

EXPLORATORY STUDY OF MALARIA SITUATION IN HANANG AND BABATI DISTRICTS AFTER REPORTED MALARIA EPIDEMIC: III. SOCIO-ECONOMIC FACTORS

*K.J. Njunwa¹, M.M. Lemnge¹, M.L Kamugisha¹, H.A. Msangeni¹, G, Mubyazi¹
A. Makundi², F. Salum³ and A. Y. Kitua²*

Abstract: Social-economic investigation was conducted in May 1999 over a period of 14 days in three villages each in Babati and Hanang Districts, Arusha Region following reports of a malaria epidemic. The aim of the study was to identify socio-economic factors that might have significantly contributed to the occurrence of the epidemic. The information gathered could serve as baseline for a more detailed case-control study to identify socio-economic risk factors in these epidemic prone districts. For that purpose, semi-structured interviews were conducted with a randomly selected sample of heads of household in the two districts. Aspects asked about include their occupations, mobility, type of houses, income, and educational level, possession of a number of household items including insecticide treated nets, as well as ownership of cattle.

The results indicated that the majority, 89.0%, of the respondents were subsistence farmers. More than 70% of the respondents earned income of Tsh. 5,000 and below per month (1 US \$ = Tsh 880). This is equivalent to US \$ 204 per year, which is above the World Bank Estimate for Tanzania of US \$ 125/year. Bednets were least owned by the least income group, while insecticide treated nets were mostly possessed by those earning over Tsh 50,000 per month. The median duration of stay of respondents in Babati and Hanang districts were 20 years and 14 years respectively. About a third of the respondents travelled very often to visit relatives or on business.

There was a 3.6 times likelihood for a person having a radio to own a bednet than someone without a radio and 4 times as likely to own an insecticide treated bednet than someone without a radio. Cattle ownership had no association with owning a bednet or an insecticide treated bednet. Bicycle had a strong positive association with bednet, so that one with a bicycle was 3.4 more likely to own a bednet than one without a bicycle. However, Ownership of bicycle was not associated with insecticide treated net in any way.

These results indicate that people in the two districts permanent homes, with an average income per month. With respect to malaria control, there will be a need for house improvement, promotion of insecticide treated nets particularly in the rural areas among the subsistence farmers and nomadic herdsmen. That would allow them to dispose of their valuable possessions such as cows to buy malaria preventive items.

Introduction

Babati and Hanang districts have experienced malaria epidemics since malaria became established in the area in the early 1940s (1). Malaria evaluation studies

conducted in Hanang District in 1984 during which Babati was still part of Hanang District (2) showed that malaria ranged from meso-endemic in the highland to hyperendemic in the lowland. Socio-economic,

¹ National Institute for Medical Research, Amani Medical Research Centre, P.O. Box 4 Amani Tanzania

² National Institute for Medical Research Headquarters, P.O. Box 9653 Dar es Salaam, Tanzania

³ Deceased

investigation conducted in 1995 in a similar district, Ngorongoro, Arusha in the divisions of Loliondo (highland) and Sale (lowland) indicated that there was considerable migration of people from the highland to the malaria mosquito infested lowland areas in search of pasture for their livestock (3). Likewise, for Babati, it has been shown there were incidents of overnight stay away from home, mainly to engage in farming activities (4). Ostensibly, in the course of carrying out both of these activities individuals are likely to be more exposed to malaria infection.

Factors likely to lead to a large proportion of the population being dramatically affected by malaria over a short period of time are several (5). These include sudden increase in the number of exposed non-immune individuals, drastic increase in the level of malaria transmission, sudden and remarkable changes in climatological, environmental, socio-economic conditions in favour of increased Anopheline mosquito survival, as well as reduced sensitivity of malaria parasites to antimalarial drugs (5, 6).

It is well understood that low socio-economic status of the people and high mortality are highly associated phenomena in many different conditions. (7) In South East Asia and Latin America malaria has been shown to be associated with poor housing, crowding, lack of knowledge about prevention of malaria, and low education level (8, 9, 10, 11, 12, 13). In Africa, less knowledge of malaria possessed by mothers, poor quality of housing and crowding and travelling to rural or other areas where malaria transmission is higher than in urban centres or their homes (14) are among the factors identified to associate with occurrence of malaria. Precipitation of a malaria epidemic in a particular situation is determined by a number of interrelated factors making it seldom to have more than one or a few major risk factors with high predictive value (4). Therefore, it is of value to assess the relative contribution of the various socio-economic factors. For example, economic depression and famine are a set of factors that would mainly tend to determine the severity of the impact of other socio-economic factors on malaria morbidity in areas of unstable malaria (15, 16).

Thus, following reports in April 1999, that there was a malaria epidemic in Hanang and Babati districts, a study was carried out in May 1999 to explore, among other aspects (17, 18, 19), socio-economic factors that relate to the occurrence of the epidemics in both Babati and Hanang Districts. This paper describes the findings of the socio-economic investigation.

Materials and Methods

Study Areas and Study Population

The study was conducted in Babati and Hanang districts,

in Arusha Region at an altitude of 800-2500m above sea level, with weather condition as already described.¹⁸ The villages covered in Babati District include Gichamedia, Nakwa, Nangara and Himiti, while those in Hanang District were Gidahababieg, Bassotu, Endasak, and Balangdalalu. Ethnically, the people in the two districts are mainly Wairaqw, Wagorowa, Wambugwe and Wabarbaig. Respective populations of Babati and Hanang districts are 288,429 and 157,577 people respectively (18). The procedure followed in the selection of the study villages is as described in reference number 19.

Socio-economic Factors

Information on socio-economic factors in the two districts was gathered by interviewing a sample of heads of household using semi-structured questionnaire. This was done by house to house visits a day after the village government had been told of the purpose of the study and an appointment made. The aspects asked the heads of household included the following: occupation, level of education of head of household (father and mother), type of houses, possession of a number of household items, level of income, bednet ownership, and mobility.

Data Analysis

All data were recorded in pre-coded forms, entered in the computer and then validated by using EPI-Info 6.04b. Data analysis was carried out using the same program. Where appropriate, comparison was made between Babati and Hanang Districts to establish if there were any significance in the observed differences in the levels of various socio-economic features used as indicators in this study. For that purpose, 2 by 2 chi-square test or binomial approximation of 95% confidence intervals (CI) of discrete proportions were used.

Results

Demographic Characteristics

A total of 602 heads of household were interviewed whereby 308 (51.2% CI: 47.2-55.1) and 294 (48.8% CI: 44.9-52.8) came from Babati and Hanang districts respectively. Of all those interviewed 254 (42.2% CI: 38.2-46.2) were males and 348 (57.8% CI: 53.8-62.3) were females. The mean age of the respondents was 37.7 years with a range of 16-85 years, while the median age was 34.5 years.

Socio-economic Factors

Occupation of Heads of Household

The main occupation of the residents of Babati and Hanang districts was similar being small holding type of farming. It accounted for 89.0% (527/592) of all the household responses in the two districts. Other activities include contract employment 4.9% (29/592), business

1.7% (10/592), fishing 0.8% (5/578) and livestock keeping 0.9% (5/578).

Level of Education of Father and Mother

Information on level of education is as shown in Table 1. In both districts most respondents had attended primary

school, though at a higher rate in Babati, 73.4% (199/279) for fathers and 72.5% (206/286) for mothers than in Hanang. Corresponding figures for Hanang were 67.7% (189/279) and 66.4% (190/286) for fathers and mothers respectively.

Table 1: Level of Education of Mother and Father

LEVEL OF EDUCATION	BABATI			HANANG		
	No.	%	Total Respondents	No.	%	Total Respondents
Father's education						
Degree/diploma/Cert.	4	1.5%		20	7.2%	
High School/O-level	20	7.4%	271	19	6.8%	279
Primary	199	73.4%		189	67.7%	
Other	48	17.7%		51	18.3%	
Mother's education						
Degree/diploma/Cert.	2	0.7%		5	1.7%	
High School/O-level	6	2.1%	284	11	3.8%	286
Primary	206	72.5%		190	66.4%	
Other	70	24.6%		80	28.0%	

Type of Houses, Possession of a Number of Household Items and Level of Income

The socio-economic status and level of income of the people was assessed by using proxy indicators as well as asking how much a person earned per month (Table 2). Where the respondents could not tell in monetary terms the value of their income, they were assisted to do so by estimating the value of their farm produce. The results show that in either district there were over 50% thatched, and over 60% mud-walled houses with mud floors of the respondents. Few houses in both Babati and Hanang had ceiling. On the other hand however, a significantly higher proportion of houses in Hanang had closed eaves than those in Babati ($\chi^2 = 17.3$, $p < 0.0001$). In Babati, houses with windows fitted with wire mesh were proportionately more than in Hanang. In both districts over 40% of the respondents owned a personal radio/cassette. Bicycle ownership was about similar at 43.4% (133/306) and 39.5% (116/294) in Babati and Hanang districts respectively ($c^2 = 0.83$, $p > 0.05$). The same applied to having a radio/cassette ($c^2 = 1.56$, $P > 0.05$). Over a third of the respondents in either district owned at least one cow.

There was a 3.6 times likelihood of a person having a radio to own a bednet than someone without a radio and 4 times as likely to own an insecticide treated bednet than someone without a radio. Cattle ownership had no association with owning a bednet or an insecticide treated bednet. Bicycle had a strong positive association with bednet, so that one with a bicycle was 3.4 more likely to own a bednet than one without a bicycle. However, Ownership of bicycle was not associated with insecticide treated net in any way.

The results on monthly income indicate that in either district over 70% earned a modest income of between Tsh. 0-15,000 (i.e up to US \$ 204 per year, the maximum being a little higher than the Tanzania World Bank Estimate of US\$ 125). Comparatively, there was not any marked difference between the two districts in the number of respondents earning between Tsh 0-50,000 per month. However, respondents exceeding Tsh 50,000 per month, were proportionately significantly more in Hanang at 14.7% (43/293), than those in Babati where they accounted for 7.6% (23/304), $\chi^2 = 6.96$, $p = 0.008$.

Table 2: Socio-economic Status Indicators and Level of Income of Respondents

ITEMS ASKED ABOUT	BABATI			HANANG		
	No. (Yes)	%	Total Respondents	No. (Yes)	%	Total Respondents
House						
Roof: Thatch	165	56.1%	294	149	51.2%	291
Metal	129	43.9%		142	48.8%	
Wall: Mud	212	69.7%	304	178	61.0%	292
Concrete	92	30.3%		114	39.0%	
Floor: Mud	226	73.6%	307	201	68.6%	293
Cement	81	26.4%		92	31.4%	
Window wire gauze	62	20.3%	306	39	13.5%	288
Ceiling	21	6.8%	307	23	7.8%	293
Eaves closed	131	43.1%	304	176	60.5%	291
Holes in walls	58	19.5%	298	50	17.3%	291
Household Items						
Personal radio/cassette	123	40.2%	306	134	45.6%	294
Personal bicycle	133	43.4%	306	116	39.5%	294
Personal Motorcycle	6	2.0%	301	9	3.1%	289
Personal car/tractor	14	4.6%	301	7	2.4%	290
Personal house	249	85.9%	290	223	81.7%	273
Cattle	105	34.3%	306	106	36.3%	292
Income/month (Tsh)¹						
Less than 15000	244	80.3%	304	212	72.4%	
15001-30000	23	7.6%	304	23	7.8%	293
30001-50000	14	4.6%	304	15	5.1%	
Over 50000	23	7.6%	304	43	14.7%	

¹Tsh 880 = 1 US\$

Bednet Ownership and Monthly Income

Ownership of at least one bednet was compared with the level of income to see if there was any association (Table 3). Those with the lowest income of Tsh 15,000 and below per month had a significantly less, 38.4%

(175/456) ownership of any net than the combined one for the rest of the groups which was 68.1% (96/141), $c^2 = 37.2$, $p < 0.0001$. Generally, ownership of any net or insecticide treated net (ITN) increased with monthly income peaking at over Tsh 50,000 per month.

Table 3: Personal Income per Month and Bednet Ownership*

PERSONAL INCOME (Tsh/month) ¹	ANY BEDNET			TREATED BEDNET		
	No. Owning	%	Total Respondents	No. Owning	%	Total Respondents
0-15,000/=	175	38.4%	456	20	11.5%	174
15,001-30,000	31	67.4%	46	4	13.8%	29
30,001-50,000	24	82.8%	29	2	8.3%	24
Over 50,000	41	62.1%	66	6	14.6%	41

*Combined results for Babati and Hanang, ¹Tsh 880 = 1 US\$

Residence and Mobility of the People

In order to establish the extent of permanence of the people in the area householders were asked how long they had stayed in their respective localities. In Babati district half of those interviewed had been resident for up to 20 years, and the longest stay was 80 years. In Hanang district the median duration of stay, on the other hand was 14 years while the longest stay was 65 years, a little shorter than that for Babati. When asked if they travelled very often 38.9% (119/306) in Babati and 33.1%

(97/293) in Hanang said they did. This suggests that the extent of people's mobility did not differ significantly between the two districts ($\chi^2 = 1.93$, $p > 0.05$).

It was further asked what the main reasons for travelling were irrespective of the frequency of travelling. Table 4 shows that visiting and doing business were the major reasons of travelling and they did not differ significantly between the two districts.

Table 4: Reasons for People Travelling

REASON FOR TRAVELLING	BABATI			HANANG		
	No.	%	Total Respondents	No.	%	Total Respondents
1. Visiting	75	62%	121	61	61.6%	99
2. Shopping	8	6.6%	121	5	5.1%	99
3. Farming	4	3.3%	121	2	2.0%	99
4. Business	24	19.8%	121	28	28.3%	99
5. Casual labouring	1	0.8%	121	1	1.0%	99
6. Fishing	3	2.5%	121	-	-	-
7. Livestock herding	3	2.5%	121	-	-	-
8. Worshipping	3	2.5%	121	-	-	-
9. Seeking treatment	-	-	-	2	2.0%	99

Discussion

Nature of the Study

As it will have been noted this study was not designed to carry out comparative assessment of the socio-economic risk factors for those who were sick and their control who are well. This would have needed a much longer time, more resources and a different design.¹⁴ Thus this study was done to establish the status of some of the socio-economic features in the two districts that might serve as a precursor for a detailed case-control study to identify the risk factors.

The numbers of heads of household interviewed in Babati and Hanang though different, they did not differ significantly. However, the total number of females interviewed was significantly higher than that of males. This perhaps emanated from the fact that men usually left to attend to family obligations earlier and/or returned later than their spouses, and thus being missed by the interviewers.

Occupation of Heads of household

The majority of respondents in this study indicated that they were subsistence farmers and just a minority were either on contract employment, doing business, fishing or herding cattle. This suggests that a marked proportion of respondents were likely be low-income earners as will be shown below.

Level of Education

It is of interest to note that a significant proportion of both male and female respondents in the two districts had attended primary school. This might facilitate easy understanding of malaria control messages. In West Africa level of mother's education was found not to have any significant association with child's mild or severe malaria¹⁴. In Tanzania, study to generate information on this type of relationship is highly needed, particularly for malaria epidemic prone areas, as there are considerable socio-economic and cultural differences between the people of East and West Africa.

Type of Housing

In the two districts the houses were found to be mainly of mud walls but about half as many thatched as those with iron roofing. Iron roofing, in a number of communities, can be regarded as a sign of elevated socio-economic status irrespective of the nature of the floor. In Tigray, Ethiopia, with thatched houses there was an over twice as much malaria risk as for earth roofs.²⁰ Similarly, with respect to malaria control, presence of open eaves put the householders at 1.85 times the risk of suffering from malaria as for those in closed eaves.²⁰ In the absence of ceiling in the majority of households visited, and where eaves are open, there would tend to be increased entry of Anophelines (as well as other human biting mosquitoes) and more malaria transmission. Nonetheless, communities in the

two districts seem to have different coping mechanisms, against malaria vectors. In Babati, more respondents had mosquito gauze on windows presumably because of higher mosquito densities around Magugu/Gichameda rice fields. On the other hand, apart from keeping mosquitoes at bay, closed eaves of houses in Hanang would reduce the night chill experienced in the district.

Other common household items such as personal radio/cassette and bicycle were owned by a substantial proportion of household though less than a half of the respondents in either district. It is not certain as to what extent individual households might wish to prioritise expenditure of their resources for malaria control activity, despite their ability to buy such other items. However, people with such items are also more likely to buy malaria control items than people without them.

Monthly Income and Bednet Ownership

Though there is variation in monthly income among the people in the two districts, it appears that householders in the two districts might afford at least one net for personal protection against malaria and mosquitoes. However, achieving increased expenditure on such malaria control items might need to be accompanied by promotional activities in the form of social marketing.^{21,22,23} Nonetheless, the question of subsidy on nets for the majority rural low-income earners needs being addressed, preferably locally.^{21,22} This is based on the account that families might need an average of three nets which is a relatively big demand on their seasonal income. Some other communities feel that the price of an insecticide treated net needs to be less than Tsh 3500 (US \$ 4.0). Selling of cow to buy malaria preventive items including drugs might need being promoted as well.

Residence and Mobility of the People

A large proportion of the respondents indicated that they did not travel very often. The rest 30% in either district said they did so. From this observation, it appears that most people in these districts are permanent inhabitants. This is rather contrary to the notion that in this part of the country there is well established what pattern way for itinerant type of livestock keeping. In fact, a cattle herding was not even mentioned as the reason for travelling away from home although a third of the respondents owned cows. However, indepth interviews with 21 health facility staff (18) gave a different finding, whereby the reason for travelling and the number of respondents were as follows: livestock herding 7/21 (33.3%), fishing 5/21 (28.6%), farming 5/21 (23.8%), cattle auctions (minada) 2/21 (9.5%), and seeking casual employment 1/21 (4.8%). It might be that those interviewed had already decided to lead a more settled kind of life and the fully nomadic ones were not there to be found.

Conclusion and Recommendations

1. There is need to promote house improvement to reduce spaces through which mosquitoes gain access into houses. This would reduce biting from mosquitoes while in bed where there is no net. Improvements include closing the eaves and holes in the walls and fitting mosquito gauze where feasible.
2. Promotion of insecticide treated nets needs to be intensified particularly in the rural areas where people may need to make bold decisions to sell their crops and/or livestock to buy such malaria preventive measures.
3. A convenient way of selling nets to the low income local people may have to be devised, such as one allowing depositing money at the shop and taking a net on completing the payment for the price of a net and/or insecticide.
4. On account of a more permanent nature of place of abode of the people in the two districts, it is feasible to attain wide coverage with insecticide treated nets and hence obtain significant malaria vector control through mass effect in addition to personal protection.
5. For the nomadic section of the population, insecticide treated nets should be made available for these people to buy and carry them along.

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References

1. Kilama, W.L. & Kihamia, C.M. (1991). Malaria. In Mwaluko *et al.*, (1991). *Health and Diseases in Tanzania*. HarperCollins Academic.
2. Irare, S.M., Mnzava, A.E.P. and Ijumba, J.N (1984). *Malaria Study in Hanang District, Arusha Region* (Unpublished).
3. Njunwa, K.J., Alilio, M.S. and Kilimali, V.A.E.B. (1995). *Malaria study in Ngorongoro, District, Arusha Region*. Report submitted to the MOH.
4. Mboera, L.E.G., Kamugisha, M.L., Njunwa, K.J., Mutalemwa, P., Kitua, A.Y., F.M. Salum and W.L. Makunde (1999). Study on epidemiological factors related to malaria epidemics in Babati, Dodoma and Lushoto Districts of Tanzania (*Report of Project ID No. 001/98 submitted to the National Institute for Medical Research*).

5. Najera, J.A., Kauznetsov, R.L. and Delacollette, C. (1998). Malaria Epidemics Detection and Control, Forecasting and Prevention. *WHO/MAL/98.1084*
6. Kihamia, C.M. & Gill, H.S. (1982). Chloroquine-resistant falciparum malaria in semi-immune native African Tanzanians. *Lancet*, ii: 43.
7. Rosen, G. (1979). The evolution of social medicine. In *Handbook of Medical Sociology*, Freeman, H.E., Levine, S. & Reeder, L.G. (editors), 3rd edition. Englewood Cliffs, New Jersey: Prentice-Hall.
8. Banguero, H. (1984). Socio-economic factors associated with malaria in Colombia. *Social Science and Medicine*, 19: 1099-1104.
9. Butraporn, P., Sornmani, S. and Hungsapruet, T. (1986). Socio-behavioural, housing factors and their interactive effects associated with malaria occurrence in east Thailand. *Southeast Asian Journal of Tropical Medicine and Public Health* 17: 386-392.
10. Fungladda, W., Sornmani, S., Klongkamnuankarn, K. and Hungsapruet, T. (1987). Sociodemographic and behavioural factors associated with hospital malaria patients in Kanchanaburi, Thailand. *Journal of Tropical Medicine and Hygiene*, 90: 233-237.
11. Castro, E. B. and Mokate, K.N. (1988). Malaria and its associated meanings; the study of Cunday in Colombia. In: *Economic, s Health and Tropical Diseases*, Ferrin, A.N and Rosenfield, P.L (editors). Manila: University of Philippines School of Economics.
12. Fernandez, R.E. and Sawyer, D.O. (1988). Socio-economic and environmental factors affecting malaria in an Amazon frontier area. In: *Economics, Health and Tropical Diseases*, Ferrin, A.N. and Rosenfield, P.L. (editors). Manila: University of Philippines School of Economics.
13. Gamage-Mendis, A.C., Carter, R., Mendis, C., de Zoysa, A.P. K., Herath, P.R.J. and Mendis, K.N. (1991). Clustering of malaria infections within an endemic population: risk of malaria associated with the type of housing construction. *American Journal of Tropical Medicine and Hygiene*, 45: 77-85.
14. Koram, K.A., Bennett, S., Adiamah, H., and Greenwood, B.M. (1995). Social-economic risk factors for malaria in a peri-urban area of The Gambia. *Transactions of the royal Society of Tropical Medicine and Hygiene* 89: 146-150.
15. Packard, R.M. (1986). Agricultural development, migrant labour and the resurgence of malaria in Swaziland. *Social Science and Medicine* 22 (8): 861-867.
16. Zubbrigs, S. (1994). Rethinking the "human factor" in malaria mortality: the case of Punjab, 1868-1940. *Parassitologia*, 36 (1-2): 121-133.
17. M.M. Lemnge, M.L Kamugisha, K.J. Njunwa, F. Salum, H.A. Msangeni, and A.Y Kitua (submitted). Exploratory Study of Malaria Situation in Hanang and Babati Districts after Reported Malaria Epidemic: IV. Sulfadoxine/Pyrimethamine (SP) and chloroquine efficacy. *Tanzania Health Research Bulletin*.
18. M.M. Lemnge, M.L. Kamugisha, K.J. Njunwa, F.M.Salum, H.A. Msangeni, and A.Y. Kitua (submitted). Exploratory study of malaria situation in Hanang and Babati Districts after a reported malaria epidemic: I. Health facility based information on malaria morbidity and mortality. *Tanzania Health Research Bulletin*.
19. Njunwa, K.J., Makundi, A., Kamugisha, M.L, Lemnge, M.M., Mubyazi G.M, Salum, F. M., and A.Y. Kitua (sumbitted). Exploratory study of malaria situation in Hanang and Babati districts after reported malaria epidemic: II. Community Perception and treatment seeking and prevention for malaria. *Tanzania Heath Research Bulletin* .
20. Carter, R., Mendis, K.N. and Roberts, D. (2000). Spatial targeting of interventions against malaria. *Bulletin of the World Health Organization* 78 (12): 1401-1411.
21. Salimu, A., Armstrong-Schellenberg, J.R.M., Nathan, R., Mukasa, O., Marchant, T., Smith, T., Tanner, M., and Lengler, C. (2001). Impact on malaria morbidity of a programme supplying insecticide treated nets in children under 2 years in Tanzania: community cross sectional study. *British Medical Journal* 322: page 270-273.
22. Armstrong-Schellenberg, J. R. M. Abdulla, S., Minja, H., Nathan, R., Mukasa, O., Marchant, T., Smith, T., Mponda, H., Kikumbih, N., Lyimo, E., Manchester, T., Tanner, M., and Lengler, C. (1999). *KINET: a social marketing programme of treated nets and net treatment for malaria control in Tanzania, with evaluation of child health and long-term survival*.
23. Insecticide Treated Nets in the 21st Century. Report of the Second International Conference on Insecticide Treated Nets. Sheraton Hotel, Dar es Salaam, Tanzania, 11-14 October, 1999, page 10.