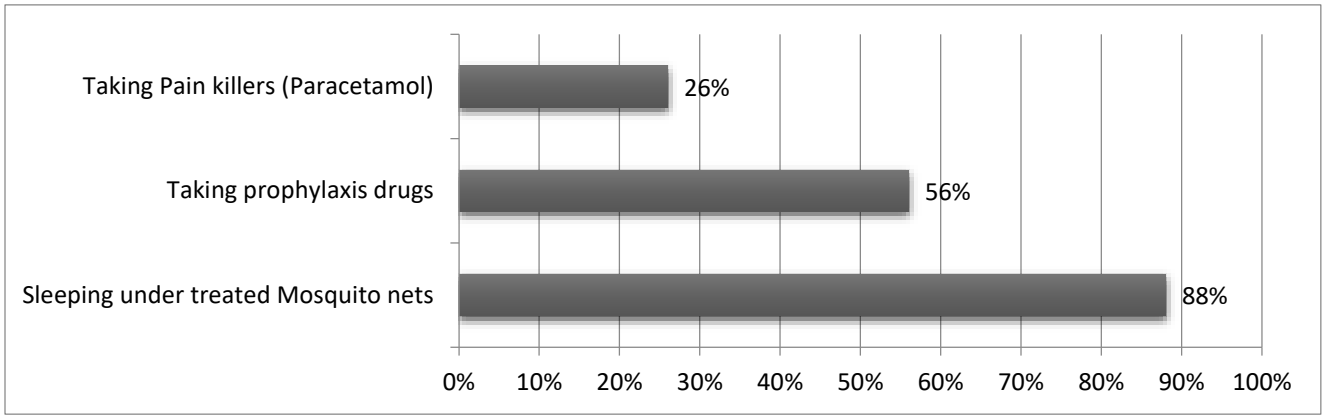


Figure 3: Showing the patient complaints at Kyamuhunga Health Centre III (N=80)
Source: Field data, 2017

Results presented in Figure 3 above indicate that the majority of the patients 58(72%) complained of having fever and headache at the HIV clinic, followed by 34(42%) of the patients who complained of having body pain and weakness. Only 2(3%) reported issues of vomiting while at Kyamuhunga Health Centre III. In addition, data was crosschecked from the ward statistic's registries of admissions, discharges, diagnoses, and deaths. The patient outcome was dichotomized as either "discharged alive from the hospital" or "fatal outcome", meaning that the patient died during the hospital stay. It was noted that of 80 respondents, the majority 50(63%) participants had a significantly lower CD4 count compared to HIV-positive without malaria. While assessing how malaria, affected the HIV-positive patient's health, 2(4%) of the participants complained of chest pain. During the interview with one of the participants, she was quoted saying, "I felt sick sometime back, my body was weak and I developed a cough, when I was brought for treatment, I was diagnosed with anemia"

Treatment and prevention measures can be put in place to control the prevalence of malaria among HIV+ Patients.

Participants were asked to reveal what they had done to control malaria infection and the results are presented as shown in Figure 4 below; Figure 4: Showing treatment and prevention measures put in place to control the prevalence of malaria among HIV+ Patients.



Source: Field data, 2017

Results presented in Figure 4 above indicate that the majority 70(88%) of the participants in this study affirmed that they slept under treated mosquito nets to

control malaria infection; followed by 45(56%) who revealed that they took Prophylaxis drugs to treat malaria infection and lastly the least 21(26%) asserted that they used pain killers (Paracetamol) to reduce fever. In addition to the above, participants were asked to reveal what they thought could be done to control the prevalence of malaria in their households and communities and the findings are presented as shown in figure 5 below;

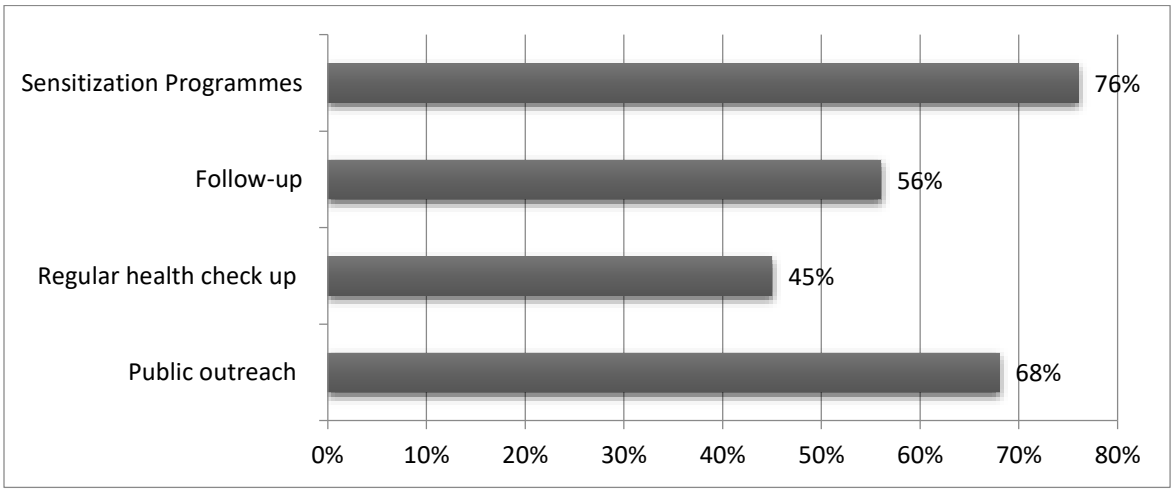


Figure 5: Suggested measures to be put in place to control the prevalence of malarial Source: Field data, 2017

Results presented in figure 5 above indicate that majority 61 (76%) of the participants urged the government to use of advocacy methods for sensitization programs that would assist in controlling the prevalence of Malaria in communities and households in Kyamuhunga Sub-County. In addition, the majority 54(68%) urged that the government should provide effective public outreach to educate people about treatment and control of these diseases (HIV and Malaria). Further, still, the majority 45(56%) urged nurses and doctors to schedule follow-ups, to visit and assess HIV+ patients at their homes. In addition, 36(45%) of the respondents urged patients to adhere to regular checkups about their state of health.

DISCUSSION

Demographic Characteristics of Respondents

Of 80 respondents who participated in the study, the majority were female patients while the least were males. It was noted that the majority36 (45%) were in the age range of 38-37 years. Age was an important risk factor; patients aged 18-37 years and > 47 years had reduced odds of having malaria while dominant among HIV Positive patients aged 38-47 years. This is in line with Johnbull *et al.* [41] who noted that the prevalence of malaria among HIV-positive pregnant women and the odds of having malaria doubled with living in a rural community. A number of risk factors were associated with malaria infection. Age was an important risk factor; women aged 26-30 years and > 30 years had reduced odds of having malaria. The odds of having malaria infection doubled when moving from urban to rural settlements. Results further showed that the majority 28(35%) had acquired secondary education and the least 04(5%) had acquired some primary education with a slightly bigger number of respondents 17(22%) who never accessed any formal education. The study showed that only 07(09%) had had some tertiary education. It was noted that the higher chances of having malaria increased among patients with a secondary level of education due to their adolescent lifestyles. This may suggest that the majority of the participants did not access viable relevant knowledge of controlling malaria transmission among HIV+ patients. This is in line with Dike *et al.* [42] who noted that higher levels of education were associated with improved knowledge and

practice about the appropriate strategies for the prevention and treatment of malaria. Results showed that the majority 29(37%) of the respondents were small-scale farmers, and 08(10%) of the patients in this study were unemployed. It was noted that a higher chance of having malaria was found among the majority of patients who were farmers as compared to civil servants. This may indicate that the majority of the patients were engaged in farming since Kyamuhunga Sub-county is dominated of majority rural farmers who practice farming. This is in line with Johnbull *et al.* [41] who noted that the chances of having malaria doubled with HIV-Positive patients living in rural communities.

Factors associated with malaria infections in HIV+ Positive patients attending HIV Clinic at Kyamuhunga Health Centre III in Bushenyi District

Based on the study findings, it was noted that Knowledge about malaria transmission 54(68%) and the use of treated mosquito nets 44(55%) were the major factors associated with malaria infections among HIV+ positive patients. It was noted that 33(42%) participants claimed that malaria could be transmitted from an infected to a healthy person and the rest 21(26%) claimed that either malaria cannot be transmitted from person to person or they had no idea at all.

Details on the hemoglobin level of patients (participants) reported the concentration levels of the patients ranged between 6.5 and 15.5 g/dl with the majority 18 (23%) of patients having Hb levels in the range of 12.5-12.9 g/dl. This represents the advanced stage of immuno-suppression. Malaria parasites were unlikely to be seen in those with normal hemoglobin levels (>10.5 g/dl). This implies that patients with a Haemoglobin level less than 10.5 g/dl indicated malaria positive and the overall prevalence of malaria among the HIV patients was 20 (25%) of the respondents. This is in line with John Bull *et al.* [41] who noted that Pregnant women on ART therapy had an increased odds ratio of having malaria parasites. Malaria parasites were unlikely to be seen in those with normal hemoglobin levels (>10 g/dl).

The effect of malaria on HIV+ patients attending HIV Clinic at Kyamuhunga Health Centre III in Bushenyi District

Results presented in Figure 1 above indicate that the majority 58(72%) of the patients complained of having fever and headache at the HIV clinic, body pain, weakness, chest pain, and issues of vomiting while at Kyamuhunga Health Centre III. It was noted that the prevalence of malaria among HIV-positive patients made them feel weak all the time and caused anemia. One of the respondents during the interview was quoted saying "I feel weak all the time. Whenever I visit the clinic I am diagnosed with malaria infection, I spend almost two weeks very weak and this disrupts my daily activities". In addition to the above, febrile illness (Fever and headache) was a common complaint in HIV-positive patients and may be due to a multitude of other causes than malaria, including viral, bacterial, and other parasitic or opportunistic infections, many of which may have clinical features indistinguishable from malaria. The results are in line with Alemu *et al.* [22] who urged that fever indicated a cytokine response that might increase concentrations of HIV-1 RNA which restricted the normal response to the cytokine stimuli of malaria. I further assessed the overall, HIV and malaria co-infected patients had a significantly lower CD4 count compared to HIV positive without malaria. Similarly, a significantly lower CD4 count among respondents on ART than among those not on ART. Changes in CD4 count in association with malaria parasite co-infection and HIV only in relation to ART status interaction. These findings are in line with Kotepui *et al.* [43] who noted that changes in blood cell counts are a well-known feature of malarial infections. These changes involve major cell lines including red blood cells (RBC), leukocytes, and thrombocytes. Hematological changes in the course of malaria infection, such as anemia, thrombocytopenia, and leukocytosis or leucopenia are well-recognized in HIV-positive patients [44, 45]. While assessing how malaria affected the HIV-positive patient's health, it was noted that a higher prevalence of malaria in HIV-infected

patients was more likely to cause anemia than in patients with only malaria infection. This is in line with Tay *et al.* [28] who argued that anemia is one of the complications in both malaria and HIV infections and contributes to morbidity and mortality.

The treatment and prevention measures that can be put in place to control the prevalence of malaria among HIV+ Patients

According to the study findings, HIV-positive patients were treated with 25 mg/kg of CQ (Avloclor, ZENECA, 10 mg/kg on days 0 and 1, 5 mg/kg on day 2) plus a single dose of 1.25 mg/kg pyrimethamine and 25 mg/kg sulfadoxine (Fansidar, Roche) on day 0. All doses were directly observed and if a patient vomited within thirty minutes of dosing, the medication was re-administered. Paracetamol was administered to all patients. Patients were followed on days 1, 2, 3, 7, 14, 21, and 28 and follow-up consisted of a brief history, clinical examination, and a blood smear for malaria on each day. This is in line with the WHO [4] Treatment classification outcome over 28 days of follow-up. In addition to the above, while interviewing one of the patients, she was quoted saying "The government provided free treated mosquito nets and provided laboratory center nearer to the people in Kyamuhunga Sub-county". The researcher went ahead to assess what could be done to control the prevalence of malaria in households and communities; it was noted that participants urged patients to go back to the clinic at any time if they feel ill, and receive full evaluation including examination of a blood smear. One participant urged that "If patients do not return for scheduled follow-up, they can be visited and assessed at home". In addition, one other participant certainly advocated for advocacy methods such as flyers and billboards to be replaced with more innovative techniques involving celebrities to sensitize possible control measures to reduce the prevalence of malaria among HIV-positive patients. Participants urged the government to provide effective public outreach to educate people about the treatment and control of these diseases (HIV and Malaria). While assessing what could be done by health workers, one of the participants was quoted saying "I think it would be better if a health worker visits patients' homes and monitors the patients' conditions and ensures regular health talks". This is in line with Pestizid [46] who asserted that the importance of community participation, health education, surveillance, improving public health systems, decentralization of malaria control implementation, local capacity building, income generation, involvement of civil society organizations, support of local research, inter-sectoral and regional cooperation would assist in controlling and preventing the prevalence of malaria among HIV-positive patients.

CONCLUSION

This study at Kyamuhunga Health Centre III in Bushenyi District found that HIV infection increased the susceptibility to new malaria infections among HIV-positive patients aged 38 years and above. Malaria infection was acquired with repeated exposure to malaria parasites especially for patients who did not use Treated mosquito nets. It is possible that the disadvantage of HIV-positive patients greatly acquired unbalanced immunity with relatively low CD4+ cell count and unbalanced hemoglobin levels, greatly affected by body pain and weakness, fever, headache, and a variety of issues of vomiting. Paracetamol, use of treated mosquito nets, clinical examination, and patient follow-up was shown to provide a beneficial effect in preventing malaria infection among HIV-positive patients.

Recommendation

Adherence to cotrimoxazole prophylaxis should be reinforced in HIV-positive patients and it should be reassessed if these patients present with acute episodes of malaria. Comprehensive HIV care should be provided, including health education, antiretroviral therapy, and malaria preventive materials such as insecticide-treated bed nets. This will help HIV-positive patients to develop better health-related behavior and higher rates of self-treatment. In addition, some protease inhibitors used in the treatment of HIV infection may also be effective in the treatment or prevention of malaria.

Protease inhibitors must be highly potent and specific for *parasite proteases* to be recognized as biological tools. It is possible that the use of protease inhibitor (PI) - based antiretroviral therapy (ART) in HIV-infected patients living in areas of high malaria transmission could prevent malaria in this vulnerable population.

Implications to Nursing Practice

The findings in this study will be used by nurses to recommend appropriate measures to control malaria infections among HIV-positive patients at the household level.

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