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Maternal Characteristics And Practices Associated With Malaria Prevalence In Pregnant Women Attending Selected Hospitals In Hodan District, Somalia.

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Abstract:
Background*: Globally, Plasmodium falciparum malaria constitutes a significant public health challenge to human and economic development particularly in the tropical regions. In 2022, WHO global estimates of malaria cases were 249 million with 608,000 deaths. During the same period, approximately 74% of Africa's population lived in malaria endemic areas where up to 5% of under 5 year-old children died. Malaria habitually occurs at low levels in Somalia with the highest incidences reported among under-five-year old children and pregnant women particularly in the Hodan District of Somalia.*
Materials and Methods
This cross-sectional analytical study using both quantitative and qualitative methods enrolled 387 pregnant women attending eight major public and private hospitals in Hodan District. A researcher-administered questionnaires were used in quantitative data collection and analyzed using SPSS version 22. Whereas qualitative insights were gathered through key informant interviews and analyzed thematically.
Results
Significant associations were found between confirmed cases of malaria and maternal characteristics such as age (30–35 years), marital status, education level, and having more than two children (p=0.00007). Knowledge and practices also showed significant associations (p<0.05), as did factors such as occupation, income, housing type, and neighborhood conditions. Key health system factors associated with prevalence included access to information (OR=4.904), facility accessibility (OR=9.067), intervention effectiveness (OR=2.521), and provider communication (OR=5.332), all with p<0.001.
Conclusion
Findings highlight key socio-demographic and health system factors influencing malaria among pregnant women. These should guide government and stakeholder policies to improve service delivery and reduce malaria prevalence in Somalia.
Key Word: *Malaria; Maternal; Prevalence; Hodan.*

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I. Introduction

Malaria remains prevalent across tropical and subtropical regions worldwide, affecting areas such as Africa, Asia, the Middle East, Central and South America, and the Pacific Islands (WHO, 2023). In 2022, an estimated 249 million malaria cases were recorded globally, resulting in approximately 608,000 deaths (WHO, 2023). The majority of these cases (233 million) and fatalities (580,000) occurred within the WHO African Region, where young children under five years of age and pregnant women face heightened susceptibility.

Pregnant women, particularly during their first and second trimesters, experience increased vulnerability to malaria due to weakened immunity. Such contact may result in serious health issues, including maternal iron deficiency, pregnancy loss, fetal demise, premature delivery, and reduced neonatal mass (WHO, 2020).

Somalia, a country in the WHO African Region, in particular, has been grappling with malaria as a significant public health challenge for years. For example, WHO (2022) noted that malaria was endemic in Somalia, with continuous annnual transmission, with the highest prevalence persistently reported in the southern regions of the country.

A study in Banadir Region of Southern Somalia by (Mohamoud et al., (2022), revealed that current maternal practices blended traditional beliefs with preventive health measures, especially malaria prevention. Pregnant women relied on prayers and Quranic readings, viewing them as healing practices for malaria. The

study highlighted the sustained preference for traditional herbal and natural remedies in maintaining health during pregnancy.

II. Material And Methods

This study employed an analytical cross-sectional design incorporating both numerical and descriptive methodologies. The study targeted pregnant women accessing malaria prevention, treatment and control services in eight (8) selected high volum facilities in Hodan District, Somalia. About 387 pregnant women were enrolled into the study and the number of participants per hospital were determined proportionally to the size of average patients for each antenatal clinic visit.

Study Design: This study employed an analytical cross-sectional design incorporating both numerical and descriptive methodologies.

Study Location: This was Hodan District is a district in the southeastern Banaadir region of Somalia. The area was selected, because there have been many malaria mortality reports.

Study Duration: November 2023 to July 2025.

Sample size: 387 participants.

Sample size calculation: The sample size was determined using the Fishers et al., (1998) formula.

Subjects & selection method: The numbers of participants per hospital were determined proportionally to the size of average patients for each antenatal clinic visit.

Table 1: Stratified selection of hospitals in the sample:

S/No.	Hospitals	Hospital stratum (Public/private)	Average patients per antenatal clinic visit	Sampled number per hospital
1	Banaadir	Public	300	97
2	Madino	Public	220	71
3	Mogadishu Somali Turkye Tayyyib	private	155	51
4	Dr. Hawa Abdi G. Hosp	private	114	37
5	Kalkaal hospital	Private	110	36
6	Hanano specialist hospital	Private	105	34
7	Somali Sudanese hospital	Private	95	31
8	Yardimeli Hospital	Private	94	30
	Total		1193	387

Inclusion criteria:

1. Expectant woman aged at least 18 years accessing malaria services at the designated medical facilities in Hodan District during the study period qualified for participation.
2. Should have lived in Hodan District for at least 6 months to qualify as a stable resident of Hodan District since people were highly mobile and could also have attended some of those hospitals.
3. Granted written informed consent

Exclusion criteria:

1.Pregnant woman who had come for malaria prevention or treatment services at the selected hospitals but were severely sick or on bed rest.
2. Pregnant women not able to grant informed consent.

Procedure methodology

Data Collection and Study Procedures

After obtaining written informed consent, data were prospectively collected using a structured questionnaire designed to capture four key domains: participant background, knowledge, behaviors, and socio-economic characteristics. This facilitated the quantification of responses for analysis and hypothesis testing. A total of 387 questionnaires were administered before conducting key informant interviews (KIIs) and focus group discussions (FGDs).

Key informant interviews provided expert insights through structured, focused conversations with individuals possessing specialized knowledge or experience. **Focus group discussions**, each comprising 8–12

participants from diverse age groups and occupations, were moderated to generate comparative, in-depth opinions on the study topics.

All participants were pregnant women residing in Hodan District, Banadir Region, Somalia, with pregnancy status confirmed using HCG Pregnancy Rapid Test Dipsticks (Gima, Italy), as previously applied by Lopez-Perez et al. (2016). Prior to malaria testing, clinical and physical examinations were conducted by trained healthcare professionals in the selected health facilities.

Malaria diagnosis followed the standards set by WHO (2000, 2024) and the Somalia Ministry of Health (2023). Peripheral parasitemia was confirmed through microscopic examination of thick blood smears for all 387 participants. Malaria prevalence was calculated as the proportion of participants testing positive, in line with previous methodologies (Lopez-Perez et al., 2016; Kitojo et al., 2019; Kenya MIS, 2020; Flatie & Munshea, 2021; CDC, 2021).

Statistical Analysis

Quantitative data were entered in Microsoft Excel, cleaned, and exported to SPSS version 22 (SPSS Inc., Chicago, IL) for analysis. Descriptive statistics including means, frequencies, proportions, histograms, and pie charts were used to summarize findings. Inferential statistics such as Pearson's Chi-square test, Fisher's exact test, and multivariate analyses were applied. A p-value < 0.05 was considered statistically significant at a 95% confidence interval. Qualitative data were coded and analyzed thematically using a password-protected computer to ensure data security.

III. Results

Socio-demographic profiles of the pregnant women (study participants)

Findings from this study show that approximately 34%, 49%, 10%, 3% and approximately 2% were in the age groups 25-29, 30-35, 36-40, 41-48 and 49 years and above respectively (Table 2). Similarly, up to about 10% of the study participants (34 of 338) had never gone to school while almost comparable proportions had both primary and secondary school levels of education with up to 24% of them having college diplomas and university degrees. Marriage and / or living with a man appeared to be an important and popular characteristic of up to 73% (24.7 of 338) study participants. Almost a half of the study participants (up to about 48%) were either employees in the private sector (26%) or civil service (22%) with less than 6% being employed by mosques, despite the fact that all study participants were Muslims. Slightly over a half (57.1%) spoke native Somali language with the Northern part dialect (where Hodan District belongs) dominating, whereas the remaining 42.9% had Somali Southern part dialect as their mother tongue as presented in table 2 below.

Table 2: Demographic profiles of participants

Variables	Category	Frequency (n = 338)	Proportion (%)
	25-29	117	34.6
	30-35	166	49.1
	36-40	37	10.9
	41 – 48	12	3.6
	49 and above	6	1.8
Level of education	Never gone to school	34	10.1
	Primary school	115	34.0
	Secondary school	108	32.0
	College Diploma	72	21.3
	University degree	9	2.7
Marital status	Married	213	63.0
	Living with a man	34	10.1
	Widowed	41	12.1
	Divorced	30	8.9
	Separated	20	5.9
Occupation	House-wife	66	19.5
	Civil servant	73	21.6
	Private sector employee	88	26.0
	Business lady	60	17.8
	Healthcare provider	32	9.5
	Mosque employee	19	5.6
Native language	Somali (Northern part)	193	57.1
	Somali (Southern part)	145	42.9

Demographic profiles and malaria prevalence in Hodan District

As shown in Table 3, a number of maternal socio-demographic characteristics appeared to be related to malaria prevalence as determined by the Chi-square test. These maternal attributes included age between 30 and

35 years ($\chi2$=9.629, df=6, p=0.00003); being married ($\chi2$=7.421, df =4, p=0.00004); Having completed structured elementary schooling (X^2=6.657, df=4; p=0.00001) and having more than two offspring ($\chi2$=11.326, df=2; p=0.00007).

Table 3: Demographic profiles and malaria prevalence

Variable	Category	With malaria	Without malaria	Significance of P<0.05
	25-29	65(38.0%)	52(31.1%)	
	30-35	77(45.0%)	89(53.3%)	
	36-40	20(11.7%)	17(10.1%)	
	41-above	9(5.3%)	9(5.4%)	
	Total	171	167	
Marital status	Married	93(54.3%)	120(71.9%)	χ^2=7.421, df=4, p=0.00004*
	Co-habiting	27(15.8%)	7(4.2%)	
	Widowed	31(18.1%)	10(5.9%)	
	Divorced	20(11.7%)	30(18%)	
	Total	171	167	
Level of formal education	Never gone to school	31(18.1%)	3(1.8%)	χ^2=6.657, df=4, p=0.00001*
	Primary school	66(38.6%)	49(29.3%)	
	Secondary school	53(30.9%)	55(32.9%)	
	College diploma	16(9.4%)	56(33.5%)	
	University degree	5(2.9%)	4(2.4%)	
	Total	171	167	
Number of children	None	17(9.9%)	22(13.2%)	χ^2=11.326, df=2, p=0.00007*
	One	69(4.0%)	70(41.9%)	
	More than 2	85(49.7%)	75(44.9%)	
	Total	171	167	

Knowledge levels and practices of the pregnant women regarding malaria prevalence in selected hospitals in Hodan District, Somalia

These study findings revealed that both groups of study participants with or without prevalent malaria displayed varied levels of itemized components of knowledge information packages. Whereas the highest proportion of those with malaria (26.3%) identified fatigue/tiredness as the most important symptom of malaria, those without malaria (44.3%) recognized diarrhea as the cardinal symptom of malaria. These observations were statistically different at p<0.05 $\chi2$=6.548, df=6, p=0.0005) as summarized in table 4 below.

Table 4: Participants 'knowledge levels and malaria prevalence

Variable	Category	With malaria	Without malaria	Significance at p<0.05
How to know if someone has malaria	Malaria germs detected in blood in the laboratory	31(18.1%)	8(4.8%)	χ^2=6.548, df=6, p=0.00005*
	Headache and fever	20(11.7%)	18(10.8%)	
	Loss of appetite	20(11.7%)	18(10.8%)	
	Shaking chills	22(12.9%)	22(13.2%)	
	Diarrhoea	6(3.5%)	74(44.3%)	
	Muscle aches/joints pain	30(17.5%)	14(8.4%)	
	Fatigue /tiredness	45(26.3%)	7(4.2%)	
	Total	171	167	χ^2=8.062, df=3, p=0.00003*
How malaria is transmitted	Infected mosquito bite	163(95.3%)	144(86.2%)	
	Unhygienic conditions	3(1.8%)	10(5.9%)	
	Exposure to cold weather	5(2.9%)	13(7.8%)	
	Total	171	167	
How to avoid contracting malaria	Few household members	30(17.5%)	12(7.1%)	χ^2=9.732, df=6, p=0.00001*
	Sleep under ITNs	34(19.8%)	24(14.4%)	
	Clear bushes around	27(15.8%)	26(15.6%)	
	Drain all water pools	45(26.3%)	20(11.9%)	
	Use mosquito repellent	14(8.2%)	34(20.4%)	
	Use residual insecticide	11(6.4%)	27(16.2%)	
	Take some preventive medication	10(5.8%)	24(14.4%)	
	Total	171	167	
Action to take when you have malaria	No action	79(40.9%)	5(2.9%)	χ^2=12.009, df=3 p=0.00005*
	Take herbs	33(19.3%)	31(18.6%)	
	Go to health facility	8(4.7%)	40(23.9%)	
	Take a full dose of effective antimalarial drug	10(5.8%)	70(41.9%)	
	Total	171	167	
Effects of malaria to pregnant	Die	11(6.4%)	17(10.1%)	χ^2=8.012, df=7
	Still birth	17(9.9%)	15(8.9%)	

woman	Low birth weight child	26(15.1%)	13(7.8%)	p=0.000 03*
	Become anemic	40(23.4%)	2816.8%)	
	Premature delivery	21(12.3%)	20(11.9%)	
	Intrauterine growth retardation	12(7.0%)	19(11.4%)	
	Increased infant mortality	19(11.1%)	25(14.9%)	
	Miscarriage	25(14.6%)	30(17.9%)	
	Total	171	167	
Malaria-related complications	Celebral malaria	35(20.5%)	0	χ^2=6.533 df=6, p=0.00003*
	Acute renal failure	18(10.5%)	24(14.4%)	
	Severe anaemia	71(41.5%)	24(14.4%)	
	Hypoglycemia	15(8.8%)	33(19.8%)	
	Bleeding	11(6.4%)	56(33.5%)	
	Acidosis	13(7.6%)	15(8.9%)	
	Total	171	167	
Media for transmitting malaria prevention messages	Radio	67(39.1%)	36(21.6%)	χ^2=8.272 df=7 p=0.00001*
	T.V	18(10.5%)	23(13.8%)	
	Social media	2(1.2%)	5(2.9%)	
	Newspaper/magazine	12(7.0%)	6(3.6%)	
	Bronchure /leaflet	1(0.6%)	3(1.8%)	
	Health education at ANC	30(17.5%)	67(40.1%)	
	Talk in Mosque	22(12.9%)	14(8.4%)	
	Community dialogue/barazas	19(11.1%)	13(7.8%)	
	Total	171	167	

Economic profiles and malaria prevalence in selected hospitals in Hodan District, Somalia

The relationship between the pregnant women's socio-economic profiles and malaria prevalence in the study area was established on occupation, family income in US dollars, type of residential house and features near households' neighborhood

Table 5: Economic profiles and malaria prevalence

Variable	Category	With malaria	Without malaria	Significance of p<0.05
Occupation	Housewife	43(25.1%)	23(13.8%)	χ^2=9.429, df=5 p=0.00002*
	Civil servant	20(11.7%)	53(31.7%)	
	Private sector employee	36(21.1%)	52(31.1%)	
	Business lady	72(42.2%)	39(23.4%)	
	Total	171	167	
Family income in US dollars	Between 50 and 100	59(34.5%)	9(5.4%)	χ^2=5.907, df=3, p=0.00007*
	Between 101 and 200	53(30.9%)	87(52.1%)	
	Between 201 and 300	47(27.5%)	58(34.7%)	
	Between 301 and 400	12(7.0%)	14(8.4%)	
	Total	171	167	
Type of residential house	Permanent	12(7.0%)	49(29.3%)	χ^2=8.375, df=3, p=0.00003*
	Semi-permanent	48(28.1%)	95(56.9%)	
	Wall covered with mud	98(57.3%)	17(10.2%)	
	Wall made of stones	13(7.6%)	7(4.2%)	
	Total	171	167	
Features near the households neighbourhood	Bushes	8(4.7%)	45(26.9%)	χ^2=7.894, df=3, p=0.00009*
	Open water drainage	89(52.0%)	56(33.5%)	
	Many mosquitoes	38(22.2%)	2(1.2%)	
	Total	171	167	

IV. Discussion

In this study, a high proportion of the of pregnant women were aged between 30 and 35 years. Age was significantly associated with malaria prevalence, with younger pregnant women showing greater vulnerability to infection. This aligns with findings by Fana (2015), which reported that younger mothers faced higher risks of severe malaria and elevated parasitaemia levels. While malaria can be serious across all age groups, younger pregnant women remain the most at risk, as supported by earlier WHO reports (2022). Similarly, the study found that marital status played a significant role among the respondents.

Knowledge on causes among participants was significantly high with a majority (99.4% of the participants) identifying the correct etiological agent and some 86.4% of the participants also identifying correctly that someone with malaria experienced headache and fever. An earlier study by Kochar et al., (2009) had indicated that women's awareness of malaria infection, its transmission routes, preventive measures, and treatment options could be substantial without necessarily leading to effective control and mitigation efforts. In this study, it was observed that 3.6% of participants took no action when experiencing malaria symptoms. This result was consistent with prior unequivocally demonstration that pregnant women's perception affected their

health-seeking behaviour in the event of contracting malaria (Gontie et al,.2020; Beiersmann et al,.2017). Some of the clinical manifestations of malaria were treated using traditional remedies at home as had been reported previously by Beiersmann et al., (2017) suggesting some knowledge on diagnosis, prevention, treatment and control among this population in Hodan District.

It has been demonstrated that income had the highest influence on malaria prevention and treatment during pregnancy. Women with lower SES were less likely to seek malaria prevention and treatment services as previously reported (Wani, 2019; Pandey et al; 2019). Lack of awareness about malaria risks and prevention, such as sleeping under LLITNs, contributed to this trend (Mhango et al; 2023). Financial constraints impede lower-income pregnant from obtaining necessary services, leading to delayed or inadequate care (Karijo, 2020). These results were similarly documented by earlier researchers and appeared associated with the portion of income allocated for malaria management and prevention (Ettling, 2019). The financial strain of malaria treatment is substantial, with expenses classified into direct costs, including payments for medical services, and indirect costs, such as transportation fees and lost earnings due to absence from formal employment. Results obtained in this study have shown that the conspicuous socio-economic effects were cultural norms and where the respondents lived.

V. Conclusion

Malaria prevalence among pregnant women in Hodan District was found to be 50.6%. This high rate was significantly associated with factors such as marital status, cultural norms, and levels of education. Notably, over 67% of the pregnant women who were infected with malaria demonstrated adequate knowledge about the disease, indicating that with proper support and empowerment, they could effectively engage in malaria prevention and control efforts. However, economic challenges—including low income, occupational limitations, the cost of mosquito nets, transportation barriers to healthcare facilities, and limited access to malaria medication—hindered effective malaria control among the participants.

VI. Recommendations

Expand Healthcare Access

Given the significant association between malaria prevalence and barriers such as access to healthcare services, the Government of Somalia should prioritize the construction of additional health facilities in Hodan District. Moreover, training and recruitment of diverse healthcare cadres are essential to ensure the delivery of quality and accessible services to the growing population.

Strengthen Routine Health Education and ANC Services

The study found that over 67% of infected pregnant women had adequate knowledge about malaria, indicating that enhanced education and support could improve prevention outcomes. Therefore, the Ministry of Health, in collaboration with partners, should ensure that all pregnant women attending public hospitals receive routine health education, quality antenatal care (ANC), free malaria treatment, and long-lasting insecticide-treated nets (LLITNs).

Develop socio-ecologically sensitive Strategic Plan

Cultural norms and socioeconomic factors were shown to influence malaria prevalence. To address these systematically, the Ministry of Health should coordinate all stakeholders in the National Malaria Control Program to develop a comprehensive Strategic Plan. This should include a communication roadmap tailored to changing behavior and improving malaria prevention and treatment practices nationwide.

Support Pregnant Women with Free Malaria Commodities

The study revealed that economic challenges, including the inability to pay for medication, hinder malaria control. In response, the Ministry of Health, in partnership with local authorities in Hodan District, should ensure that unemployed and low-income pregnant women receive free malaria prevention commodities and treatment to reduce financial barriers.

Promote Further Research on Cultural Beliefs and Malaria

Given that cultural norms were significantly associated with malaria prevalence, researchers in Somali universities and research institutions should conduct further studies exploring the interface between traditional and spiritual beliefs and current biomedical approaches. Such research can inform culturally sensitive and effective malaria prevention and management strategies during pregnancy.

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