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Document heading **doi: 10.21276/apjhs.2017.4.3.19** **Research Article**

Preventive Strategies for Malaria in Under-Five Children of Poor Resource Communities of Ndola, Zambia

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ABSTRACT

Background : Malaria in under-five children is a major public health problem throughout the tropical and subtropical region of the world. Fifty percent or more people who die in Zambia are children under-five years. Though Zambia has made strides in malaria prevention and control in the last five years, malaria kills more children under the age of five than any other illness. The aim of the study was to determine preventive strategies in association with malaria in under-five children of poor resourced communities of Ndola evaluating the effectiveness of the Insecticide Treated Nets (ITNs), the use of indoor spraying and evaluating the behaviours in terms of malaria prevention**. Methodology:** This was a descriptive survey method was conducted in which a questionnaire was administered to mothers of under-five children. The study was conducted at Chipulukusu Clinic Ndola Zambia. Descriptive statistics was used to analyze the data. Quantitative data was entered into the computer for analysis using Microsoft excel and SPSS vs20. **Result** the study enrolled a total of 361 under-five children out of which 138 (38.23%) of the children RDT (detecting *Plasmodium falciparum*) results where positive and that 223 (61.77%) of them were negative. The study established that 225 (62.33%) of the children were using mosquito nets as compared to 136 (38.23) % that were not using them. The majority of the mothers with a percentage representation of (271) 75% were using mosquito nets and only 90 (25%) were not. Spraying was done and 21% of the respondents had their houses sprayed in less than 3months, 17% between 6-8months, 9% between 12-15 months together with 3-5 months, 4% between 9-11 months and the least being 2% more than 16 months ago. Association between RDT positive results and the use of mosquitoes nets was significant with a *p* value of 0.025. **Conclusion :** It was established that the use of insecticide treated nets (ITNs) and exposure to indoor residual spraying (IRS) are not adequate enough to zero mosquito bites to the children. It was also noted that mother's behaviors to prevent the risk of mosquito bites was poor.

Key words: Malaria, Children, Insecticide Treated Nets (ITNs) and Indoor Residual spraying (IRS), Chipulukusu, Ndola.

Introduction

Malaria is a parasitic disease transmitted to humans though a bite from a female Anopheles mosquito. There are four main types of parasites that can cause malaria namely, Plasmodium ovale, Plasmodium malariae, Plasmodium vivax and Plasmodium falciparum. Malaria is an acute febrile illness. After the infective mosquito bite, in a non-immune compromised individual, symptoms usually appear 10-15 days. The first symptoms include; fever, headache, and chills these symptoms may be mild and difficult to recognize as malaria. If not managed within 24 hours, P. falciparum malaria can progress to severe illness, often leading to death. [7].Malaria infection in under-five children has become a serious public health concern in Zambia nevertheless, it is preventable and treatable. However, in 2010 the disease killed an estimated 660, 000 people largely children under-five years in sub-Saharan [7].Insecticide treated nets (ITNs) and indoor residual spraying (IRS) prevent malaria infection by reducing the possibility of an individual to be bitten by a malaria-carrying mosquito [2].Unlike many childhood illnesses, malaria can progress from mild to

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severe illness within few hours of the onset of the symptoms [5]. In this respect, recognition of danger signs and timely action in seeking medical care is essential to effective disease management and achievement of a significant reduction in severe morbidity and likelihood of death [6].According to the World Health organization in 2013, the republic of Congo and Nigeria accounted for more than 40% of estimated global malaria deaths. Despite the improved understanding of malaria pathophysiology and its management, childhood morbidity and mortality remain very high particularly due to limited access to health care and increased drug resistance.[12].Factors that have been reported to contribute to the increase in malaria cases include the following; children care-givers particularly the mothers do not make use of available healthcare such as the use of ITNs, health services, and environmental factors

Materials and methods

Study site

The study area was Chipulukusu a low income residential area. This area is situated in Ndola district the third largest city in Zambia, with a population of 455,194 (2010 census provisional), It is the industrial and commercial center of the Copperbelt province. It being a low income residential area, it is one of the highly densely populated areas among the compounds found in Ndola district

Study Design

The study employed a quantitative research methodology and research design adopted for this study was the descriptive survey method. This design was considered suitable because it aided in collecting information from respondents particularly the people that visited the clinic seeking medical services in relation to the malaria treatment for their children under the age of five years.

Sample Size/Sampling Method

The walking in patients at Chipulukusu clinic makes up the sampling frame for this study. Purposively and conveniently the researcher targeted a sample size of 400 respondents. Questionnaires were distributed to the purposively and conveniently sampled 400 walking in patients that had brought their children under the age of five with suspected malaria infection. Out of the 400 questionnaires administered only 361 were validated and 39 where rejected for incompleteness. This gave a 90% response rate.The sampling technique employed in this researchwas a non-probability sampling. Convenience sampling was used in this case because; the respondents do not come to the clinic in any order. Anyone moves in any time and since the researcher was only at the clinic at certain hours of the day, it is best to use convenience sampling in order to get as many as possible patients.The sampling frame for any probability sample is a complete list of all cases in the population from which your sample will be drawn [17].A convenience sample is a sample where the respondents are selected, at the convenience of the researcher. The researcher makes no attempt, or only a limited attempt, to ensure that this sample is an accurate representation of some larger group or population.

Data Collection

A questionnaire was used as primary data collection instrument. The questionnaires divided into two sections one addressing the general information of the respondents whiles the second section representing the main issues of the study variables adopted for the study. The questionnaire included closed ended questions. The questions were designed to collect quantitative data.

Data Analysis and Presentation

The collected data was examined and checked for completeness and comprehensibility. The data was then summarized, coded and tabulated. Descriptive statistics was used to analyze the data. Quantitative data was entered into the computer for analysis using Microsoft excel and SPSS vs20. The spread sheet was used to process the frequencies, averages and percentages which were used to discuss the findings. Tables, pie charts and bar graphs were used to present the data. Other statistical inferences were done manually. Proportions of the outcome of variables were calculated and compared using Chi-square test, and a result yielding a p value of less than 0.05 was considered statistically significant.

Ethical consideration

Permission to conduct this study was obtained from The Ndola Central Hospital Tropical Disease research Centre (TDRC) Ethical Review Committee and the Copperbelt University School of Medicine. Consent was obtained from sister in charge at Chipulukusu clinic as well as from the participants and participation was voluntary.

Results

This section shows information on the demographic characteristics of respondents and their behaviours in terms of malaria prevention and strategies employed by the respondents. It also provides the RDT results of the respondents that took part in the study.

Demographic Data

The first aspect was to determine the demographic data of the respondents. It included the ages of the children's, residence, guardianship and sex of the

parents that took the children to the clinic at the time the study was being conducted.

Age Distribution

Age was considered to be very cardinal in this study henceforth the researcher sought to determine the age groups of the children. This was so important in that it would help in establishing the age group that was more vulnerable to mosquito bite and other illnesses leading to mosquito infection and also establishing the age group that visited the health clinic more frequently. The distribution was tabulated in the ***table 1***.From the data presented the study established that children with less or equal to one year's visited the clinic more than the other age groups. This was clearly stated as depicted in ***table 1***because they had the majority representation with 34 percent as compared to the other age groups. The least was those with 4 to 5 years at 10% representation. The study further established that those with 2 to 3 years were second as indicated. From the data presented the study reviewed that children under the age of one were more vulnerable to various infection as compared to the other age groups and that they visited the clinic more often than the other age groups. They were more of them attending the clinic for medical attention as compared to the other ages under the age of 5 years. As of this the researcher further state that there is need to ensure that proper care is provided to these children as they cannot communicate hence the need to ensure that the environment they are staying are very conducive in all aspects.

Residential Area

The clinic that was used as the study site has a wide catchment area which was Chipulukusu clinic situated in Ndola. But due to its wide coverage area the respondents had indicated various residential areas. The distribution is tabulated in the ***table 1***

It was established that the majority of the respondents came from Mapalo with the frequency rate of 214 giving a 59% rate as compared to the others. The list was Musalu at 19% representation. This was very clear that most of the children came from Mapalo as compared to the other areas which fall within the catchment area of the clinic. These would have been due to the area being located near a stream.

Sex Distribution

The study sought to establish the sex distribution of the parents or guardians that had taken the children to the clinic during the time of the study. The results were presented in ***table 1***. It was established that there was equal representation of the parents/ guardians that had taken or accompanied the children that where suspected to have malaria infection. This was a clear indication that both sexes were more concerned of the welfare of their children as the data shows.

Complaints of the Children

The respondents that visited the clinic during the study had various complaints about their health which they presented to the clinician during the time of the study. This was in view to help the clinician to ascertain the possible disease the children were suffering from. For the purpose of this study the researcher's interest was on identifying the symptoms in the complaints presented. It is clear to note that the earliest symptoms of malaria are very nonspecific and variable, and include fever, headache, weakness, myalgia, chills, dizziness, abdominal pain, diarrhea, nausea, vomiting and anorexia. The distribution of the complaints was tabulated in ***figure 1***.There were variations as to the complaints presented to the clinicians by the respondents during the time the study was conducted. Some of the respondents had a combination of multiple symptoms were as others had singular as depicted in the figure above. The study established that there was no child that indicated that they had abdominal pains as 100% of the children never presented it as a complaint. Majority of the respondent 69% indicated that they had fever, 63% they had diarrhea, and only 27% had headache as their complaint. It was further established that 1% of the children presented cold as a complaint to the clinician at the time the study was conducted. It was also established that 14% were sneezing, 25% were vomiting and only 2% were convulsing.

RDT Testing Results

The study further wanted to have a clear indication of the RDT for Plasmodium falciparum results of those children that had visited the clinic to seek medical services and had suspected malaria infection and other illnesses. This was done by checking the RDT results of the suspected malaria patients. The results were presented in ***figure 3.***It is clear to note that the study used non probability sampling technique to select the respondents. Thus the researcher only sought children that had various complaints presented which quite often has impact on the treatment seeking pattern and health outcome especially in under-five children and any other complaints presented to the clinician during the time of the study. Some the symptoms that the researcher utilized to conveniently and purposively select the respondents were headache, vomiting, fever diarrhea among others. However, the researcher targeted all the children that visited the clinic for not being unwell. However of the selected respondents the data established that 38% of the children RDT results indicated positive results meaning that 38% of the children were infected by malaria (plasmodium falciparum) and that 62% of them were not. Thus there

RDT results were negative. It was clear to state it is true that diagnosis of malaria is still challenging because of the non-specific nature of the signs and symptoms, which overlap considerably with other common, as well as potentially life-threatening diseases in that symptoms of malaria are very nonspecific and variable, and include fever, headache, weakness, myalgia, chills, dizziness, abdominal pain, diarrhea, nausea, vomiting, anorexia.

Use of Mosquito Nets

Despite the treatment to be given by the clinician at the time the study was conducted it was very cardinal to establish as to whether the respondents were taking any preventive measures to deter the infection of malaria from mosquito bites. To establish this researcher sought to determine if the respondents were using mosquito nets as a preventive measure or whether they had indoor residual spraying. The results were presented in ***table 2.***The study established that 62% of the children were using mosquito nets as compared to 38% that were not using them. It is clear to state that the researcher did not establish as to why the 38% where not using mosquito nets. In spite of the data presented in ***table 2*** which showed that majority of the children with percentage representation of 62% were using mosquito nets. The researcher also wanted to establish as to whether the mothers of the children were equally using the mosquito nets. The responses were tabulated in ***table 2***.It was established that majority of the mothers with a percentage representation of 75% were using mosquito nets and only 25% were not. However, the results presented do not correspond as there were more mothers sleeping in mosquito nets as compared to the children. This could be one of the reasons as to why 38% of the children RDT results were positive. If only more of the children were sleeping in mosquito nets them a very minimal number would test positive.

House Residual spraying

Despite having a lot of prevention measures against malaria. Among the many measures the researcher wanted to establish whether the respondent's houses were sprayed at one point in time. The responses were tabulated in ***table 2.***It was established that 65% of the respondents had their houses sprayed at the time the study was being conducted. Of the 100% respondents that took part in the study 35% had their houses not prayed by the time the study was conducted. However, the study established that 35% of the children that took part in the study were still vulnerable to mosquito bites as they would not spend 100% of their time in mosquito nets. They were only protected from mosquito bite for a shorter period of time as compared to the time they spent not in the mosquito nets. It is very clear that these preventive measure complement each other thus stating they are complimentary hence the need to ensure that the houses are sprayed as well not only relaying on the use of mosquito nets.

Time frame for house residual spraying

It was also important to establish as to when the spraying was done. The responses were tabulated in the ***figure 2***. The study established that there were variations as to when the spraying was done. 21% of the respondents had their houses sprayed in less than 3months, 17% between 6-8months, 9% between 12-15 months together with 3-5 months, 4% between 9-11 months and the least being 2% more than 16 months ago. Form the data presented it is clear that measures should be put in place that residual spraying is done periodically but within a short possible time to ensure that the chemical strength is maintained thus increasing the force of repelling mosquitoes in the house.

Prevention Behaviours by Mothers

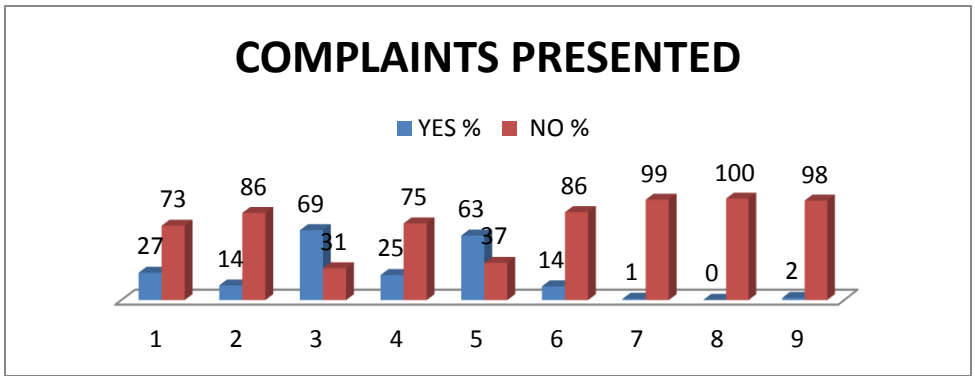
It was also the interest of the researcher to establish whether the children shared the bed they slept in with any other person. Thus, researcher wanted also to establish the distribution of the children that share the bed with their mothers. This was to establish the level of care among mothers of the children that were brought to the clinic at the time the study was being conducted. The results were tabulated in the ***table 2.***It was established that the children 100% shared the bed they slept in by some persons. However, 73% of the persons were their parents whereas 27% were not their parents. This could be a contributing factor in the case of the positive RDT results as the level of care differs from parents of a child to any other person. Parents would show more concern and care as compared to any other person. Thus, the variations in level of care and concern resulted in most children being exposed to mosquito bites; hence there is need that these children share the bed with their mothers as it would reduce the risk of them being exposed to mosquito bites.

Table1: Demographic data

	Frequency	Percentage distribution
Age group (class boundaries)		
***lessthan* 1**	122	34%
1 to 2	69	19%
2 to 3	91	25%
3 to 4	42	12%
4 to 5	37	10%
Total	**361**	**100%**
Residential area		
Mapalo	214	59%
Chipulukusu	78	22%
Musalu	69	19%
Total	**361**	**100%**
	Sex	
Male	180	(49.9%)
Female	181	(50.1)%

Table 2:Preventive practices

	Use of Mosquitoes by Children	
Use	225	(62.3%)
Not Using	136	(37.7%)
	Use of Mosquito nets by mothers	
Use	271	(75.1%)
Not Using	90	(25%)
	Residual Spraying Of the House	
Yes	234	(64.8%)
No	127	(35.2%)
	Sharing the bed with the child	
Parents	262	(72.6)%
Others	99 (27.4)%	



1- Headache 2-coughing 3-fever, 4-vomiting 5-diarrhoea, 6- sneezing, 7-cold, 8-abdominal pains 9-convulsions.

Fig 1: Complaints of the children

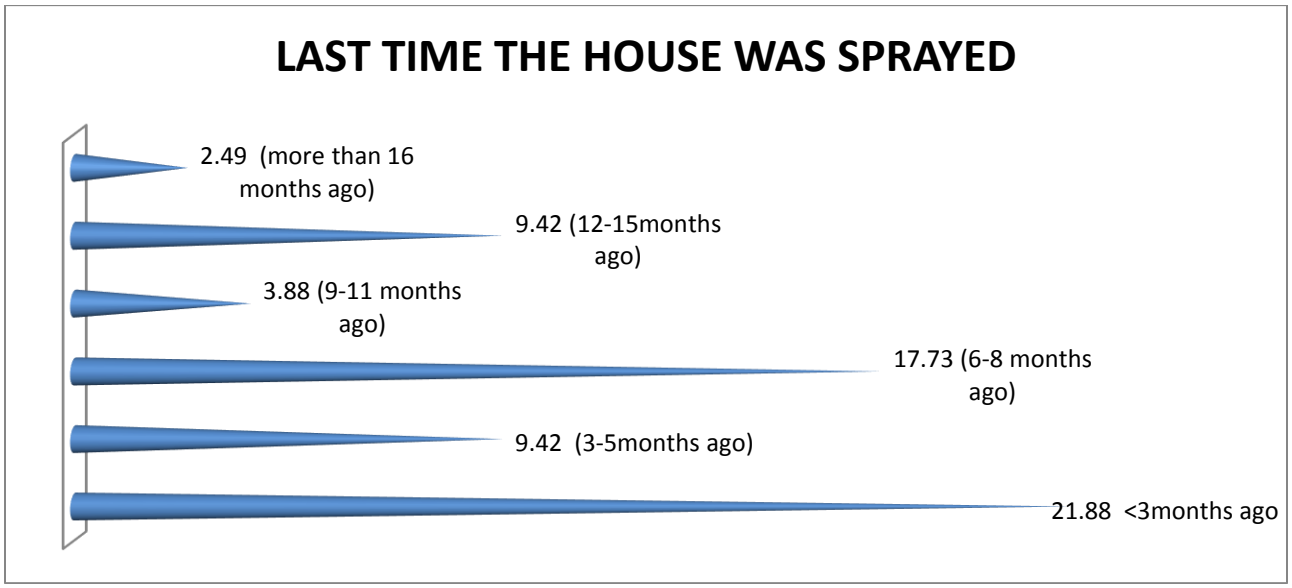


Fig 2: When the house was sprayed

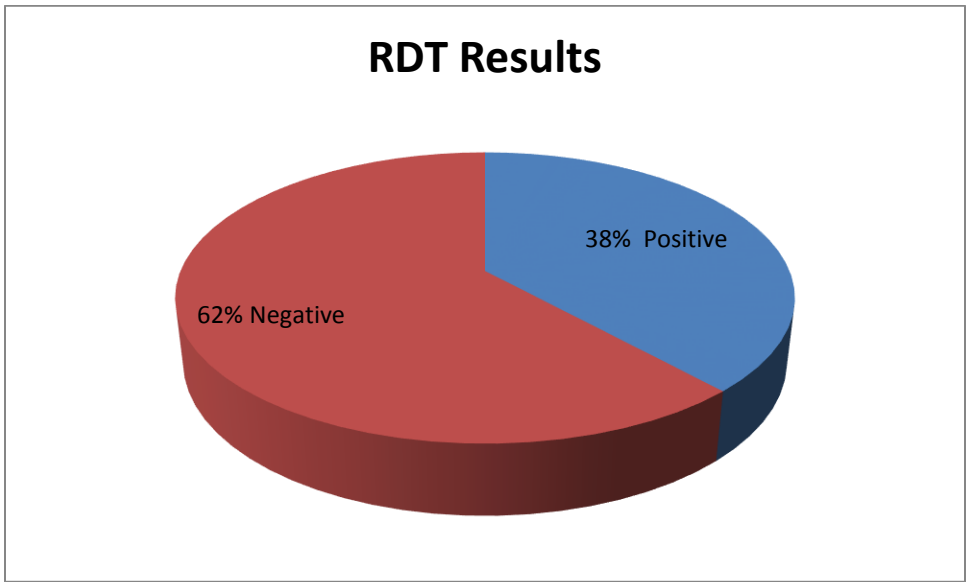


Fig 3: RDT Results

Table 3:Association of preventive strategies and risk factors with malaria

As shown in **table 3**, the preventive practices/risk factors associated with malaria that were significant include the

Practices / Risks Factors		Rapid Diagnostic Test Result		Total	P Value
		Positive	Negative		
Sex	Male	81(58.7%)	99 (44.4%)	180	0.008
	Female	57(41.3%)	124(55.6%)	181	
Age	Less Than 1 Year	49(35.5%)	73 (32.7%)	122 (33.8%)	4.0103
	Between 1-2 Years	30 (21.7%)	39 (17.5%)	69 (19.1)	
	Between 2 -3 Years	31 (22.5%)	60 (26.9%)	91 (25.2%)	
	Between 3-4 Years	18 (13.0%)	24 (10.8%)	42 (11.6%)	
	Between 4-5 Years	10 (7.2%)	27 (12.1%)	37 (10.2%)	
Period In Which House Was Sprayed	House Not Sprayed	98 (71.0%)	136 (31.0%)	234 (64.8%)	0.053
	Less Than 3 Months	36 (26.1%)	43 (19.3%)	79 (21.9%)	0.129
	3-5 Months	11(8%)	23 (10.3)	34 (9.4%)	0.459
	6-8 Months	23 (16.7%)	41 (17.4%)	64 (17.7)	0.678
	9-11 Months	9 (6.5%)	5 (2.2%)	14 (3.9%)	0.041
	12-15 Months	14 (10.1%)	20 (9.0%)	34 (9.4%)	0.710
	More Than 16 Months Ago	4 (2.9%)	5 (2.2%)	9 (2.5%)	0.697
Use Of Mosquito Net By Child	Yes	76 (55.1%)	149 (66.8%)	225 (62.3%)	0.025
	No	62 (44.9%)	74 (33.2%)	136 (37.7%)	
Use Of Mosquito Net By Mother	Yes	98 (71.0%)	173 (77.6%)	271 (75.1%)	0.161
	No	40 (29.0%)	50 (22.4%)	90 (24.9%)	
Does The Mother Sleep In The Same Bed With The Child	Yes	91 (65.9%)	171 (76.7%)	262 (72.6%)	0.026
	No	47 (34.1%)	52 (23.3%)	99 (27.4%)	

use of mosiquito nets by child ***p value=0.025***, and if the mother sleeps under the same bed with the child **p value 0.026** and gender with a ***p-value 0.008***.

Discussion

The purpose of the study was to establish the association of preventive strategies with malaria in under-five children of poor resource communities of Ndola. It was established that the two common strategies of reducing exposure to mosquito bites in them-selves are not adequate enough to ensure zero mosquito bites to the children. In short it is very clear to state that from the findings these two strategies are complimentary to each other. An association between malaria and the use of ITNs in this study was found to be statistically significant with a p-value of 0.026, similar observations were seen in a study in Nigeria that the use of ITNs have an effect on malaria positive results this could be due poor prevention and controlby the care-givers of under-five Nigerian children have thepotential to adversely influence the utilization of insecticide treated nets by the children.[15]Whether there is an association between malaria and gender is a controversial issue, however in this study it was found to be statistically significant with a p value of ($\mathbf{P} < 0.008$), the result of this study has reinforced different observations by others in a study carried out in Shashogo District, Southern Ethiopia, in which they stated Parental illiteracy and large family size are the two most reported socio-demographic characteristics, which, in one way or another, may significantly affect a child's nutritional status.[14]Hence the need to ensure that these children sleep under mosquito nets as well as ensuring that the houses are exposed to residual spraying.

It was also established that behaviours of the few mothers in terms of care to prevent the risk of mosquito bites to the children was low as they did not sleep with their children in the same bed. Compared to a study conducted in Nigeria shows that malaria prevention and behaviors of caregivers of under-five children have the potential to influence the utilization of insecticide treated nets by children. [13] Therefore there is need to enhance the teaching on the preventive behaviour and care of the mothers toward mosquito

bites to the children. Another study done in Uganda shows that children whose parents sleep under mosquito nets and share a bed with them are more likely to use a mosquito net and have an influence on malaria positive cases.[16] In other studies it also shows that, young children in poor households are more likely to share a bed with their parents [18]

Limitation of the study

A major one was that some potential confounders under the age of five with cases as diarrhea diseases, parasitic diseases and other agents were excluded from this study.

Conclusion

It is important to note that some if not all parents of the under five are caught in a vicious cycle of poverty, lack of resources, lack of knowledge, education and training, as well as lack of knowledge of malaria, poor paying jobs, lack of transport, large families and a high incidence of malaria. Only hard work, the necessary funds and multiple disciplinary multi pectoral approaches which should also include members of the community can break the cycle. In order to prevent unnecessary illness of the under five children three major aspects urgently need to be dealt with. Firstly the poverty of the members of these communities should be addressed; secondly education and training of the community members should take place and should include health education about the prevention and control of malaria. Thirdly service delivery by health and other officials to combat the conditions should be improved. However, it was established that there is a relationship between the preventive strategies of malaria among the children and mothers who visit the clinic for various illness treatment and suspected malaria infection.

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