International Journal of Tropical Medicine 6 (3): 61-69, 2011
ISSN: 1816-3319

Knowledge of Malaria Prevention and Control in a Sub-Urban Community in Accra, Ghana

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Abstract: Knowledge of community members in malaria is a major factor that can influence malaria prevention and control. The study sought to identify possible relationships between personal characteristics of community members and their knowledge of malaria prevention and control. It was found out that educational level of the people did not relate to their knowledge of malaria prevention ($\chi^2 = 2.112$, df. 3, $p = 0.55$). Females had higher knowledge on malaria than males. Both the less educated and highly educated are aware that malaria can be prevented. Formal educational levels might not directly affect ones' knowledge about the causes of malaria. In conclusion, knowledge in malaria prevention and control might not result from formal education only but other sources such as non-formal and informal education. Respondents' knowledge level on matters relating to malaria was high yet their actions towards prevention and control were discouraging.

Key words: Community, malaria, influence, respondent, discourage, Ghana

INTRODUCTION

Malaria is a disease of humans caused by infection with protozoan parasites belonging to the genus *Plasmodium*. It is characterized by chills, fever and in the most severe cases, coma leading to death. The parasites are transmitted by the bite of female mosquitoes (the vector of the parasite) of about 60 species belonging to the genus *Anopheles*. *Plasmodium falciparum* among others is the main cause of severe clinical malaria and death. Malaria is a global disease and exists in over 100 countries with higher incidence in the tropical areas of Africa, Asia and Latin America (TDR/WHO, 2004). Its distribution is limited by conditions that are inimical to the development of the mosquito vector such as temperature and altitude.

In Sub-Saharan Africa the situation has actually deteriorated and there have been resurgences of the disease in several countries in Asia. The optimistic concept of eradication of malaria half a century ago has had to be modified and the emphasis is now on prevention and control. In recent years, the region has experienced a dramatic renaissance of this disease and almost with up to 450 million clinical cases of malaria recorded each year. The spread of malaria in tropical countries has been enhanced by factors such as population growth, urbanization, the opening up of previously sparsely inhabited areas, migration, refugees and conflicts.

Overseas travelers usually have to seek expert advice before going to malarial areas. Each year there are thousands of cases of imported malaria, some fatal in Europe, the United States and Australia as a result of travelers taking inappropriate prevention measures or skipping treatment altogether.

It is to be noted that if adequately and promptly treated, malaria is still a curable disease. However, drug resistance is a growing problem, largely due to widespread uncontrolled and unregulated drug distribution. Again low level of knowledge in the disease, incorrect beliefs and wrong attitudes toward the disease has compounded the problem, making it difficult for prevention and control.

It is clear that Ghana lies within the tropics and as such one of the most endemic areas of malaria. The annual economic burden from malaria is 1-2% of Ghana's GDP. Malaria continues to be a top killer disease in Ghana especially in children.

In 1998, the NMCP and the Nougouchi Memorial Institute for Medical Research (NMIMR) teamed up to conduct research into the effect of chloroquin on the parasite (plasmodium) that causes malaria. The results of the study indicated that chloroquin was no more effective on the parasite. A source indicated that the major causes of this failure was negative beliefs about the disease, lack of adequate knowledge about the drug, negative attitudes towards dosage of the drug and bad habits in preventive and control measures. This led to the social aspect of prevention and control to be considered for research.

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It can be stated further that incorrect or non-scientific traditional beliefs and inappropriate behavior can interfere with the effectiveness of a control measure such as vector control or the use of bio-medical drugs. These issues are particularly important in communities where the success of malaria control programs is inhibited by low level of knowledge in the disease and negative attitudes and practices of the people. In such cases, an understanding of the communities perceptions and behavior would be crucial to the success of specific prevention and control measures. The influence of people's knowledge, values, attitudes and practices are so unique to every given community that one must understand and incorporate them into the design and implementation of malaria prevention and control programs. Unfortunately, research into these areas has not gained the needed popularity and the few ones conducted are not well published to enable access by institutions and organizations in malaria control. As Muela (2000) indicated:

> Without the realizing it, medicine has carried us into the social sphere there to meet up with the great problems of the time. Let us be well aware that there are not concerned here with the treatment of a patient by means of medicinal remedies and the adjustment of his home environment. No, researchers are dealing with the entire culture of a million and a half of the fellow citizens who have been physically and morally degraded (Muela, 2000)

Human behavior is influenced by social, cultural, economic and political factors. It is clearly related to health including the risk of infectious diseases like malaria. The failure of past malaria initiatives can frequently be blamed on the lack of adequate consideration given to the social and behavioral aspects of malaria control. Information on people's knowledge about the disease, their attitudes towards prevention and control methods as well as the various actions they take to prevent and control the disease is vital to successful management of the disease. For the past years social research has not gone much into this area. Other socio-economic factors such as income and educational levels are also very crucial to the success of malaria prevention and control programs.

Health education on malaria often fails to address the ethno-medical perceptions and socio-economic realities of the target audience (Agyepong *et al*., 1996). Malaria is frequently referred to as a disease of the poor or a disease of poverty (Worrall *et al*., 2002). In this case differences in education and income levels might affect prevention and control methods and choice of drugs for treatment. A study from Tanzania examined the relationship between socio-economic status and treatment seeking behavior for fever (Abdulla *et al*., 2001). In the study the rate of treatment seeking was compared between the 15 lowest and highest socio-economic status quintiles (measured as an asset index) and suggested that the poor may experience greater vulnerability to the consequences of malaria, arising from less treatment seeking. Most KAP studies on malaria and ITN use stressed on affordability and knowledge about its use (Gyapong *et al*., 1992). They also stressed that people perceived the orthodox methods of insect control as effective but expensive and as such preferred the traditional ones. This shows clearly the role of income and education in malaria prevention and control. The study is aimed at finding out the relationship between knowledge in malaria and the choice of malaria prevention and control mechanisms.

The most extensively trialed vaccine is the SPf66, a vaccine against blood stages. SPf66 was found to be effective at reducing the number of episodes of malaria in adults living in malarial areas in South America but was ineffective in preventing malaria when tested on children in Africa where a vaccine is most needed. Several promising lines of enquiry are now being investigated including the possibility of incorporating genes for antigens, representing different stages in the life cycle into vectors (organisms that carry the disease) suitable for DNA vaccines.

In most parts of Africa particularly south of the Sahara, people used various herbs as insecticides and material covering as an improvised bed nets for prevention. In 1958, an epidemic of malaria in Ethiopia caused >3 million cases and 150 thousand deaths (Gilles *et al*., 1993). Madagascar in 1988 and other countries such as Botswana, Zimbabwe, Burundi and Zaire experienced a short epidemic of the *P. falciparum* (the deadliest malaria parasite) claiming over 250 thousand lives. In the history of West Africa people resided on top of hills not only as a war strategy but in search of a good environment free from mosquitoes and for that matter malaria.

Knowledge in malaria and preference of prevention methods: The discovery of the insecticide Dichloride biphenyl Trichloroethane (DDT) in 1942 by Paul Muller the nobel prize laureate in physiology and medicine and its first use in Italy in 1944, made the idea of global eradication of malaria seemed possible. Subsequently, widespread systematic control measures such as spraying with DDT, coating marshes with paraffin (to kill Anopheles mosquito larvae), draining stagnant water and

the widespread use of nets and effective drugs such as chloroquin were implemented with impressive results. Despite initial success there was a complete failure to eradicate malaria in many countries due to a number of factors. Although, technical difficulties such as mosquito and parasite drug resistance have played a part, the main failure to reduce the disease is probably due to socio-cultural factors preventing efficient application of control measures (MacCormack, 1984).

Systematic malaria control began with the rise of tropical medicine and promising strides made in malaria research in the late 19th century. Two orientations of control strategies were developed at the beginning of the 20th century. One approach was to fight malaria parasites in the human host and was therefore, centered on chemoprophylaxis and chemotherapy. The other approach focused on reducing malaria transmission through environmental vector control. The various control strategies were based on gradual reduction of vector population by larvicides and insecticides and by destroying breeding sites through proper environmental care. This gave rise to the approach of controlling the environment as a method of reducing malaria incidence. There was criticism of this vector-centered approach. It was objected that vector control could only show an impact where intensive and large-scale campaigns were launched i.e., where organizational control of the environment was feasible (Muela, 2000).

In the 1920s, the league of nations organized a conference involving top malarialogists to discuss issues concerning malaria control and how it can be eradicated. A lively debate was held between the advocates of the vector-centered approach which was mainly supported by British and American scientists and the approach focused on the human host, led by Italian researchers (Packard and Gadehla, 1997). The vector-centered conceptualized malaria as an essentially a biological problem and can best be controlled by technologically reducing the vector and its cycle of development. The Italian malarialogists however, moved far from this approach to advocate for social medicine model where the host (human being) is rather focused. They in fact saw malaria as closely linked to underdevelopment and emphasized the long-term need of improving populations living standards (Packard and Brown, 1997).

Malaria prevention and control in a particular area or region of the world rely heavily on socio-cultural factors. The question of why the global eradication program succeeded in some countries and failed completely in others gave birth to social research into malaria. Najera (1994) argues that the disappearance of malaria in parts of Europe was associated with economic development related to agricultural expansion rather than vector control or chemoprophylaxis. Thus, the mechanical approach of spraying insecticide and medical advancement in developing new drugs alone cannot solve the malaria problem especially in Africa where economic development is slow. It was realized that various human factors such as knowledge in the disease, cultural beliefs and behavior towards such diseases strongly affect medical interventions.

The world ministerial conference held in Amsterdam on 27th October 1992 identified that social, political and economic changes can seriously undermine control measures and that there should be individual and community's participation in prevention and control programs. The African continent could not see any success in the global eradication program because of the presence of diverse and unique beliefs and cultures. In a launching of the Malaria Action Plan Asenso-Okyere noted that the epidemiological view of disease analysis and surveillance alone cannot help but a consideration of the socio-economic aspects will bring maximum success.

People in different societies hold a variety of beliefs about the causes and transmission of malaria that vary according to cultural, educational and economic factors and have direct consequences for both preventive and treatment seeking behavior as well as for activities to control malaria. Whether it is intentional or not human behavior affects health-promoting and disease-preventing activities in some instances, increasing risk and in others reducing it. Inhorn and Brown (1997) have noted that human groups have often unwittingly facilitated the spread of infectious diseases through culturally coded patterns of behavior or through changes in the crucial relationship among infectious disease agents, their human and animal hosts and the environments in which the host-agent interaction takes place.

Knowledge level of people directly affects how they react to anything about the disease. Most of this knowledge however is a transformation of beliefs and values. In this case, people who might be thought of having a high level of knowledge might rather be carrying a lot of misconceptions. This study seeks to bring out actual knowledge and attitudes of the community concerned.

One of the declarations made by the WHO at the ministerial conference in 1992 was that drug resistance which comes as a result of poor knowledge, attitudes and practices of the disease and usage of drugs is one of the major threats to prevention and treatment (Gilles *et al*., 1993). They therefore, concluded that continuous research both basic and operational should be conducted especially on the social and economic determinants of

malaria incidence and disease prevention and control. Over recent years there has been emphasis on the idea that improving knowledge about malaria in communities will lead to better use of interventions (Marsland, 2006). Marsland outlined the following beliefs as associated with malaria after a qualitative study:

- Mosquito bites are traditionally symbolic of a woman's suffering when in mourning
- Sleeping under a net at a funeral or a son building a brick house for himself before he builds a home for his father results in punishment by witchcraft
- Keeping a woman under a net at funerals is one of many ways in which men use symbols of modernity to discipline women's behavior

In a KAP study of the involvement of women in community-directed treatment with ivermectin in Uganda, it was found that women who had previous knowledge in the use of ivermectin, participated well in health education programs while those with less knowledge failed (Katabarwa *et al*., 2001). According to the health belief model, knowledge about the disease and its effects usually enable the individual accept interventions. People with an appreciable level of knowledge in malaria are more likely to accept and use ITNs and other preventive and control methods. Gyapong *et al.* (1992) stated that most people in Ghana believed mosquitoes can cause headache, weakness, skin itching and sores but not malaria. They in fact perceive mosquitoes as nuisance rather than agents of malaria. During their study at the Kasena-Nankana district in the northern region of Ghana, they distributed insecticide impregnated bednets to the people first as a means of preventing the nuisance of mosquitoes rather than malaria. It was later on that the people reported reduction in malaria episodes in their homes. In addition to knowledge in the disease, Gyapong and her team found the following factors as contributing to the choice of particular control mechanism: income, housing patterns, endemicity and availability of the materials.

A similar study occurred in Gambia where the study population was given the nets as vector control mechanisms but later the people realized that the bednets could control malaria (MacCormack *et al*., 1989). Gyapong *et al.* (1992) summarized that the realization of the link between mosquito bite and malaria is a greater prospect for successful community health education.

Purpose of the study: The purpose of the study was to find out the relationship that exist between personal characteristics and knowledge of malaria prevention and control the people of Alajo.

Hypothesis: There is no significant relationship between personal characteristics of people in the community and knowledge of malaria prevention and control.

MATERIALS AND METHODS

Population: The population of the research was made up of male and female adults from selected households in the community using the legal age of 18 years and above, numbering two thousand (2000). However, the area was zoned into five clusters and three selected with a population of 620.

Research design: In order to measure Knowledge/ perceptions, Attitudes and Practices (KAP) of a community, a survey research was selected for the study. It adopted the approach with some aspects of the qualitative approaches making it a mixed method. A list of houses in the community was available at the Accra Metropolitan Assembly (AMA), Central Ayawaso district office which was used to select the sample for the study.

Sampling procedure: A map (plan) containing 40 blocks (groups of houses) was used to randomly select 20 blocks. The blocks were numbered serially and carefully selected without replacement. A list of houses in each of the 20 blocks was used to randomly select 4 houses in each block making a total of 80 houses. This was done in order to ensure fair spread of the respondents thereby increasing reliability of the data. From each house, two adults (a male and female, 18 years or above) were selected for the study. Where there was one adult in the house he or she was selected and another house was randomly selected in addition to the already selected where one person was interviewed. As a result the sample size was 160 forming 25.8% of the total target population with 75 males and 85 females.

Instrumentation, data collection and procedure: The questionnaire was the main instrument for the study. This comprised of both close-ended and open-ended questions. The first part covered the background of respondents (age, sex and educational levels). The second part covered knowledge on malaria prevention while the third part concentrated on knowledge on causes of malaria. The fourth part of the questionnaire was on respondents knowledge on malaria preventive practices. Four research assistants were selected to help in the questionnaire administration and collection with knowledge in the local languages of the community (Akan, Ga, Hausa). Most of the respondents had basic education and as such could read and answer the

questionnaire on their own. The few less literate or illiterate ones who could not read and answer on their own had their schedule interpreted in the language of their choice to be recorded in English. The administration of the questionnaire took weeks.

RESULTS

Knowledge of malaria: This study covers information on respondents knowledge of malaria in relation to causes and prevention.

Knowledge of the nature of malaria: One aspect of understanding peoples knowledge about malaria is the extent to which it affects the individuals. To this end it became essential to know whether malaria can affect everybody can kill and is preventable. The results are shown in Table 1.

Table 1 shows that >90% of the respondents had the knowledge that malaria can affect everybody. Knowledge about the disease's potential to kill was 97.5%. This indicates that almost all the respondents perceived malaria as a killer disease. Similarly >90% believed malaria as preventable. The indication is that the percentage of respondents who knew malaria as a killer disease was slightly higher than the other perceptions.

Another discovery was the relationship between knowledge of preventing malaria and sex of respondents as shown in Table 2.

In line with Table 2, more females (96.5%) than males (88%) believed that malaria is preventable. The Chi-square analysis at 0.05 significance level with 1 degree of freedom was 4.121. This means that there was a significant relationship between sex of respondents and knowledge of malaria prevention (χ^2-4.121, df. 1, N-160, p-0.042). A further inquiry to establish the relationship between knowledge of malaria prevention and educational level of respondents showed similar results.

The Table 3 shows that with each level of formal education except the basic level, >90% of the respondents knew malaria was preventable. Critically, 50% of respondents with lower level of education believed malaria was preventable. The Chi-square rate at 0.05 significance level with 3 degree of freedom was 2.112. This means that there was no significant relationship between knowledge of whether malaria is preventable and educational level of respondents (χ^2-2.112, df. 3, N-160, p-0.55).

Knowledge of causes of malaria: The relationship between knowledge on causes of malaria and sex of respondents revealed that there were no significant differences between the sexes as shown in the Chi-square analysis and the statistical table.

Table 1: Knowledge of malaria

	Yes		No		
Knowledge	f	%	f	%	Total
Malaria can affect everybody	147	91.9	13	8.1	160
Malaria can kill	156	97.5	4	2.5	160
Malaria is preventable	148	92.5	12	7.5	160

Table 2: Whether malaria is preventable with sex of respondents

	Whether malaria is preventable					
	Yes		No		Total	
Sex of respondents	F	%	F	%	F	%
Male	66	88.0	9	7.5	75	46.9
Female	82	96.5	3	3.5	85	53.1
Total	148	92.5	12	7.5	160	100.0

Table 3: Knowledge of whether malaria is preventable and educational levels of respondents

	Whether malaria is preventable					
	Yes		No		Total	
Level of formal education	F	%	F	%	F	%
No formal education	19	95.0	1	5.0	20	12.5
Basic education	55	88.7	7	11.3	62	38.8
Secondary education	53	94.6	3	5.4	56	35.0
Tertiary education	21	95.5	1	4.5	22	13.7
Total	148	92.5	12	7.5	160	100.0

Table 4: Sex of respondents with knowledge on causes of malaria

	Sex of respondents					
	Male		Female		Total	
Causes of malaria	F	%	F	%	F	%
Unclean environment	37	49.3	35	41.2	72	45.0
Mosquito bite	38	50.7	46	54.1	84	52.5
Others	0	0.0	4	4.8	4	2.5
Total	75	45.9	85	54.1	160	100.0

The Table 4 shows that more than half of both male (50.7%) and female (54.1%) respondents knew malaria was caused by mosquito bite. A significant number of the males (49.3%) and females (41.2%) believed that malaria is caused by unclean environment. Other causes which were stated only by the females include: drinking of bad water, eating oily foods being exposed to heat or sunlight and excessive tiredness. The Chi-square analysis indicates further that both male and females had similar level of knowledge of the causes of malaria (χ^2-4.209, df. 3, N-160, p-0.240). The Table 5 shows respondents' knowledge about causes of malaria with educational level of respondents.

The Table 5 shows that 63% of those with tertiary education believed that malaria is caused by mosquito bite as against 45% of those with no formal education. Also half of those with no formal education believed malaria is caused by unclean environment while a little above one-third of those with tertiary education believed it is caused by unclean environment. None of those with

Table 5: Respondents' educational level with causes of malaria

	Level of formal education									
	None		Basic		Secondary		Tertiary		Total	
Causes of malaria	F	%	F	%	F	%	F	%	F	%
Unclean environment	10	50.0	29	46.8	25	44.6	8	36.4	72	45.0
Mosquito bite	9	45.0	31	50.0	30	53.6	14	63.6	84	52.5
Others	1	5.0	2	3.2	1	1.8	0	0.0	4	2.6
Total	20	12.5	62	38.8	56	35.0	22	13.7	160	100.0

Table 6: Respondents' knowledge of the best method to prevent malaria with educational level of respondents

	What can be done to prevent malaria in the community									
	Cleaning the environment		Sleeping in bed nets		Residual spraying		Drinking good water		Total	
Educational level of respondents	F	%	F	%	F	%	F	%	F	%
None education	7	35.0	7	35.0	3	15.0	3	15.0	20	12.5
Basic education	43	69.4	7	11.3	8	12.9	4	6.5	62	38.8
Secondary education	42	75.0	6	10.7	7	12.5	1	1.8	56	35.0
Tertiary education	11	50.0	4	18.2	7	31.8	0	0.0	22	13.7
Total	103	64.4	24	15.0	25	15.6	8	5.0	160	100.0

Table 7: Respondents' perception of effective methods for preventing mosquito bite with educational level

	Which method is effective for preventing mosquito bite									
	Bed nets		Spray		Coils		Repellent		Total	
Level of formal education	F	%	F	%	F	%	F	%	F	%
No formal education	10	50.0	7	35.0	3	15.0	0	0.0	20	12.5
Basic education	43	69.4	11	17.7	4	6.5	4	6.5	62	38.8
Secondary education	32	57.1	19	33.9	2	3.6	3	5.4	56	35.0
Tertiary education	16	72.7	5	22.7	0	0.0	1	4.5	22	13.7
Total	101	63.1	42	26.3	9	5.6	8	5.0	160	100.0

stertiary education believed in other factors (drinking bad water, eating oily foods and walking under the sun, etc.). In all slightly more than half (52.5%) of the respondents knew malaria is caused by mosquito bite. The Chi-square analysis shows that there was no significant relationship between level of formal education and respondents' knowledge about causes of malaria (χ^2-5.350, df. 9, N-160, p-0.803). A further study into the relationships was the relationship between knowledge on best method of malaria prevention and education.

From Table 6, environmental cleanliness was found to be the best method of preventing malaria in the community. None of those with tertiary education saw drinking good water as a means of preventing malaria. The relationship was made clear with the Chi-square analysis (χ^2-22. 204, df. 9, N-160, p-0.008). This means that there was a significant relationship between knowledge of the best method of preventing malaria in the community and educational level of respondents. The Table 7 shows knowledge of the best method of preventing mosquito bite with educational level of respondents. The Table 7 shows that 69.4% of the respondents who have up to basic education, preferred bed nets. Those with tertiary education had the highest number of respondents choosing bed nets as most effective method of preventing mosquito bite. Almost all respondents at the various levels of education had higher percentage of them preferring bednets to the other methods. In all, 63.1% of the respondents chose bed nets as most effective for preventing mosquito bite.

The Chi-square analysis indicates no significant relationship between knowledge of most effective method of preventing mosquito bite and level of formal education (χ^2-11.363, df. 9, N-160, p-0.252). Thus formal education has no effect on one's knowledge of which method is effective for preventing mosquito bite.

DISCUSSION

A majority of the respondents (91.9%) believed that malaria could affect everybody. In a similar way 97.5% had the knowledge that malaria could kill. While the findings of Gyapong *et al.* (1992) indicated that most of the people perceived malaria as mere headaches and weakness, this study found out that the community members perceived malaria as a killer disease. This also contradicts the findings of McCombie (1996) in Tanzania which indicated that respondents perceived malaria as a mild disease with

less potential to kill. This shows that people perceived malaria as a killer disease and also a disease that can be prevented. Alajo being an urban community, information from drug manufacturing and marketing organizations through the media might contribute a lot to increasing knowledge of malaria among people. The Ministry of Health and some non-governmental organizations might have also contributed to increasing knowledge of malaria through mass media educational campaigns.

In terms of sex, it was found out that more females than males knew malaria as preventable. It can therefore be said that females have higher knowledge of malaria than males. Since, females normally take care of children in times of sickness, they might get into contact with information on malaria more than males. Frequent visit to the clinic and drug stores can lead to knowledge acquisition thus females are more likely to have higher knowledge of malaria. There was however no differences in terms of educational levels of respondents and the knowledge of whether malaria is preventable. Both the less educated and highly educated had the knowledge that malaria can be prevented. This might mean that knowledge of malaria is not fully acquired through formal education. Other sources such as non-formal education might contribute a larger percentage to one's knowledge in the disease.

Knowledge about causes of malaria: The causes of malaria, in relation to unclean environment and mosquito bite revealed that half of the respondents (52%) believed malaria was caused by mosquito bite while 44% responded that malaria was caused by unclean environment and not mosquito bite. This confirms the recommendations of Gyapong *et al.* (1992) that respondents could not realize the link between mosquito bite and malaria. MacCormack *et al.* (1989) also found out that when respondents were given bednets they first perceived it as giving them comfortable sleep rather than preventing malaria. It took a long time before they realized that it could prevent malaria. People might be focusing much on the effects of malaria rather than its causes. This can be attributed to the source of knowledge which is mainly drug marketers whose concern is mainly treatment rather than prevention.

The other causes of malaria as stated by the respondents were: drinking of bad water, eating oily foods being exposed to heat or sunlight and excessive tiredness. The health belief model of disease prevention and control indicates that people's belief and knowledge about causes of a disease determines their knowledge about the disease whether it is serious, dangerous or infectious. If respondents have the knowledge and belief that malaria is caused by mosquito bite, they are more likely to perceive it as preventable. On the other hand if they do not know the causes they are less likely to perceive it as not preventable.

It is significant to note that 63% of respondents with tertiary education and 45% of respondents with no formal education knew malaria was caused by mosquito bite. None of those with tertiary education believed in other factors (i.e., drinking bad water, eating oily foods, walking under the sun, etc.). A test of relationship (Chi-square analysis) indicated that there was no relationship between educational level and knowledge about causes of malaria. As a result, educational levels might not directly affect ones knowledge about the causes of malaria. Knowledge in malaria prevention and control might not result from formal education only but other sources such as non-formal and informal education. Community members are educated on health issues through informal sources such as advertisement from drug manufacturers, radio and television programs and newspapers.

Knowledge of the best methods of preventing malaria: About two-thirds of the respondents selected cleaning the environment as the best method for preventing malaria in the community. It was found out that more males than females believed cleaning the environment was the best method of preventing malaria in the community. Very few of the respondents (15%) perceived Insecticide-Treated bed Nets (ITNs) as effective for community-wide prevention of malaria. At least 50% of the respondents with high level of formal education and 35% of respondents with no formal education believed cleaning the environment will prevent malaria in the community. A test of relationship (Chi-square analysis) indicated a significant relationship between formal educational levels and knowledge of the best method of preventing malaria in the community.

The best methods for preventing mosquito bite were found to be insecticide-treated bednets followed by insecticide spray then incense coils and the least being mosquito repellents. When knowledge of the best methods of preventing mosquito bite was matched with the educational level of respondents, 72% of those with tertiary education believed bed nets were the most effective for preventing mosquito bite. Rashed *et al.* (1999) suggested that ITN acquisition might be increasing with those who had completed secondary but not primary education. Kaona *et al.* (2000) also indicates a positive association between level of formal education and knowledge in malaria. With this study 50% of those with no formal education believed bed nets were the most effective method of preventing mosquito bite. This shows

that formal educational level might have some relationship with knowledge of the most effective method for preventing mosquito bite. However, the Chi-square analysis did not reveal any significant relationship between them.

The choice of preventive and control mechanisms revealed that 39% of the respondents used insecticide spray followed by ITNs (29.4%) and then insecticide incense coils (23.8%). A third (30%) of insecticide spray users were the youth. Although, an appreciable number of the youth were using ITNs, the number which uses insecticide spray was alarming. Spray is comparatively expensive and uneconomical so that the youth whose income might not be high were spending more than necessary for malaria prevention. This might increase household expenditure on malaria prevention thereby increasing poverty level among people. Mosquito coils were mainly used by the elderly (56 and above). There was significant relationship between age and choice of method (s) used for preventing mosquito bite. The younger adults often use insecticide spray and bed nets while the elderly used insecticide incense coils and insecticide spray.

It was further found out that more males than females often use insecticide spray. Females however, used mosquito coils more often. In terms of income both low and high income earners used insecticide spray. Other methods including burning of corn husks and orange peels, electric fans and cover clothes were used only by respondents with less than GH¢100 as monthly income. This means that income might play a major role in choosing the best method for preventing mosquito bite. Although, 63.1% of respondents perceived ITNs as effective for preventing mosquito bite only 29.4% were using them. In another way, 72.7% of respondents with tertiary education believed ITNs were most effective for preventing mosquito bite but only 27.3% were using them. It also came to light that very few (5%) of the respondents knew of mosquito repellents. In a sub-urban community where the people spend more time outside their rooms the use of repellents could be imperative to the successful prevention of malaria. Fai and Lee (1996) explained the Singapore's Army's dissatisfaction and rejection of insect repellents given them as mistrust of the quality, side effects and potency of the repellents. The servicemen were also not satisfied with the mode of application of the repellents. One vital cause of low knowledge in repellents could be attributed to manufacturers' adverts which promote brand names than the product itself.

There is therefore, evidence that people's actions towards malaria prevention and control were not the result of their knowledge of the disease but that such knowledge is not transformed into desired actions. According to Agyepong *et al.* (1996), health education of malaria often fails to address the ethno-medical perceptions and socio-economic realities of the target audience and encouraged that these realities should be considered in every malaria education program. One of such socio-economic realities is the finding which reveals a gap between peoples' knowledge of malaria and desired actions or practices of its prevention and control. Most KAP studies on malaria and ITN use stressed on affordability and availability of ITNs (Gyapong *et al.*, 1992) rather than knowledge and attitudes which powerfully shape behavior. There is something more than just understanding the knowledge level of people and their actions. Some factors like the source of such knowledge whether it is through informal education or non-formal education, determines how well they can act in the right way. If communities are educated only through informal sources such as the mass media and advertisements of product marketing organizations, they are more likely to pick misconceptions along with true knowledge. Gyapong *et al.* (1992) stated that most people in Ghana believed mosquitoes can cause headaches, weakness, skin itching and sores but not malaria. They perceived mosquitoes as mere nuisance rather than agents of malaria.

Reasons for the preference of the methods selected indicated that almost half of the respondents (49.4%) saw the methods as killing mosquitoes faster instead of directly preventing mosquito bite. Other reasons for particular method selected were its convenience in application and affordability. This can be explained that respondents choice of most effective method were not fully based on its efficacy to prevent mosquito bite but other factors like convenience in application and affordability. This confirms the finding by Gyapong *et al.* (1992) that most people do not have the perception that mosquitoes directly cause malaria. People believe that mosquitoes are worrisome at night and perhaps disturb sleep so that anything to help them sleep comfortably is perceived as effective. In this case, choice of malaria prevention method might not depend fully on its efficacy to prevent mosquito bite.

CONCLUSION

Respondents' knowledge level on nature and effects of malaria was high. Females had higher knowledge in malaria than males. There was no difference in terms of educational levels of respondents and knowledge of whether malaria is preventable. Both the less educated and highly educated had the knowledge that malaria can be prevented. Only half of the respondents believed malaria was caused by mosquito bite. Formal educational

levels might not directly affect ones' knowledge about the causes of malaria. Knowledge in malaria prevention and control might not result from formal education only but other sources such as non-formal and informal education.

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