HIV and Malaria Infections and Associated Risk Factors Among Febrile Illness Patients in Northwest Ethiopia

Kuzey Batı Etiyopya'da Febril Hastalıklı Bireylerde HIV ve Sıtma Enfeksiyonları ve İlgili Risk Faktörleri

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ABSTRACT

Objective: Malaria and human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS) are the major medical challenges of priority faced by the sub-Saharan African countries in general and Ethiopia in particular. Thus, the aim of this study was to determine the prevalence and associated risk factors of HIV and malaria infections among febrile illness patients.
Methods: A cross-sectional study was conducted from November 1, 2014 to May 30, 2015 at Kolla-Diba Health Center, Northwest Ethiopia. After obtaining informed consent, blood samples were collected from each febrile patient for the laboratory determination of HIV and malaria infections. Sociodemographic data and other associated factors for HIV and malaria infections were collected using a structured questionnaire.
Results: Of the total of 384 febrile illness patients, 23.7% (91/384) were positive for *Plasmodium* species. Of these, the most prevalent was *P. falciparum*, 56.0% (51/91), followed by *Plasmodium vivax* infection, 38.5% (35/91). In this study, 13.8% (53/384) of the participants were positive for HIV. Furthermore, 3.13% (12/91) of the participants were coinfected with HIV and malaria. According to the findings of the present study, genital ulcer patients and those who do not use bed net were significantly associated with HIV and malaria infections, respectively.
Conclusion: Malaria and HIV are still common challenges independently occurring in the study area. The coexistence of the two diseases cannot be underestimated. Hence, health professionals should strengthen the provider initiative counseling and testing (PICT) program as a means of HIV/AIDS prevention and control strategy. Furthermore, approaching the febrile illness patients for both malaria and HIV diagnoses may help in having a joint HIV and malaria prevention and control strategy.
Keywords: Human immunodeficiency virus, Malaria, Kolla-Diba Health Center
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ÖZ

Amaç: Sıtma ve insan immün yetmezlik virüsü (HIV)/edinilmiş immün yetmezlik sendromu (AIDS) genel olarak Sahra altı Afrika ülkelerinde, özellikle Etiyopya'da, karşılaşınan en önemli tıbbi problemlerdir. Bu çalışmanın amacı, febril hastalığı olan bireylerde HIV ve sıtma enfeksiyonlarının yaygınlığını ve ilgili risk faktörlerini belirlemektir.
Yöntemler: Bu kesitsel çalışma 1 Kasım 2014 ile 30 Mayıs 2015 tarihleri arasında kuzey batı Etiyopya'daki Kolla-Diba Sağlık Merkezinde yapıldı. Bilgilendirilmiş onam alındıktan sonra, HIV ve sıtma enfeksiyonlarının laboratuvarda belirlenmesi için her febril hastadan kan örnekleri alındı. Sosyodemografik veriler ve HIV ve sıtma enfeksiyonları için diğer ilişkili faktörler, yapılandırılmış bir anket kullanılarak toplandı.
Bulgular: Toplam 384 febril hastanın %23,7'si (91/384) *Plasmodium* türleri açısından pozitifti. Bunlar arasında en yaygın olanı %56,0 (51/91) ile *P. falciparum* ve takibinde %38,5 (35/91) ile *Plasmodium vivax* enfeksiyonu idi. Bu çalışmada, katılımcıların %13,8'i (53/384) HIV pozitif bulundu. Ayrıca, %3,13'ü (12/91) HIV- ve aynı zamanda sıtma ile enfekteydi. Çalışmamızın bulgularına göre, genital ülser hastaları ve cibinlik kullanmayanlar ile sırasıyla HIV ve sıtma enfeksiyonları arasında anlamlı bir ilişki bulundu.
Sonuç: Sıtma ve HIV halen çalışma bölgesinde bağımsız bir şekilde görülen yaygın problemlerdir. Her iki hastalığın birlikteliği göz ardı edilmemelidir. Bu nedenle sağlık çalışanları HIV/AIDS'i önleme yolu ve kontrol stratejisi olarak, gönüllü danışmanlık ve test odaklı PICT (provider-initiated counseling and testing) programını güçlendirmelidirler. Ayrıca, febril hastalara hem sıtma hem de HIV tanısı için yaklaşım HIV-sıtma birlikteliğinin önlenmesi ve kontrol stratejisinde yardımcı olacaktır.
Anahtar Kelimeler: Insan immünyetmezlik virüsü, sıtma, Kolla-diba Sağlık Merkezi
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INTRODUCTION

Malaria and Human immunodeficiency virus (HIV) are among the leading causes of morbidity and mortality in resource-limited settings including sub-Saharan Africa (1). Malaria is still an important public health concern worldwide, particularly in Sub-Saharan Africa. However, According to the 2015 WHO report Turkey has achieved a 99% decrease in malaria between 2000 and 2013, from 11,381 to only 34 cases, and is categorized in the elimination phase by the World Health Organization (WHO) (2).

Despite the international community's efforts to reduce the incidence and prevalence of these diseases, they remain serious health problems in tropical and sub-tropical regions throughout the world (1). Globally, an estimated 1.6 million people died of HIV/AIDS in 2012 (3).

A report from the Republic of Turkey Ministry of Health which was published in 2013 showed that, a total of 7050 individuals were HIV positive from 1985 until November 2013, of these, People aged between 40-49 years are those who are most affected by the infection (4). Although, the world has committed to ending the AIDS epidemic by 2030 and people living with HIV on antiretroviral therapy has increased, in 2015 there were 2.1 million new HIV infections worldwide in the HAART era (5).

According to 2014 World Health Organization estimate report, there were an estimated 198 million cases of malaria worldwide in 2013, and an estimated 584 000 deaths, of which 90% of all malaria deaths occur in Africa (6). Both malaria and HIV infection cause more than 4 million deaths each year (7).

Malaria and HIV infections are major public health problems in many parts of the world. Both infections kill millions of people each year with disproportionate heavy burden on South America, India, Southeast Asia and Africa (8, 9). Evidence shows that malaria co-infection with HIV triggers malaria disease progression (10), increases the risk of severe malaria in adults and congenital infection (11), and this dual infection render the spread of both diseases especially in sub-Saharan Africa (12).

HIV infection intensifies the effect of malaria among pregnant women and infants, creating significant impairment and alteration in cellular, humoral immunity and resistance to *P. falciparum* infection. Similarly, more recent literature shows that malaria and HIV co-infection results in adverse pathological outcomes in both diseases, such as, increased HIV viral loads following acute malaria, increased malaria episodes in HIV positive individuals, reduced hemoglobin (Hb) concentrations during malaria and HIV co-infection, and reduced efficacy of anti-malarial drugs (13, 14).

Providing integrated health services in areas heavily affected by malaria and HIV is crucial for reducing the burden of the two diseases. The introduction of new medicines and diagnostics by malaria and HIV programmes at the same time, offers opportunities for joint planning, training and service delivery (15).

In Ethiopia, malaria is also one of the ten top disease in the list of common infectious diseases and 3/4 of the total land mass of the country is considered as endemic area for malaria and about 68% of the total population is at risk of malaria infection (16). However, The incidence rate of malaria in Ethiopia reduces from 2.8 in 1990 to 621,345 in 2015 (17).

Though malaria and HIV are known to be the most severe of all infections in Ethiopia (18), we are not aware of any recent report of malaria and HIV infections among febrile illness patients in Ethiopia particularly in the study area. Hence, this study was designed to determine the prevalence of HIV and malaria infections and associated risk factors among febrile illness individuals.

METHODS

Study design, period and setting: An institutional based cross sectional study was conducted from November 01, 2015 to May 30, 2015 at Kolla-Diba Health Center, Northwest Ethiopia. Kolla-Diba is 727km far from the capital city of Addis Ababa and it is the first health center in the country which was established by since 1947 by Ethiopian and German Governments after malaria kills thousands of the surrounding people. Currently, the health center can serve more than 400,173 populations of Dembia District in which malaria is still a big problem.

Inclusion and exclusion criteria: All patients with febrile illness who have been counseled and give informed consent during the study period were included. Those febrile patients who are unable to give blood and on anti-malaria treatment in the previous two weeks were excluded from the study.

Sample size and sampling technique: The sample size was determined using the following single population proportion formula: N = z2 p (1-p)/w2, where N = individuals presenting with febrile illness, Z = standard normal distribution value at 95 % CI which is 1.96, P = the prevalence of febrile illness (0.5%, since there is no prevalence report in the study area), W = the margin of error, taken as 5 %. Accordingly, the sample size calculated was 384 and all these febrile patients were selected using convenience sampling technique until we got the allocated sample size.

Data collection

Socio-demographic, risk factors and different clinical features: Once eligible patients with febrile illness were recruited for the study. Information on socio-demographic characteristics; sex, age, educational status, residence, occupation and study participants were interviewed for the presence bed net, stagnant water and duration of clinical manifestation of malaria. Moreover, other related risk factors for HIV including, history of blood transfusion, presence of genital ulcer, history of hospitalization and sexual practice were collected using a structured questionnaire. However, children whose age of <15 years was not asked sexual practice.

HIV testing and malaria detection techniques

Patients who have clinical manifestations of febrile illness were counseled for HIV testing by trained counselor and blood sample from their finger was taken by capillary tubes. Then the sample was tested for HIV by using KHB, STAT-PAK and Uni-gold according to the previous national HIV rapid test series algorithm by trained medical laboratory technician/technologist (19). For microscopic examination of malaria parasite, both thick and thin smear were made and air dried. The thick smears were stained by Giemsa stain and the thin smears were first fixed by absolute

methanol and then stain with Giemsa for the detection and identification of the malaria species, respectively, by using oil immersion (100X) objective microscope.

Data management and quality control: The questionnaire was prepared originally in English and translated into Amharic and back to English to keep the consistency of the questions by independent individuals. Training was given for the data collectors to insure the possible quality data. The principal investigator and supervisors checked and reviewed the filled questionnaires to ensure completeness and consistency of the information collected. Incorrectly filled or missed questionnaires were turned back to the data collector for correction in the next day. Re- entry of 10% of the data into software was made by the principal investigator to verify whether the data was properly entered or not to maintain data quality.

Table 1. Sociodemographic characteristics of the study participants at Kola Diba Health Center, 2015

Characteristics	Frequency	%
Gender		
Male	226	58.9
Female	158	41.1
Age group, years		
<10	59	15.4
10–20	75	19.5
21–30	105	27.3
31–40	77	20.1
41–50	39	10.2
>50	29	7.6
Residence		
Rural	169	44.0
Urban	215	56.0
Marital status		
Married	208	54.2
Single	163	42.4
Widowed	4	1.0
Divorced	9	2.3
Educational status		
Illiterate	168	43.8
Elementary school	134	34.9
High school	63	16.4
Certificate and above	19	4.9
Occupation		
Merchant	25	6.5
Farmer	26	6.8
Student	125	32.6
Housewife	65	16.9
Daily laborer	23	6.0
Unemployed	45	11.7

For HIV testing, the test kits (KHB, Stat-pak and Uni-gold) have their own internal quality control materials and the person who performs the test procedure was strictly followed the manufacturer instructions. The staining solution (Giemsa stain) for malaria examination was prepared daily to avoid precipitations. Some of the prepared malaria slides were also further cross checked by another technologist blindly.

Statistical Analysis

Data were cleaned and documented using Epi Info version 7 (Centers for Disease Control and Prevention, Atlanta, GA, USA) and exported to the Statistical Package for Social Sciences version 20 (IBM Corp., Armonk, NY, USA) for analysis. Both descriptive and analytical statistical procedures were utilized. Descriptive statistics, such as percentages, mean values, and standard deviations were used. Binary logistic regression was used to identify factors associated with HIV and malaria infections. A bivariate analysis was performed to identify the association of each independent variable with HIV and malaria infections. Variables with P values <0.2 in the bivariate analysis were entered in the multivariate analysis to identify the determinants of HIV and malaria to control the possible effect of confounders. Adjusted odds ratios (AORs) with 95% confidence interval were used to determine the strength of associations, and P values<0.05 in the final model were considered significant determinants of HIV and malaria infections. The goodness-of-fit of the model was tested using the Hosmer-Lemeshow test for the full model (p>0.05).

RESULTS

Socio demographic Characteristics of Study Participants

A total of 384 febrile illness patients were counseled and tested for HIV and malaria infections. Of these, 226 (58.9%) were males (with the mean age of 28±15.7 years) and 158 (41.1%) were females (with the mean age of 28±14.7 years). The majority of the study participants (105; 27.3%), were in the age group of 21-30 years, 215 (56.0%) were from rural areas, and 168 (43.8%) were illiterate (Table 1).

Prevalence of *Plasmodium* Species and HIV/AIDS among Febrile Illness Patients

In this study, the prevalence of *Plasmodium* species and HIV were 91 (23.7%) and 53 (13.8%), respectively. Of the *Plasmodium* species, the predominant species was *P. falciparum* (51/91; 56.0%), followed by *P.vivax*(35/91; 38.5%); 5/91 (5.5%) of them had mixed infection with *P. falciparum* and *P.vivax*. The prevalence of malaria among males was higher (60;26.5%; p=0.001) than among females. Furthermore, the majority of malaria patients (27.9%; 60/215; p=0.001) were from rural areas. The prevalence of HIV was significantly higher in females than in males (20.9% vs. 8.8%; p=0.001). The proportion of HIV seropositivity among febrile illness patients was higher (28.2%) in the age group of 41-50 years, whereas the proportion of malaria positivity among febrile illness patients was higher (29.5%; p=0.05) in the age group of 21-30 years. The prevalence of HIV among urban and daily laborers was 39 (23.1%) and 12 (52.2%), respectively (Table 2).

HIV and Malaria Infections among Febrile Illness Patients

Of the 384 febrile illness patients, 12 (3.1%) were co-infected with both HIV and malaria, of which, the prevalence of *P. falciparum*

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Table 2. Sociodemographic characteristics of the study participants in relation to HIV and malaria infections at Kola Diba Health Center, 2015

Characteristics	HIV			Malaria		
Gender	**Positive N (%)**	**Negative N (%)**	**p**	**Positive N (%)**	**Negative N (%)**	**p**
Male	20 (8.8)	206 (91.2)	***	60 (26.5)	166 (73.5)	+
Female	33 (20.9)	125 (79.1)		31 (19.6)	127 (80.4)	
Age group, years						
<10	7 (11.9)	52 (88.1)	*	12 (20.3)	47 (79.7)	0.341
10–20	5 (6.7)	70 (93.3)		21 (28.0)	54 (72.0)	
21–30	12 (11.4)	93 (88.6)		31 (29.5)	74 (70.5)	
31–40	14 (18.2)	63 (81.8)		15 (19.5)	62 (80.5)	
41–50	11 (28.2)	28 (71.8)		8 (20.5)	31(79.5)	
>50	4 (13.8)	25 (86.2)		4 (13.8)	25 (86.2)	
Residence						
Urban	39 (23.1)	130 (76.9)	***	31 (18.3)	138 (81.7)	*
Rural	14 (6.5)	201(93.5)		60 (27.9)	155 (72.1)	
Marital status						
Married	28 (13.5)	180 (86.5)	***	44 (21.2)	164 (78.8)	0.330
Single	18 (11.0)	145 (89.0)		44 (27.0)	119 (73.0)	
Widowed/divorced	7 (53.8)	6 (46.2)		3 (23.1)	10 (76.9)	
Educational status						
Illiterate	17 (11.1)	151 (89.9)	0.257	38 (22.6)	130 (77.4)	0.370
Elementary school	23 (17.2)	111 (82.8)		37 (27.6)	97 (72.4)	
High school	9 (14.3)	54 (85.7)		14 (22.2)	49 (77.8)	
Certificate and above	4 (21.1)	15 (78.9)		2 (10.5)	17 (89.5)	
Occupation						
Civil servant	5 (20.0)	20 (80.0)	***	3 (12.0)	22 (88.0)	***
Merchant	4 (15.4)	22 (84.6)		5 (19.2)	21 (80.8)	
Farmer	11 (8.8)	114 (91.2)		40 (32.0)	85 (68.0)	
Student	11 (14.7)	64 (85.3)		24 (32.0)	51 (68.0)	
Housewife	6 (9.2)	59 (90.8)		12 (18.5)	53 (81.5)	
Daily laborer	12 (52.2)	11 (47.8)		1 (4.3)	22 (95.7)	
Unemployed	4 (8.9)	41 (91.1)		6 (13.3)	39 (86.7)	

†=p<0.1, *p<0.05, **p<0.01, ***p<0.001

Table 3. Prevalence of HIV-malaria infections at Kola Diba Health Center, Northwest Ethiopia, 2015

	HIV status of study subjects		
Plasmodium species	**Positive No (%)**	**Negative No (%)**	**Total No (%)**
P. falciparum	8 (2.1)	43 (11.2)	51 (13.3)
P. vivax	4 (1)	31 (8.1)	35 (9.1)
Mixed infection	0 (0)	5 (1.3)	5 (100)
Negative	41 (10.7)	252 (65.6)	293 (76.3)
Total	53 (13.8)	331 (86.2)	384 (100)

and *P. vivax* among HIV infected patients was 8 (2.1%) and 4 (1%), respectively (Table 3).

Associated Factors for HIV and Malaria Infections among Febrile Illness Patients

Febrile illness patients with genital ulcer had two times the risk (aOR=2.15, 95% CI=1.05-2.39) of acquiring HIV than corresponding patients without genital ulcer (Table 4). Febrile illness patients who did not use bed net had three times the risk (AOR=3.30, 95% CI=1.36-8.0) of acquiring malaria than corresponding patients who used bed net. The proportion of febrile illness patients who currently do not use bed net was 113 (29.4%). Of which,78/384 (20.3%) were malaria-positive, which

Table 4. The possible risk factors of HIV infection at Kola Diba Health Center, Northwest Ethiopia, 2015

Characteristics	HIV status			
	Positive N (%)	Negative N (%)	aOR (95% CI)	p
Sexual practice				
With regular partner	32 (14.4)	190 (85.6)	0.988 (0.43–2.2)	0.95
				0.815
With irregular partner	10 (12.7)	69 (87.3)	1.091 (0.4–2.9)	
No sex at all	11 (12.3)	72 (86.7)	1	1
History of blood transfusion				
Yes	4 (1)	7 (1.8)	0.43 (0.1–1.8)	*
No	49 (12.8)	324 (84.4)	1	1
Presence of genital ulcer				
Yes	13 (54.2)	11 (45.8)	2.15 (1.05–2.39)	***
No	40 (11.1)	320 (88.9)	1	1
History of hospitalization				
Yes	5 (20.8)	19 (79.2)	0.92 (0.27–3.13)	0.89
No	48 (13.3)	312 (86.7)	1	1
*p<0.05, **p<0.01, ***p<0.001				

Table 5. The possible risk factors of malaria infection at Kola Diba Health Center, Northwest Ethiopia, 2015

Characteristics	Malarial status			
	Positive N (%)	Negative N (%)	aOR (95% CI)	p
Have bed net				
Yes	213 (55.5)	58 (15.1)	1	1
No	78 (20.3)	35 (9.1)	3.30 (1.36–8)	***
Bed net usage frequency				
Every night seasonal	49 (23.0)	164 (77.0)	1	1
Every night yearly	14 (24.1)	44 (75.9)	0.44 (0.18–1.0)	*
Presence of stagnant water				
No	74 (24.6)	227 (75.4)	1	1
Yes	17 (20.5)	66 (79.5)	1.131 (0.6,2–2.0)	0.68
History of blood transfusion				
No	91 (24.4)	282 (75.6)	1	1
Yes	0 (0.0)	11 (100.0)	0,75 (0.19–2.0)	0.69
*p<0.05, **p<0.01, ***p<0.001				

was significantly associated with malaria positivity (p=0.008; Table 5).

DISCUSSION

Malaria and HIV affect millions of people across overlapping geographic distributions, and the risk of transmission of both HIV and malaria may increase because of the coexistence of the two diseases in a given area. Hence, interactions between the two diseases may have major implications for the treatment, care, and prevention. The major burden of malaria and HIV occur in sub-Saharan Africa, South-East Asia, Latin America, and the Caribbean (20). However, the prevalence of HIV and malaria as well as the extent of geographical overlap widely varies within each region. Even in countries with a high prevalence of both infections, there may be differences in disease distribution at a local level.

The biological basis of HIV and malaria interactions has already been well established. Briefly, HIV infection induces cellular diminution and early abnormalities of CD4+ T cells, decreases CD8+ T-cell counts and function, causes the deterioration of specific antigen responses (humoral immunity), and leads to the alteration of innate immunity through impairment of cytolytic activi-

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ty and cytokine production by natural killer cells. Therefore, HIV infection affects the immune response to malaria, particularly premonition in adolescents and adults and pregnancy-specific immunity, leading to different patterns of the disease in HIV-infected patients compared with HIV-uninfected patients (21).

A report showed that, the patients with *P. falciparum* infection have approximately twice the risk of being HIV positive compared with individuals who live in areas with low *P. falciparum* parasite rate (22). Furthermore, it has been observed that HIV-infected people in areas of malaria transmission have more frequent episodes of symptomatic parasitemia (21).

In the present study, the prevalence of malaria was 23.7%, which was consistent with that in a study conducted in Northwest Ethiopia (19.4%) (18). However, this was lower than that in studies conducted in Nigeria (27%) (23) and Mozambique (28%) (24). This difference may be caused by the geographical variation, the methodology used, and the malaria control strategy. In the present study, the predominant *Plasmodium* species was *P. falciparum* followed by *P.vivax*. A similar finding was also reported in previous studies in Ethiopia (18, 25). The prevalence of malaria infection was more common among male febrile illness patients. This may be associated with their frequent outdoor activities that may expose them to vector-borne diseases, such as malaria.

In this study, 13.8% of the febrile illness study participants were positive for HIV infection, which is higher than that in a previous study conducted in Southern Ethiopia (4.2%) (26). However, the prevalence of HIV in the present study is lower than that in the study conducted done in Uganda (81%) (21). These differences maybe because of sample size and geographical variation. The prevalence of HIV was significantly higher in females than males (20.9% vs 8.8%; p=0.001). The proportion of HIV seropositives among the febrile illness patients was higher (28.2%) in the age group of 41-50 years. This is in line with study conducted in Uganda (33.3%) among actively working-class people (21). The prevalence of *P. falciparum* among HIVpositive study participants was 15.1%. Similar findings were also reported among asymptomatic HIVpositive individuals in Nigeria (27) and Mozambique (28).

According to the findings of the present study, the prevalence of HIV and malaria coinfection was 3.1%. This result was lower than that in other findings reported from Nigeria (17.5%) (29),Cameroon (29.4%) (30), and Northwest Ethiopia (18). The difference could be because of the current status of immunity of HIV-positive patients, the study design we used, and the incidence of malaria in different settings.

According to the present study, 71.6% of the study participants were using mosquito bed nets. This indicates that the mosquito nets were maximally distributed. However, 29.4% of the study participants were not using bed nets. Of which, 20.3%were malaria-positive, indicating that the lack of bed net usage was significantly associated with malaria positivity (p=0.008). This number was in agreement with that in a previous report in Uganda (17%) (31), suggesting that bed nets are relatively effective in preventing the spread of malaria.

Study Limitations

Since the HIV viral load test and CD4+ count matches were not available in the study area at the time of data collection, the HIV viral load and CD4+ count data were not collected. Hence, we could not differentiate HIV-positive individuals reaching the progressive AIDS stageson the basis of only clinical examinations. Therefore, further research is required in the near future.

CONCLUSION

HIV and malaria remain the most common independently occurring challenges in the study area. The coexistence of the two diseases cannot be underestimated. Genital ulcer patients and individuals not using bed nets were found to be at a significant risk of acquiring HIV and malaria, respectively, in the study area. Health professionals should strengthen the provider-initiated counseling and testing (PICT) program as a means of HIV/AIDS prevention and control strategy. Furthermore, approaching the febrile illness patients for both HIV and malaria diagnosis may help to have a joint HIV and Malaria prevention and control strategy in the study area.

Ethics Committee Approval: Ethical clearance was obtained from ethical committee of University of Gondar. A permission and support letter was also obtained from Kolla-Diba district health bureaus. The purpose and importance of the study was explained to each study participants. To ensure the confidentiality of the study participants' information, anonymous typing was applied whereby their name and any identifier of the participants were not written on the questionnaire. The study participants were interviewed individually to keep their privacy. Above all data was collected after full verbal and written consent was obtained from each study participates. Any positive findings were informed to the study participants. Positive patients for malaria and/or HIV were treated by the health center following the nation's standard for clinical management.

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Etik Komite Onayı: Bu çalışma için etik onay Gondar Üniversitesi etik kurulundan alındı. Ayrıca Kolla-Diba ilçe sağlık bürosundan izin ve destek mektubu alındı. Her katılımcıya çalışmanın amacı ve önemi açıklandı. Çalışmaya katılanların bilgilerinin gizliliğinin sağlanması amacıyla, anket formlarına katılımcı isimleri ve kimlikleri yazılmadı. Kişisel gizlilik için, her katılımcıyla bireysel olarak görüşme yapıldı. Veriler katılımcılardan yazılı ve sözlü onam alındıktan sonra toplanıldı. Katılımcılar herhangi bir pozitif

bulgu hakkında bilgilendirildiler. Sıtma ve/veya HIV pozitif hastalar sağlık merkezince, ulusal klinik yönetim standartlarına uygun olarak tedavi edildiler.

Hakem Değerlendirmesi: Dış bağımsız.

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