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FACTORS RELATED TO INCREASE IN PREVALENCE OF MALARIA IN KERFI, EASTERN CHAD

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Abstract

Malaria is one of the principal causes of morbidity and mortality in Kerfi and is responsible for over 22% of all outpatient visits. A descriptive cross-sectional survey was conducted in which information was gathered from Kerfi clinic consultation registers through face to face interview with 170 heads of households. Knowledge of malaria was significantly related to seeking and complying with treatment, taking preventive measures and advising other community members to seek treatment. Use of insecticide treated mosquito nets was affected by factors such as sleeping outside houses and hot climatic conditions (P = 0.039). The effectiveness of the spraying program was affected by type of housing (90.5% poles and grass). There was no significant association between malaria infection and status of population (internally displaced people (IDPs) or host community (HC), prevalence odds ratio (POR 1.0811, 95% CI 0.494-2.3659). There was no significant difference in malaria infection by gender or age group. There was an improvement in clinical malaria diagnosis in 2008, as 2628 parachecks-F tests were done and 1847 (70%) of the tests were positive compared to 2007 where 2344 parachecks-F tests were done but only 608 (25.9%) were positive. The increase observed was not necessarily an epidemiological increase, but an indication of increased awareness, resulting from patients' positive health seeking behaviour and improved diagnosis and reporting. Stakeholders in malaria prevention and control programs should understand traditional and cultural factors that hinder use of insecticide treated nets.

***Key words*:** malaria, prevalence, Chad.

1.0 Introduction

Malaria has remained a complex public health problem globally, where most cases and deaths due to malaria occur, despite it being a preventable disease. According to the World Health Organisation (WHO) 2008 report, there were an estimated 300 million malaria cases among 3.3 billion people globally at risk in 2008, causing nearly a million deaths, mostly of children under 5 years. Eight-six percent (86%) of the 247 million episodes of malaria in 2006 were in the African Region (WHO 2008). Malaria is one of the principal causes of morbidity and mortality in Chad and is responsible for over 30% of outpatient visits (WHO 2008). The first national 5-year malaria strategic plan for malaria control in Chad was tabulated from 2001 to 2006 with the aim of reducing malaria burden by 30% by 2006 and by 50% by 2010. However, the malaria burden was reduced by only 10%, (Ministere d'Sante Publique 2007 Annual Report, undated).

In Kerfi the annual statistical abstract indicated that 22% of all patients consulting at the health centre are diagnosed as malaria, followed by acute respiratory infections (18%), diarrhoea (7%) and dysentery (3%) (Ministre d'Sanitare Publique, Tchad, 2007). This study sought to establish how much these factors contribute to increase in malaria prevalence in Kerfi in 2008, a semi-arid region that spans into Sudan located southeast of Chad, close to West Darfur boarder.

Beier (2008) in Burundi indicated how level of knowledge of risks of developing severe malaria disease and death, and knowledge of malaria-related morbidity as a health problem at individual and household level has contributed to successful prevention and control of malaria in endemic areas. People's knowledge on malaria, especially the signs and symptoms, prompted them to seek early treatment. Studies in Ethiopia, Burkina Faso, and Uganda investigated the effect of early treatment on sick children (Malimbo et al., 2006; Sirima et al., 2003). These studies found that if mothers had adequate malaria knowledge they could seek early treatment within 24 hours of onset of symptoms and could continue treatment for the recommended duration. This resulted in a reduction in the severity of the malaria attack and chances of mortality among the under five aged children.

Scientific evidence exists on ITNs' ability to reduce morbidity and mortality as shown by Langeler et al.'s (1997) studies in Asia and Africa. In these studies insecticide-impregnated bed nets reduced the incidence of clinical attacks by 15% provided they are used properly.

A trial in Gambia by Alonso et al. (1991) showed that insecticide treated bed nets reduced overall deaths by >50%. The beneficial features of bed nets are that the population readily accepts them and that they have high usage rate of 86%, even in the absence of expensive promotional programs, (Mutambu and Shiff 1997). However Wiseman et al (2007) argue that in order to obtain the optimum benefit of long lasting insecticide treated nets (LLITNs) a high degree of community awareness on their proper usage is essential, this was also supported by Nyarango et al (2006) in the study conducted in Eritria on reduction of morbidity and mortality of malaria due to combination of control methods.
Studies carried out by Alaii et al (2003) in Kenya showed that both age and temperature affect the probability that an individual will use an ITN: people are less likely to use ITNs when it is hot, and older people are more likely to use ITNs than young children. While the effect of temperature is not surprising, it was disappointing to observe that young children, the age group most likely to have malaria, were less likely to adhere to ITN use than older people

Studies conducted in Equatorial Guinea showed that indoor residual spraying offered protection from infection to its occupants, and high spray coverage in an area is of benefit to the whole community, including those whose houses were not sprayed, due to the neighborhood effect of IRS, (Kleinschmidt et al, 2007). Achieving high levels of spray coverage in IRS programs therefore has the dual benefit of protecting people living in sprayed houses directly as well as indirectly offering a level of protection to those living in unsprayed houses. In Mozambique, Conteh et al., (2004) reported that other factors like sleeping habits (sleeping outside during hot days), fishing, and renewal of houses especially temporary shelters renders the spraying program ineffective. Those who sleep outside and go for fishing in lakes during the night are not protected from bites. These people will be infected and still be counted as occupants of sprayed households. This implies that the spraying program could be regarded as not useful.

For an IRS program to be successful, it is vital to maintain a high level of public support, as this determines ultimately the ceiling of spray coverage that can be achieved. For example in the Equatorial Guinea study by Kleinschmidt et al, (2007), 92% of the respondents expressed a desire to have their houses sprayed, which was a cornerstone of the accomplishment of the national malaria program project because the community supported and accepted the program.

2.0 Methods Used

A descriptive cross-sectional survey was employed to establish factors that contribute to high prevalence in malaria. Information was gathered from Kerfi clinic consultation registers, interviews conducted with both the internally displaced and host community population with the assistance of 10 enumerators. The study population comprised of inhabitants of Kerfi town that is approximately 4000 internally displaced people and 6000 host community, constituting the Murro and Dadjo tribes respectively. There were 1700 households in Kerfi during the period of the study.

A sample size of 170 households was calculated using EPI-INFO 3.4.1, STATCALC from a population of 1700 households in Kerfi and 95% CI. Expected frequency of use of bed nets by household members (15%) was derived from Graves et al (2009) study in Ethiopia. Interviews were conducted with 170 heads of households in Kerfi and where the head of the household was not present, the wife or an adult person in that household was interviewed. All available malaria consultation registers at Kerfi clinic for the period of June to December 2007 and June to December 2008 were reviewed. All parachecks-F tests records for the periods mentioned above were also reviewed to check the actual malaria confirmed cases for the purpose of calculating true malaria prevalence.

Ten (10%) percent of the total households were randomly selected in both host community and IDP settlement. The team of ten enumerators selected a central place in IDP settlement and/or host community. A pen was spun to get the initial direction for each enumerator. Each enumerator took the direction pointed by their pen and picked every 10^{th} household to interview the head of the Household. Each enumerator interviewed a total of 17 households.

An interview guide was used to solicit information on the following factors; housing type, population movement, culture, proximity to vector-breeding site and vector availability, socioeconomic status, age, occupation, sex, residential mobility and travel, knowledge of malaria, household size, sleeping room density, presence of domestic animals near home, use of preventive methods (bed net use), health seeking behaviours and IRS program. If any of the family members had suffered from malaria, they asked for the clinic card to verify diagnosis. This was carried out to screen households that might report false information on treatment received.

Checklists were developed for reviewing clinic documents to ascertain demographic characteristics of the patients, case management and outcomes. The instruments were developed in English and translated to French with back translation to English to ensure that the meaning of the questions remained the same. Data collection instruments were pre-tested in Goz Beida town before they were used in Kerfi so as to ensure their validity and reliability.

Enumerators were trained for two days so that they understood the interview guide and hence would collect information in the same manner. During the interview sessions at homesteads, enumerators observed whether the ITNs were available and properly fixed in households and whether the house had recently been renovated. It was also determined whether any household residents slept outside, and if so whether they used an ITN. Mentor, Oxfam GB program reports and MSF clinical records and reports were reviewed. All records of parachecks-F tests between Jun-Dec 2008 and Jun – Dec 2008 were reviewed and analysed manually. Analysis of parachecks-F tests was carried out to establish true positive and false positive of clinical diagnosis.

Collected data were entered into the EpiInfo statistical software, version 3.4.1 of 2007. To investigate the association between malaria infection and risk factors, single table analysis was conducted for each potentially explanatory risk factor. Age and sex were retained in all multivariable models to control for any potential confounding effects.

The research protocol was reviewed and approved by the institutional review board of Africa University. Permission to conduct the research was requested and granted from the Ministry of Health, Regional Medical Officer and Goz Beida District Medical Officer, in Chad. All study participants gave written consent to the study and participation was voluntary.

3.0 Results

3.1 Characteristics of households in Kerfi

Interviews were conducted with 170 heads of households, representing 10% of the total households in Kerfi. Majority (62%) of the participants from both the host communities and Internally Displaced People (IDP) were heads of households, with most of them (53.6%) being women and 26% were female-headed household. The age range of people interviewed was 15 to 60 years and median was 23.

Table 1 shows that the literacy levels of people in Kerfi were low, with only 15.7% able to read and write French or Arabic or both French and Arabic. Only a few people (2.96%) from host communities acquired primary and secondary levels and none of the respondents had any tertiary education. The mean household size was 7 people and mean number of children under 5 years per household was 3 (SD=2.7). Most of the populations (88.7%) were peasant farmers and the majority (55.9%) of the families in Kerfi had two rooms despite a large mean (7) size of the family.

Table 1: Demographic characteristics of the respondents of a malaria prevalence study March 2009.

	Host community		**IDP**		**Totals**	**Totals**
	No (N= 70	%	No (N= 98	%	N=168	%
1. Person Interviewed						
Head of household	43	61.4	61	62.2	104	61.9
Partner of head of household	25	35.7	37	37.8	62	36.9
2. Gender of respondent						
Male	30	42.8	46	46.9	76	45.2
Female	40	57.2	50	51.0	90	53.6
3. Gender of household head						
Male	48	68.6	74	75.5	122	72.6
Female	20	28.6	24	24.5	44	26.2
4. Age of respondent						
15 – 20 years	6	8.6	4	4.1	10	6
21 – 45 years	40	57.2	66	67.3	106	63.1
46 and above	23	32.9	27	23.5	50	29.8
5. Level of education						
Primary	4	5.7			4	2.4
Secondary	1	1.4			1	0.56
Tertiary						
Quoran (Arab's formal education)	6	8.6	15	15.3	21	12.5
None	59	84.3	82	83.7	141	84
6. No of people per household						
12+	6	8.6	6	6.1	12	7
8-11	33	47.1	40	40.8	73	43.5
4-7	30	42.9	51	52.0	81	48.2
1-3	1	1.4	1	1.0	2	1.2
7. No of children under 5 years in the household						
0	3	4.3	5	5.1	8	4.8
1	10	14.3	13	13.3	23	13.7
2	23	32.9	32	32.7	55	32.7
3	20	28.6	26	26.5	46	27.4
4	12	17.1	13	13.3	25	14.9
5+	2	2.8	8	8.3	10	6

3.2 Knowledge of Malaria

Majority of the respondents (86.6%) were aware of malaria and had received information mostly from health workers (80.3%) as well as from NGOs (Mentor, Oxfam GB and MSF), friends and relatives and 87% had suffered at least one attack of malaria that season. Most of the respondents (79.8%), reported that children under-5 years were the group at the highest risk of getting malaria, followed by pregnant women (45.8%). Malaria symptoms mentioned by the participants were mostly fever (69.6%), headache (62.5%), feeling cold (69.6%), loss of appetite and vomiting (47%).
Regarding transmission of the disease, seventy percent of the respondents were aware that malaria is transmitted through mosquito bites, while 36% thought one could get malaria from drinking dirty water and 28% thought you could get malaria from getting cold. Table 2 summarizes respondents' views on prevention of malaria.

The respondents mentioned that malaria could be prevented by avoiding mosquito bites (66.7%), using insecticide treated mosquito nets (54.8%) and spraying houses with insecticides (48.2%). Those who associated malaria transmission with drinking dirty water thought that drinking clean water could prevent the disease. Our results indicated that knowledge of malaria prevention was related to use of insecticide treated nets in the household (OR 1.457, 95%CI 0.6739-3.15).
Having had suffered from malaria disease was significantly positively associated with knowledge on malaria. Those who had suffered from malaria were at 4.17 times odds of gaining knowledge about malaria prevention and control measures (OR=4.17 95% CI 1.961–6.1493;p=0.0001).

Table 2: Knowledge on prevention of malaria

	N = 168			
Prevention method	**Yes**	**%**	**No**	**%**
Sleeping under an insecticide treated mosquito net	92	54.8	76	45.2
Avoiding mosquito bites	112	66.7	56	33.3
Taking preventive medicine	35	20.8	133	79.1
Use of repellents	48	28.6	120	71.4
Spraying houses with insecticides	81	48.2	87	51.8
Avoid getting cold	43	2.6	125	74.4
Drinking clean water	36	21.4	132	78.6

3.3 Use of long lasting insecticide treated nets (LLITN) in Kerfi

Our review of records revealed that Oxfam GB and Mentor distributed LLITNs to 3500 households. Coverage ratios in households with children were higher than in those without children (1.82 versus 1.19). The mean number of LLITNs in the household was 1.6 (SD=1.76). Of the 6845 LLITNs issued to the households that were sampled, it was found out that 4,372 (63%) were still in place. The factors affecting LLITN use included age, temperature, and presence of mosquitoes. Of these, the most clearly significant effect was age, for which the probability of adherence in children <5 years of age showed a 14.5% reduction as compared with individuals more than 5 years. A large proportion of the respondents (70%) reported that they rarely use the LLITNs due to hot climatic conditions.

When respondents were asked if they had themselves slept under a net the previous night, 60% reported they had slept under a net the previous night, those who did not (40%) cited unfavourable climatic conditions in the form of high environmental temperatures and no mosquitoes were present during the season when the study was conducted. The majority of respondents stated the main advantage of sleeping under a net was that it prevented one from being bitten by mosquitoes (84%) a further 6% mentioned that it protected one against malaria. Of the 70% who reported any disadvantage two thirds mentioned the net being too hot or decreased ventilation and half the respondents mentioned 'other' reasons like difficulty in getting up during the night and the net taking time to fix around the bed. Relatively high temperatures were associated with reduced adherence (POR 1.31, 95%CI 0.501-4.3659).

3.4 Indoor Residual Spraying (IRS)

Mentor used locally trained people to spray a total of 7500 household units. Most of the structures were constructed using poles and grass (90.5%), while 4.7% were constructed using mud brick and grass, and a few, 1.2% were constructed using farm bricks and iron sheets and grass. Mentor used DDT to spray the houses. Majority of the respondent (65.1%) reported that Mentor carried out the indoor residual spraying in June 2008. While the indoor residual spraying program might have been successful, majority of the houses (73.4%) were renovated just after four months (June-September) when malaria transmission actually peaks in October to December. The sprayed grass and poles with residual insecticides were replaced and this exposed the occupants to more mosquitoes. According to the findings of this study, majority of the adults (78.1%) slept outsides, while adult males spent the night fishing. A large proportion (80%) slept in their fields during the agriculture season, which coincides with the peak of malaria season.

3.5 Malaria prevalence in Kerfi

According to the data collected from Kerfi clinic registers, it was observed that 41.4% who were diagnosed of malaria were 15 years and above, 26.1% were 6-14 years and 32.6% were under-5 years. Malaria prevalence indicated

that all age groups were at risk of getting malaria in Kerfi. Data collected through interviews indicated that there was no statistical significance between malaria prevalence and sex (female 52.7%) males (47.3%). There was no significant association between being an internally displaced person or host community and malaria prevalence (POR 1.0811 (95% CI 0.494-2.3659).

Results from record reviews indicate that there was an improvement in clinical diagnosis in 2008, as 2628 parachecks-F tests were done and 70% (1847) of the tests were positive as compared to 2007 where 2344 parachecks-F tests were done but only 25.9% (608) were positive.

4.0 Discussion

People's knowledge on any disease, especially the signs and symptoms, prompt them to seek early treatment. Knowledge is a cornerstone for success and motivation. Beier (2008) in his studies in Burundi also found out that the level and distribution of knowledge of risks of developing malaria disease and death at individual and household level contributed to successful prevention and control of malaria in endemic areas. Wiseman et al (2007) shared the same sentiments when they reported that in order to obtain the optimum benefit of LLITNs a high degree of community awareness on their proper usage is essential. Non-governmental organisations have conducted malaria education in Kerfi for the past one and half years and this may have raised awareness in the population. Our respondents were aware of malaria and had received information from health workers, friends and relatives. This awareness may have enhanced the utilization of mosquito nets and the early treatment seeking behaviours in our study sample. Evidence from our findings suggests that most participants knew the signs and symptoms of malaria and they were able to pinpoint that children under-5 years and pregnant women were most risk of contracting the disease. This knowledge may have contributed to high retention of LLITNs and use of insecticides treated nets by children and pregnant women and our findings complement studies by Malimbo et al. (2006) and Sirima et al. (2003) who found that if mothers had adequate malaria knowledge they could seek early treatment within 24 hours of symptoms onset.

The results on coverage of insecticide treated nets in Kerfi indicate that major progress has been made in net distribution (mean of 1.6) since the Malaria baseline survey of 2007, which indicated a mean of 0.5 (Mentor Baseline survey report, 2007 Unpublished). Langeler et al., (1997) in Asia and Africa concluded that there is scientific evidence that LLITNs could reduce morbidity and mortality from malaria. An interesting feature of the Langler et al (1997) results is that possession of insecticide treated net by a household was associated with a lower risk of malaria infection, whereas in our study sleeping under insecticide treated net the previous night did not appear to provide significant protection. This may be due to the timing of the survey after peak mosquito season, or because the questions regarding net use for the night before the survey did not accurately capture the net use over a longer period. It may also be that the mere presence of an insecticide treated net in the house gives protection. An interesting finding was that though the mean number of LLITNs was 1.6, communities in Kerfi rarely used the LLITNs citing hot climatic conditions. This is in tandem with studies carried out by Alaii et al (2003) in Kenya, which showed that temperature affected the probability that an individual would deploy his or her LLITN, people are less likely to use LLITNs when it is hot.

The majority of houses in Kerfi are made of pole and grass. In this study it has been established that more than 73.4% of the households renovated at least some of their walls and roofs in October 2008, which might have had rendered the insecticide ineffective after only four months of spraying program. Therefore this practice reduces the effectiveness of IRS program in this context, as the residual insecticide only works for a period of two to three months instead of 6 months.

The findings on indoor residual spraying agreed with studies done in Mozambique by Conteh et al. (2004) when they found out that other factors like sleeping habits (sleeping outside during hot days) and other income generating activities like fishing renders the spraying program not useful. Kerfi lies in a hot climatic region and majority of people sleep outside.

Studies conducted in Equatorial Guinea showed that indoor residual spraying offered protection from infection to its occupants, and high spray coverage in an area is of benefit to the whole community, including those whose houses were not sprayed, due to the neighborhood effect of IRS (Kleinschmidt et al., 2007). But in this case where during the agricultural season which coincides with the pick of malaria season most people (80%) sleep in their fields away from the sprayed neighbourhood, IRS does not offer any protection. In an area with unstable malaria, all age groups are susceptible to infection. Kerfi was no exception as from the conducted analysis malaria prevalence was neither statistically associated with age nor was it associated with gender. Males and females had an equal chance of getting malaria infection.

The study was conducted after the malaria season and this may have affected the observations on use of insecticide treated nets. Environmental factors such as changes in temperature and rainfall are determinants for development of breeding sources and these could affect transmission of malaria. The researchers assumed these factors to be constant in this study because there was a lack of data at the time of the analysis. Data collection was also affected by insecurity in Kerfi, some populations were not accessed due to security concerns in those areas.

5.0 Conclusion

The NGOs in Kerfi carried out several campaigns on malaria prevention and control and this could have contributed to increase in awareness on malaria signs and symptoms, prevention and control and the knowledge acquired might have contributed to Kerfi population seeking early treatment, accept IRS and use of mosquito nets. There was evidence of increased awareness of malaria in Kerfi as shown by high recall rate and knowledge on malaria signs and symptoms, prevention and control. The health seeking behavior like seeking early treatment was registered among most of the

participants including use of mosquito nets. Agencies involved in malaria prevention and control programs in Kerfi and similar geographical settings should target all age groups and conduct assessments on traditional and cultural factors that might contribute to high malaria prevalence.

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Authors' contributions

Manenji Mangundu, Elizabeth Chadambuka and Agnes Mangundu were involved in the conceptualization of the study. Manenji Mangundu, James January and Roy Tapera were involved in the analysis of data and drafting of the final manuscript for publication.

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