Prevalence and Factors Associated with Malaria Among Adults Living in Bosaso-Somalia

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Abstract: According to WHO-EMRO report in 2016, Confirmed malaria cases in Somalia from 2013 to 2015 were gradually increased from 7407, 11001 and 20953 respectively, indicating that malaria is a serious health concern in Somalia and specifically Bosaso become one of the most endemic areas of malaria in Somalia. Bosaso is one of the most populous towns in Somalia's Puntland state, with a population of over 700,000 people. Bosaso district is a malaria endemic area with malaria control measures in place, yet the prevalence of malaria in this town remains high, with around 11522 cases reported in the first nine months of 2017. Malaria threatens the entire Somali population, with 51 percent at high risk, therefore this study aims to determine the prevalence and factors related to occurrence of malaria in Bosaso. Between December 2017 and January 2018, a community-based analytical cross-sectional research was done in eight selected villages in Bosaso, Somalia. 384 adults living in Bosaso were interviewed using a pretested questionnaire. In January 2018, 75 (19.7 percent) of the study population had malaria. Age and family income were found to have a statistically significant association with malaria occurrence (OR = 2.2, 0.013 and 2.3, 0.033, respectively). Regarding prevention measures, people who did not use mosquito nets had an increased risk of malaria (OR = 2.18, P-value = 0.004), and people who did not use protective clothing had an increased risk of malaria (OR = 1.75, P-value = 0.035), Furthermore, open or half-covered water tanks in the home were linked to the prevalence of malaria (OR = 1.6, P-value = 0.029). Finally, to reduce malaria occurrence in Bosaso these measures should be taken; Malaria prevention and control education should be provided to the community via the use of mass media and any other appropriate method, and individuals should follow malaria preventative measures like as sleeping under mosquito net, using IRS in home and taking on protective cloths in exposed areas.

Keywords: Malaria, Risk Factors, Mosquito Nets, Bosaso

1. Introduction

Malaria is a life-threatening caused by Plasmodium parasite infection. Malaria is the most deadly, and it predominates in Africa, it contributes substantially to the poor health situation in Africa. [1]

Malaria remains a major global public health and development challenge. It caused 216 million cases and 655,000 deaths worldwide in 2010, of which 81% of the cases and 91% of the deaths were from sub-Saharan Africa. [2]

In 2014, about 276 million people in eight countries in Eastern Miditerenian Region were at some risk of malaria, with 108 million at high risk, reported incidence rates were >1 per 1000. Six countries have areas of high malaria transmission are Afghanistan, Djibouti, Pakistan, Somalia, Sudan and Yemen. [3]

Reported malaria cases in countries with high malaria burden in Eastern Miditerenian Region shows that confirmed malaria cases in Somalia from 2013 to 2015 were gradually increased from 7407, 11001 and 20953 respectively, [4] therefore Malaria is a major health problem in Somalia, The entire population of Somalia is at risk of malaria, with 51% at high risk. [5] The intensity of malaria transmission varies in different parts of the country, ranging from unstable and epidemic-prone in Puntland and Somaliland, to moderate in Central Zone and moderate to high in the South Zone. [6] Bosaso is one of most populated towns in Puntland state of Somalia that roughly hosts more than 700,000 individuals.

Bosaso district is a malaria endemic area in which malaria control measures such as the use of Artemisinin combined therapy (ACT), the use of insecticide treated bed nets (ITNs), indoor residual spraying of insecticide (IRS), and Intermittent Preventive Treatment (IPTp) for pregnant women and children have been implemented. Despite of all these efforts yet the overall incidence of malaria infection remains high, in the first nine months of 2017 about 11522 cases are reported from the town. [7] This verifies that there could be several factors associated with occurrence of malaria other than usage of preventive measures which are related to this problem.

Bosaso district (the area targeted by the study) has been selected because it is a seasonal hyper transmission and endemic area, accordingly to the stratification of National Malaria Control Programme (NMCP).

Malaria infection is an enormous public health problem with substantial risks for the pregnant mothers, their fetus and neonates, children, adults and everyone in the community. Malaria during pregnancy may cause intra-uterine death of the fetus, it may also cause premature or abortion. [8] This study aims to explore the prevalence and associated risk factors of malaria occurrence in Bosaso district, thus, this study will help the ministry of health, National and international health organizations and policy makers for intervention.

2. Methods and Materials

2.1. Study Design

The study design was a community based analytical cross-sectional study which was conducted between December 2017 and January 2018 in eight selected villages in Bosaso-Somalia.

2.2. Study Area

This study was conducted in Bosaso district the capital of the Bari region. Bosaso is the commercial city of Puntland state of Somalia, it is located north eastern regions of Somali, its sea level town.

Administratively the district has 2 divisions (Biyo-kulule and Balade) 16 villages and 34 IDP camps. It has a population of 700,000 people. The district has 5 hospitals and 8 health centers.

2.3. Study Population

The study population were adults living in Bosaso.

2.4. Sample Size

Sample size was calculated by using the formula below, the estimated sample size was 384 study participants.
Where:

$$N = \frac{(1.96)^2 \times 0.51 - 0.5}{(0.05)^2} = 384$$

N = 384
N= Total number of subjects required in the sample
Z= a standardized normal deviate value that correspond to a level of statistical significance equal to 1.96
P= estimate of prevalence of malaria in adults - 50%
d= margin of error which correspond to the level of precision of results desired

2.5. Sampling Technique

Multi stage sampling technique comprising of simple random sampling and systematic sampling methods was used. The simple random sampling was used to select the villages and the systematic sampling for the houses. The names of all the villages was written on pieces of papers, folded, put in a container and shaken thoroughly and eight of them was picked to get the villages for the study. The study participants was selected equally from the eight villages.

In each village, 48 respondents was selected using systemic. In any house entered, head of the HH was interviewed. This continued until the entire 384 sample was selected.

2.6. Data Collection Instruments/Methods

A structured and pre-tested questionnaire was used to collect information on socio-demographic factors, Practice and Health Seeking behavior of the respondents, utilization of malaria prevention and control measures, environmental and breading sites factors and occurrence of malaria during study period was administered to the 384 eligible participants, whereby every head of the selected household either female or male present at home was interviewed in Somali language.

2.7. Data Management and Analysis

Questionnaire was checked for errors and completeness before entry into the SPSS and Odds Ratio (OR) was used to find out the association between risk factors and malaria occurrence among. A p-value of less than 0.05 was considered as a statistically significant.

3. Results

3.1. Socio-Demographic Characteristics

Table 1. Socio-demographic Characteristics of respondents (n=380).

Variables		Frequency	Percent
Sex	Male	35	9.2
	Female	345	90.8
Age	15-25	101	26.6
	25-35	138	36.3
	35-45	69	18.2
	45-55	40	10.5
	Above 55	32	8.5
Marital status	Single	55	14.5
	Married	299	78.7
	Others	26	6.8
Number of children	0-3	176	46.3
	4 upto 6	130	34.2
	more than 6	74	19.5
Occupation	Business man/woman	67	17.6
	Teacher	5	1.3
	Government employee	12	3.2
	Student	46	12.1
	House wife	196	51.6
	Unemployed	44	11.6
	Others	10	2.6
Family income	less than 100 $	45	11.9
	100$- 200$	113	29.7
	200-300	104	27.4
	300-400	71	18.7
	more than 400$	47	12.4
Education level	Illiterate	136	35.8
	Primary school	135	35.5
	Secondary school	69	18.2
	Bachelor's degree or higher	40	10.5
Number of family members	2 upto 5	80	21.05
	6 upto 9	177	46.58
	more than 9	123	32.37

Table 1 summarizes the socio-demographic characteristics of the respondents. The majority of the respondents 345 (90.8%) were female, while only 35 (9.2%) were male. The majority of the respondents, 138 (36.3%), were between the ages of 25 and 35 years, 101 (26.6%) were between 15 and 25 years, 69 (18.2%) were between 35 and 45 years old, and the remaining 72 (19%) were over 45 years old. 299 (78.7%) of the respondents were married, while the remaining 81 (21.3%) were single or had other marital statuses such as widowed or divorced. Around 130 (34.2%) of respondents have four to six children, 121 (31.8%) have one to three children, 74 (19.5%) have more than six children, and the remaining 55 (14.5%) have no children. More than half 196 (51.6%) of the participants were housewives, 94 (24.7%) of the respondents were employed, 46 (12.1%) of the respondents were students, and the rest 44 (11.6%) were jobless. 113 (29.7%) of the respondents stated that their family income was between $100 and $200, 104 (27.4%) was between $200 and $300, 71 (18.7%) said their family income was between $300 and $400, 47 (12.4%) their family income was more than $400, and 45 (11.9%) their family income was less than $100. 137 (36.1%) of the respondents had completed primary school, 70 (18.4%) had completed secondary school, 41 (10.8%) had completed university, and the remaining 132 (34.7%) were illiterate. Around half 177 (46.58%) of the respondents' family members were between 6 up to 9 persons, 123 (32.37%) of them, their family members were more than 9 person and the rest 80 (21.05%) were between 2 up to 5 individuals.

3.2. Practice and Health Seeking Behavior

Table 2. Practice and Health Seeking behavior of the respondents (n=380).

Prevention practice	Good	147	39%
	Poor	233	61%
Health seeking behavior	good	345	90.80%
	Poor	35	9.20%

Table 2 shows that the majority of respondents 233 (61%) had poor prevention practices because they did not employ all prevention measures such as IRS, mosquito nets, and so on, while the remaining 147 (39%) had good prevention practices. The majority of the respondents (345) have good health seeking behavior, whereas the remaining 35 (9.2%) have bad health seeking behavior.

3.3. Socio-Demographic Factors and Occurrence of Malaria

Table 3. Association between Sociodemographic factors and occurrence of Malaria (n=380).

		Malaria incidence during last month		Odds Ratio	P-Value
		Yes	No		
Sex	Male	7	28	1.0	0.967
	Female	68	277		
Age	15-35	36	204	2.2	0.013
	above 35	39	101		
Marital status	Married	60	239	1	0.406
	Single/widowed/divorced	15	66		
Occupation	Employed	30	110	1.2	0.918
	Unemployed	45	195		
Family Income	<$100 - $ 200	46	126	2.3	0.033
	> $200	29	179		
Education Level	Illiterate to primary level	59	212	1.6	0.257
	Secondary and above	16	93		

As shown in Table 3, respondents' sex had no association with the occurrence of malaria (OR=1 and P-value = 0.967), but those aged 35 and above were 2.2 times more likely to have malaria than those aged 15 to 35, and the association was statistically significant (P = 0.013). Marital status had no association with the occurrence of malaria (OR=1 and P-value = 0.406), and the risk of malaria was 1.2 times higher among employers compared to those who were unemployed, but the relationship was not statistically significant (P-value = 0.916). The risk of malaria was 2.3 times higher among those who had low family income compared to those who had middle and high family income, and the relationship was statistically significant (P-value = 0.033). Those with less than a primary level of education have 1.6 times the risk of malaria as those with secondary level and above (P-value = 0.257).

3.4. Environmental Risk Factors and Occurrence of Malaria

Table 4. Association between environmental risk factors and occurrence of Malaria (n=380).

		Malaria incidence during last month		OR	P-value
		Yes	No		
Type of House	stones/ bricks with cement building	67	281	1.4	0.719
	iron sheets and Bushes	8	24		
Number of rooms in the house	1-3	70	294	0.52	0.237
	4 and more than	5	11		
Condition of the house	proximal to breeding sites	48	178	1.3	0.648
	clean environment	27	127		
Barkets in the house	Covered barkets and water pipes only	24	130	1.59	0.03
	semi covered/ uncovered	51	174		
Algae in Barkets	Yes	41	130	2.04	0.013
	No	22	142		
Windows screened with mosquito wire guaze	Yes	23	133	1.75	0.041
	No	52	172		

Table 4 shows that people living in iron sheet or bush houses have a 1.4 times higher risk of malaria than those who live in stone/bricks building houses, but the relationship is not statistically significant (P-value = 0.719), the number of rooms in the house has no association with the occurrence of malaria (OR = 0.52, P-value = 0.238), as well as people living live in houses close to breading sites have a 1.3 times higher risk of malaria than those who live in houses further away, in addition to that open or half-covered water tanks in the home were linked to the prevalence of malaria (OR = 1.6, P-value = 0.029), but also households with algae in their water tanks were 2 times more likely to have malaria than those without algae or who only use water pipes (P-value = 0.013). People who did not have mosquito wire gauze screened on house windows were 1.75 times more likely to have malaria than those who did have mosquito wire gauze screened on the windows, and this association was statistically significant (P-value = 0.041).

3.5. Prevention Methods Practice and Occurrence of Malaria

Table 5. *Association between Prevention methods usage and occurrence of Malaria (n=380).*

		Malaria incidence during last month		Odds Ratio	P-value
		Yes	No		
Sleeping under Mosquito net	Yes	22	145		
	No	53	160	2.18	0.004
Usage of protective cloth	Yes	26	147		
	No	49	158	1.75	0.035
House sprayed with IRS	Yes	38	199		
	No	37	105	1.85	0.018

Table 5 shows that people who did not use a mosquito net were 2.18 times more likely to have malaria than those who did, with a statistical significance of (P-value = 0.004), people who did not use protective clothing like long trousers and sleeves were 1.75 times more likely to have malaria than those who did, and this relationship was statistically significant (P-value = 0.035), and people who did not use IRS (indoor residual spraying) were 1.85 times more likely to have malaria than those who did, and the relationship was statistically significant (P-value= 0.018).

4. Discussion

The results revealed that 75 (19.7%) individuals in the study population had malaria in January 2018, 17.9% of them were female and they were majority of the respondents almost 90.8%, 63.2% of the respondents were the age between 15 to 35 years, 78.7% of the respondents were married, 63.2% of the respondents were unemployed but more than half of the respondents' family income were above $200, on the other hand mostly 35.8% were illiterate and 35.5% were primary level.

Mostly around two-thirds of the respondents 61% had poor prevention practice they were not using malaria prevention measures, but mostly 90.80% of them had good health seeking behavior.

As shown in Table 3 sex of the respondents had no association with occurrence of malaria (OR=1 and P-value = 0.967), the age above 35 years had associated with occurrence of malaria (OR= 2.2, P = 0.013) similarly another study conducted in Tanzania stated that older age group were associated with occurrence of malaria (P-value= 0.015), [9] Marital status had no association with occurrence of malaria (OR=1 and P-value = 0.406), There was association between occupation and malaria occurrence but the relationship was not statistically Significant (OR = 1.2, P-value = 0.916), Low family income was associated with malaria occurrence (OR= 2.3 P-value = 0.033), Low level of education or illiteracy had associated with occurrence of malaria (OR = 1.6, P-value = 0.257).

Iron sheet or bush houses were associated with occurrence of malaria since mosquitoes are accessible but the relationship was not statistically Significant (OR= 1.4, P-value = 0.719), but in contrast other study conducted in South- West Cameroon by Theresa etal stated that poor house condition is significantly associated with occurrence of malaria (P-value = 0.001) [10] Number of rooms in the house has no association with occurrence of malaria (R = 0.52, P-value = 0.238), people who were living houses which are proximal to breading sites were associated with occurrence of malaria but this relationship was not statistically Significant (OR = 1.3, P-value = 0.648), open or are half covered water storage tanks were associated with occurrence of malaria since they are potential sources for mosquitoes to breed which may further lead to malaria occurrence (OR = 1.6, P-value = 0.029), water storage tanks with algae were associated with occurrence of malaria since mosquito larva eats constantly algae, plankton, fungi and other microorganisms in the water in order to grow (OR= 2, P-value = 0.013). [11] People whose their houses' windows were not screened with mosquito wire gauze were associated with malaria (OR=1.75, P-value = 0.041).

People who were not use mosquito net had associated with malaria (OR = 2.18, P-value = 0.004,) similarly another study conducted in Ethiopia stated that lack of mosquito net is associated with malaria (P-value = 0.0001), [12] people who were not use protective clothes like long trousers and sleeves had associated with malaria occurrence (OR= 1.75, P-value = 0.035), similarly those who were not using IRS in their homes had associated with malaria occurrence (OR= 1.85, P-value= 0.018).

5. Conclusion

In conclusion, the findings of this study show that 19.7 percent of the study population had malaria, demonstrating that malaria is a significant public health concern among adults in Bosaso and that several variables contribute to the prevalence of malaria in Bosaso. Malaria incidence was observed to have a statistically significant relationship with age and household income (OR = 2.2, 0.013 and 2.3, 0.033, respectively). Those who did not utilize mosquito nets had a higher risk of malaria (OR = 2.18, P-value = 0.004), and people who did not wear protective clothes had a higher risk of malaria (OR = 1.75, P-value = 0.035). Furthermore, uncovered or half-covered water tanks in the residence were associated with malaria prevalence (OR = 1.6, P-value = 0.029).

6. Recommendation

1) Ministry of Health and Bosaso local Authority should

enact policies on Malaria prevention and Control.

2) Health education about malaria, its transmission and prevention strategies should be given to the community by using mass media and any other suitable method.

3) Water storage tanks in households should be covered tightly and clean them from algae that mosquito larvae feed.

4) People should practice Malaria prevention measure like sleeping under mosquito net and usage IRS.

Acknowledgments

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