Home-based malaria management in children by women: evidence from a malaria endemic community in sub-Saharan Africa

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ABSTRACT

Objective: To examine the medicines and dosage that mothers who engaged in home-based malaria management administer to children aged ≤ 5 years having signs and symptoms associated with malaria. It was also to discuss the possibilities of designing an effective home-based malaria management strategy.

Methods: The data were obtained from face-to-face semi-structured interviews conducted with mothers in the Ugbowo Community of Benin City, Nigeria who were selected using multi-stage systematic random sampling technique. The data were

analyzed by qualitative content analysis, arithmetic mean, simple percentages and bar chart.

Results: Approximately 90% of the interviewees engaged in home-based malaria management and 10% patronised the hospital. Most of the interviewees who engaged in home-based malaria management administered medicines that stimulate the production of red blood cells and supplies vitamins to children having signs and symptoms of malaria, followed by painkillers, anti-malaria and cough medicine was the least. Of the anti-malaria medicines administered to children almost 80% of the interviewees administered chloroquine to children, 15% quinine and three per cent halfan. Approximately 60% of the interviewees had the correct knowledge of the dosage regime for chloroquine, 38% for quinine and nine per cent for halfan.

Conclusions: Although home-based malaria management is important it cannot serve as a substitute to the hospital. Some diseases have signs and symptoms that are similar to that of malaria which implies that administering anti-malaria medicines to a child without confirmatory tests might lead to irredeemable complications in that child. If the strategy is to make home-based malaria management effective and sustainable mothers and community health officials should be involved in designing the strategy. Simple rapid diagnostic test kits for malaria should be made available to community health officials and pharmacists so that confirmatory tests could be carried out before dispensing medicines.

Keywords: Anti-malaria medicines, Indigenous knowledge, Malaria management, Mothers, Paediatrics

1. Introduction

The *Plasmodium falciparum* (i.e. a protozoan parasite) has been the main cause of malaria which has led to the deaths of many children in sub-Saharan Africa [1,2]. Malaria leads to various abnormalities in children such as renal failure, anaemia and hepatic dysfunction [3,4]. Although several initiatives such as roll back malaria have been introduced by international organizations and malaria endemic nations to control malaria it still remains a public health problem [5, 6]. The roll back malaria initiative has focused on the introduction of artemisinin (i.e. group of medicines that possess the most rapid action against *Plasmodium falciparum*) based combination therapy with home treatment [7]. It is aimed at creating awareness on most available potent anti-malaria medicines and appropriate dosages to people [8]. Medicines for the treatment and prevention of malaria (anti-malarial medicines) can be classified into: quinine and it related compounds, halofantrine, anti-folate compounds, aminoquinoline, antibiotics and pyronaridine. The derivative of quinine such as chloroquine has been mostly used for treatment of malaria however it is becoming less popular because *Plasmodium falciparum* tends to develop resistance to it [9,10]. Quinine has been one of the important anti-malarial medicines but its side effects such as cinchonism leading to blurred vision and impaired hearing [11] and it bitter taste has restricted it use. However, quinine and its isomer such as quinidine are often used as a last resort for treatment of malignant form of malaria [10]. Antibiotics such as tetracycline have anti-malarial effects and it can be used with other anti-malarial medicines to improve efficacy [12]. To help overcome the incidence of resistance of *Plasmodium falciparum* to anti-malarial medicines the World Health Organization has proposed a combination of artemisinin derivatives such as

artemether, amodiquine-sulphadoxine-pyremethamine, artesunate-mefloquine and artesunate-amodiaquine [13].

The control of malaria in a community requires knowledge of potent anti-malarial medicines for management of the disease. Effective home-based malaria management has the potential of reducing malaria related deaths in malaria endemic countries [14,15]. Self- medication for malaria treatment is common in some African countries such as Nigeria, Uganda and Tanzania [15,16,17]. Several factors influence choice of medicines for treatment of malaria. These include knowledge of anti-malaria medicines, knowledge of symptoms and signs of malaria infection, and social impacts of the disease [18, 19,20]. Because most of the malaria related deaths occur among children in sub-Saharan Africa [2] and that women play an important role as caregivers at home [21] this paper has focused on how mothers care for children suspected to have malaria infection. Moreover, the study reported in this paper was conducted in the Nigerian rainforest where malaria is endemic [22]. Malaria has been one of the main causes of death among children in Ethiopia, Burkina Faso and Nigeria [23,24,25,26]. Several malaria control strategies have been implemented to help reduce malaria related incidence in sub-Saharan Africa. For example, prompt access to diagnostic testing using rapid diagnostic tests [27], home-based management of malaria [28], use of insecticide treated bed nets and indoor insecticide sprays [29,30] and artemisinin-based combination therapy [8]. For malaria control strategy such as home-based malaria management to be effective and sustainable it is important for women who are often caregivers to be involved in planning the strategy. This has the potential of making the strategy more acceptable, sustainable in malaria endemic community and could help integrate indigenous with scientific

knowledge in management of malaria. In designing a home-based malaria management strategy related to children it is important to have knowledge regarding the way that caregivers have managed malaria infected children in the past and what could be done to improve the current situation.

In the literature there are several published papers that have focused on home-based malaria management. For example, malaria self-medications and choices of medicines [8,31], home management practices of malaria in Abeokuta, Nigeria, and Uganda [32,33,17], home management of malaria in children by mothers in Kenya and Nigeria [34,15]. Although self-medication is common in some African countries such as Nigeria only few studies [8,31] have focused on medicines that people who practice self-medication use for treatment of malaria infection. Although effective treatment for malaria infection is available, the disease still remains one of the main causes of sickness and deaths especially in children in sub-Saharan Africa. In some cases malaria infected children are managed at home but the inability of their caregivers to correctly recognize malaria related signs and symptoms and the required care have often led to serious complications and sometimes deaths in children [35,36]. Because in Africa mothers are often the caregivers especially on childhood ailments [37], it is important to better understand how they care for malaria infected children and the knowledge that these caregivers are lacking. This will help health managers in designing home-based malaria management strategy that integrates mothers' experiences as well as address areas they have been lagging behind. To the best of our knowledge there is no previously published paper especially in Nigeria that has focused on the medicines and dosage that mothers who practice home-based malaria management administer to children exhibiting some

signs and symptoms of malaria infection. The aim of this paper was to explore how mothers care for children aged ≤ 5 years having some signs and symptoms of malaria infection, medicines and dosage administered to these children. It was also to explore the possibilities of designing an effective home-based malaria management strategy that involves mothers and health officials. The study reported in this paper involves women of Ugbowo Community in Benin City, Nigeria who were selected by multi-stage systematic random sampling technique. It is hoped that the findings will provide women with more understanding on how to care for children infected by malaria and how to incorporate this in designing an effective home-based malaria management strategy.

2. Materials and methods

2.1. The study area

This study was conducted in the Ugbowo Community located in Egor Local Government Area, Edo State, Nigeria. Because the Ugbowo Community is located in the rainforest region the environmental condition of the area is conducive for breeding of mosquito, i.e. vector for transmission of *Plasmodium falciparum* [38]. For example, it rains for greater part of the year (eight months) and the dry season is only four months in Ugbowo. Moreover, the Ugbowo Community has poor drainage systems. For example, some of these drainage systems are either faulty or non-functional. This has led to the presence of stagnant water in some areas of the Community and serves as breeding places for mosquitos. Evidence [39] has shown that there are more cases of malaria related ailments in Benin City (Ugbowo is part of the City) during the wet season than in the dry season

which further compounds the problem. Health facilities such as pharmacy, patent medicine stores and hospital are either found in or located near the Ugbowo Community.

2.2 Data collection and Analysis

The data collection was made by semi-structured face-to-face interviews [40]. Prior to the interviews discussions on research design were held with some academics at the Department of Clinical Pharmacy, University of Benin, Benin City, Nigeria whose works were related to prevention and control of malaria. These academics helped in the design of potential questions for the interviews. A question draft was developed and sent to the academics for their comments. After modifying the draft to address concerns raised by the academics it was sent back to them again. This continued until all the academics were satisfied with the question draft. To verify whether the questions can be understood by potential interviewee pre-test interviews were carried out in January 2002. The interviewees for the test were randomly selected from the Ugbowo Community and were asked to comment on whether the questions are easy to comprehend and to suggest ways of improving the questions. Their comments led to some changes in the question draft and the final questions were produced. The questions consist of open-ended and closed-ended question format.

The main interviews were conducted from February to May 2002 which combined the dry and wet seasons thus helping to reduce the effect of season on the results. All the interviews were carried out in the late evening (i.e. 17:00 and 19:00 hours) when most women in the Ugbowo Community are expected to be at their homes. This was a way to increase chances of involving women from several socioeconomic backgrounds in the

interviews. Participants to the interviews were selected by multi-stage systemic random sampling procedure [41]. Firstly, 15 streets were randomly selected from Ugbowo community and 10 houses from each of the street selected. Secondly, one woman who had a child aged ≤5 years that have had malaria was randomly selected from each house and interviewed. If there is no woman who meets the selection criteria in the selected house another house is randomly selected again. In all, a total of 155 women were interviewed.

Prior to the interviews the purpose of the study reported in this paper was explained to the interviewees, i.e. increasing women participation in management and control of malaria infection. The interviewees were informed that their responses will be held in confidence. They were asked questions such as income, number of children ≤5 years, age, education, occupation and marital status. The interviewees were asked about the most important thing they do when they suspect that their child have malaria infection, whether they administer treatment to their children at home and to give names of medicines they have used for the treatment. The interviewees were asked about the dosage administered to the child suspected to have malaria infection, where they often buy the medicines used for caring for the child and whether the child often get relieved at the end of treatment at home. The data generated from the interviews were analysed by qualitative content analysis i.e. a research method for interpreting qualitative information through classification process of coding, categorizing and identifying themes [41] and by simple percentages, arithmetic mean and bar charts using the Microsoft Office Excel.

3. Results

The results showed that 131 (87%) of all people who were selected for the interviews agreed to participate in the interview. Of the 131 interviewees, 125 answered all questions associated with the variables used in the study reported in this paper. Out of the 125 interviewees approximately 90% (113) reported that they administer treatment against malaria infection to their children at home (home-based malaria management) and 10% took their children to the hospital. The analysis reported in this paper is based on responses from the 113 interviewees who practice home-based malaria management. The results revealed that all the interviewees have formal education, most of them engaged in trading, married and purchased medicines from pharmacy (Table 1).

Insert Table 1 here

The results showed that on average medicines that the interviewees administered to children suspected to have malaria can be classified into five (Fig 1). Of these classes, medicine that stimulates the production of red blood cells (haematinic) and supplies various vitamins and minerals (multivitamin) was the highest administered to children, followed by painkillers (analgesic), anti-malaria and cough medicine (antitussive) was the least (Fig 1).

Insert Fig 1 here

Among the anti-malarial medicines administered to children chloroquine was the most frequent (78%) followed by quinine (15%) and halfan (3%) see Fig 2. However, some of the interviewees (3%) reported that they administer choloroquine but if the malaria persists they switch to quinine and some (1%) reported to have switched from chloroquine to halfan. Almost all the interviewees (99%) reported that their children experienced relief after completing dose of the anti-malarial medicine that was administered. The results revealed that 60% of the interviewees have correct knowledge of the dosage regime for choloroquine, 38% for quinine and only nine per cent for halfan. Of these all the interviewees who had secondary and post-secondary school education, respectively can adminsiter the correct dosage for chloroquine. All the interviewees who had secondary school education also have the correct knowledge of the dosage regime for quinine while only few who had primary school education had the correct knowledge.

Insert Fig 2 here

Almost all the interviewees (95%) reported that they used non-medicine preventive measures against malaria infection and five per cent used medicines. The medicines used were mainly pyrimethamine and chloroquine. The insecticide-treated bed net was the most non-medicine measures used.

The results showed that the interviewee who had secondary school education, engaged in trading, married and purchased anti-malarial medicines from pharmacy were more likely to administer chloroquine to children (Table 2). The interviewee who gets <16330 NGN (i.e. average annual income from this study), aged ≤36 years and had ≤3

years old child were also more likely to administer chloroquine to a child suspected to have malaria infection. The interviewee who had primary school education, engaged in trading, married and purchased anti-malarial medicines from patient medicine store were more likely to administer quinine to a child. This was also so for the interviewees who get ≥16330 NGN annually, aged >36 years and had a child aged >3 years. The interviewee who had post-secondary school education, engaged in trading, married and purchased anti-malarial medicine from pharmacy were more likely to administer halfan to a child. The interviewee who gets ≥16330 NGN annually, aged >36 years and had a child aged >3 years were also more likely to administer halfan to a child suspected to have malaria infection.

Insert Table 2 here

4. Discussion

Although malaria infection is primarily treated using anti-malarial medicines the results of the study reported in this paper have revealed that mothers who practice home-based malaria management administer various groups of medicines to children suspected to have malaria. For example, greater percentage of the mothers interviewed administered a group of medicine that stimulates the body to produce more blood and supply minerals and vitamins (haematinic/multivitamins). Because one of the important early signs of malaria in children is often loss of appetite this might be the reason the mothers administered haematinic/multivitamins to help improve the child's appetite. This suggests that mothers practicing home-based malaria management often initiate treatment based

on “trial and error”. The result is consistent with findings elsewhere in Nigeria. For example, it was found that some people who practice self-medication often use wrong medicines [8]. Because some other diseases have similar signs to malaria thus administering medicines to children based on guesses might worsen the situation. Although home-based malaria management is important it should focus more on first aid measures given to the sick child before taking him or her to the hospital. It is important to note that before administering medicines (especially prescription medicines) to a child appropriate diagnostic test should be done to help in identifying the correct medicine. It is interesting that some mothers give their children medicines that stimulate production of red blood cells (haematinic) and multivitamin. This have the potential of boosting the immune system of the child infected by malaria and help lower the tendency of future malaria infection. This indicates the importance of giving children haematinic and multivitamins to help boost their immune system which could lower their vulnerability to malaria infection.

When a child loses appetite it is often common for him or her to develop fever [42]. As in many African countries mothers often find it easier to detect abnormal body temperature in their children. Once they notice that a child’s body temperature is above normal the next call of action is to give the child medicine such as paracetamol (i.e. analgesic) to help normalise the body temperature. This could the possible reason that analgesic was the second most important class of medicine administered to children suspected to have malaria. The finding is in line with that of Obembe et al. [31], who found that some residents of Ilorin City, Nigeria who engaged in self-medication uses paracetamol when they have fever.

From experience some mothers in Nigeria who engage in home-based malaria management often give anti-malarial medicine to their children once they do not get relief after administering analgesic. This might be a reason that anti-malarial medicine was the third most important class of medicines mothers administer to children suspected to have of malaria infection. The results regarding antitussive been the least medicine administered to children suggests that most mothers do not often wait until their child start coughing before giving them anti-malarial medicine. This could be the reason that antitussive was the least important class of medicines given to a child suspected to have malaria infection. Because *Plasmodium falciparum* is becoming resistant to some anti-malarial medicines in some cases antibiotics are used to improve the effectiveness of anti-malarial. However, this practice is not very common especially among people who are not very familiar with how different medicines interact thus this is not popular among people who engage in home-based malaria management. This may be the reason that only few of the mothers administered antibiotics to their children.

Although effort has been made by the Nigerian government toward provision of health facilities for residents it is worrisome that most mothers practice home-based malaria management and only few patronise the hospital as revealed by the results of the study reported in this paper. The results conform to findings from other part of Nigeria [43] and elsewhere in Africa [16,17] however it differs from findings from a study in the Gambia [44]. A possible reason is the long waiting time in some of the state owned hospitals in Nigeria and sometimes the nearest hospital might be several kilometres away from home. Although private hospitals may be available it is often expensive which makes it accessible to only high income earners in the society. It is interesting that a

297 greater percentage of mothers interviewed bought medicines from pharmacy. This has the
298 potential of getting access to correct medicines especially if mothers could give the
299 pharmacist the right information about some signs they observed on the sick child. The
300 present situation could be improved if simple rapid diagnostic testing kits for malaria are
301 made available to health professionals such pharmacists so that children could be tested
302 for malaria before treatment.

303 Regarding anti-malarial medicines used by mothers who practised home-based
304 malaria management the results reported in this paper revealed that these mothers tend to
305 prefer the most popular and cheapest medicine. Over the years chloroquine has been one
306 of the cheapest and effective medicine for treatment of malaria until in the recent past
307 when it was discovered that *Plasmodium falciparum* show some level of resistance to it.
308 This could be a reason most mothers administered chloroquine to children suspected of
309 having malaria infection. The findings are in line with that of other studies such Jombo et
310 al. [8] and Chukwuocha [45]. However, it differs from that of Obembe et al. [31]. A
311 possible reason for the difference in the findings is that the study by Obembe et al. [31]
312 has focused on malaria in adults and most of the respondents were male but the present
313 study has focused on medicines mothers administer to children. Because the knowledge
314 regarding home-based malarial management is often passed from generation to
315 generation some mothers may not be well informed about resistance of *Plasmodium*
316 *falciparum* to some anti-malarial medicines. This suggests the importance of educating
317 mothers on the strategy developed to address the problem such as the use of artemisinin
318 combination therapy.

Like chloroquine, quinine has been used for the treatment of malaria for a long time and it is one of the most effective drug however it strong bitter taste and critical side effects [10,11] when not used properly often make people to shy from using it. A reason that the mothers interviewed preferred chloroquine could be that quinine has been highly regulated and it is often used as a last resort. Moreover, quinine is more expensive than chloroquine. It is interesting that the results showed that quinine which is among highly regulated medicines in Nigeria is still been dispensed by some patent medicine stores. This suggests the need for developing a more effective strategy for monitoring the activities of these medicine stores. Halfan is not as popular as chloroquine and quinine and it is more expensive as well as has not been available as long as the other two anti-malarial medicines. This maybe a reason that only few of the mothers interviewed used halfan. Halfan has the advantage of not leaving a bitter taste which suggests that children may prefer it compared to chloroquine and quinine. Although the mothers claimed that they only administered other anti-malarial medicines when the one in use proved to be ineffective it is important for them to be well informed on some implications regarding the use of various anti-malarial medicines simultaneously. For example, administering medicines such as chloroquine and quinine simultaneously is not advisable.

People who have used a particular good several times should be more familiar with it [46]. Because most of the mothers interviewed administered chloroquine to children suspected to have malaria they are likely to have more knowledge about the medicine than other anti-malarial medicines. This could be a possible reason that more of the mothers had correct knowledge of the dosage for chloroquine compared to quinine which is regulated and not readily available. Halfan is relatively new to the market compared to

342 the other two medicines which implies that mothers may not know much about it thus
343 only a few mothers had knowledge about it dosage.

344 Education provides people with access to opportunities that help them know more
345 about things happening around them [47]. The results of the study reported in this paper
346 revealed that education plays an important role in home-based malaria management
347 especially in the area regarding correct knowledge of dosage for anti-malarial medicines.
348 For example, all the mothers who had at least secondary school education had correct
349 knowledge of dosage for chloroquine, quinine and halfan. This suggests the importance
350 of educating women on issues related to childhood health care. In controlling malaria at
351 community level it might be better to target preventive measures to help reduce burden
352 that the disease impose on individuals and the community at large. For example,
353 improving sanitary conditions, sleeping under insecticide-treated bed nets and destroying
354 places that provides favourable condition for breeding mosquitoes. The use of haematinic
355 and multivitamins for boosting the immune system of children is also important.

356 In consumer behaviour, if given alternative products people often prefer to buy the
357 product that has the least price [48]. The results revealed that income is important in
358 choice of anti-malarial medicine. For example, mothers who have more money bought
359 more expensive anti-malarial medicine. This suggests that if the strategy is to provide
360 people with effective medicine for treatment of malaria such as artemisinin combination
361 therapy it is important to educate the people on the importance of using the medicine and
362 the medicine should be made affordable for all income categories of people.

363 If the strategy is to make home-based malaria management more effective and
364 sustainable it is important to educate mothers and potential mothers on the implications

of administering various anti-malarial medicines to children and medicines that should not be used simultaneously. More community health workers should be given special training on diagnosis, treatment and control of malaria. These health workers should collaborate with women practising home-based malaria management in carrying out their tasks. It is important for women to be well informed on some medicines that can only be dispensed by pharmacy and those that patent medicine stores are prohibited from dispensing. Simple diagnostic tests kits for malaria should be made available to pharmacists and other health professionals so that children can easily be diagnosed and treated appropriately. Effective anti-malaria medicines should be made available at prices that most people can afford and mothers should be encouraged to be giving their children medicines and foods that boost the immune system as well as reduce exposure of their bodies to mosquito bites.

Conflict of interest statement

We declare that we have no conflict of interest.

Foundation Project: Supported by Department of Clinical Pharmacy, University of Benin, Nigeria.

Acknowledgements

We thank all interviewees in Ugbowo Community and the members of staff of the Department of Clinical Pharmacy, University of Benin, Nigeria who spent their valuable

time for the interviews and development of questions used for the interviews. We would like to thank Pharm. (Mrs.) O.E. Aghomo, Department of Clinical Pharmacy, University of Benin, Nigeria for her value advice on data collection methods.

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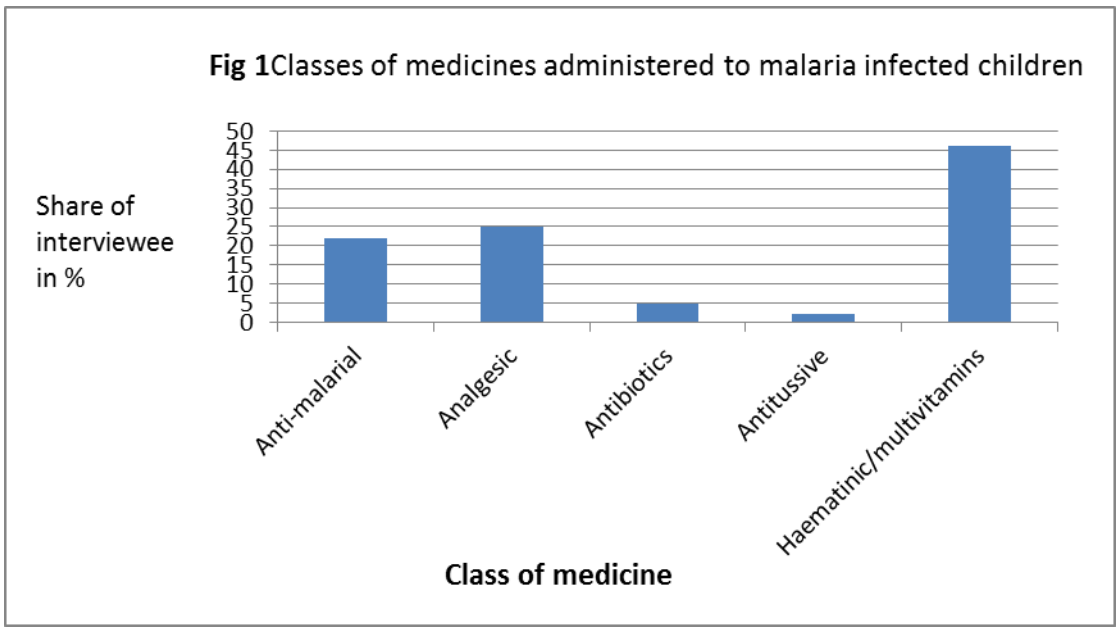

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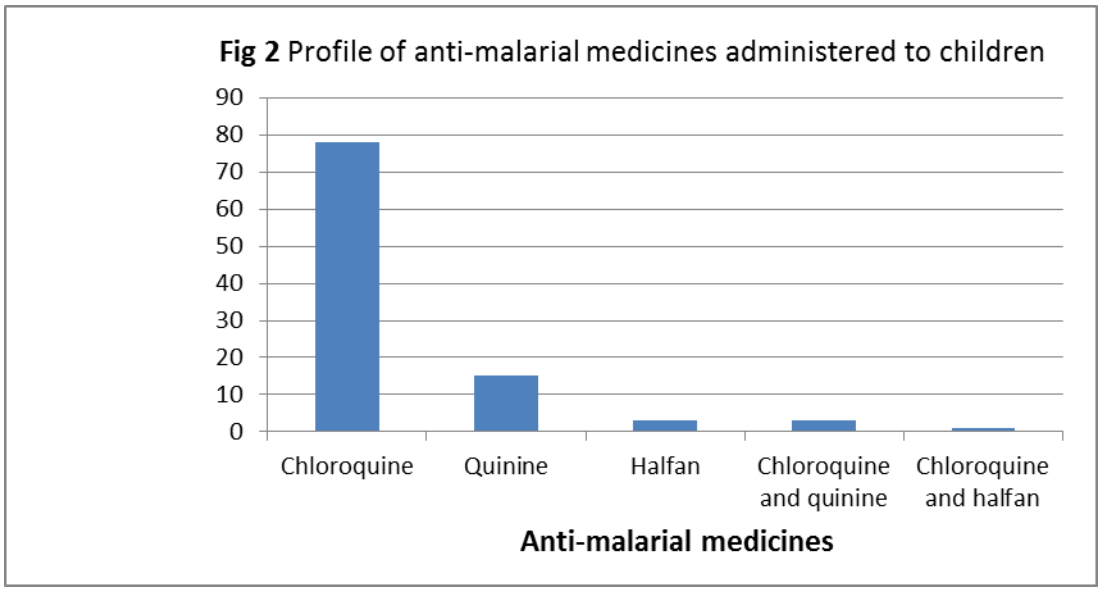
Fig 2 Profile of anti-malarial medicines administered to children
90
80
70
60
50
40
30
20
10
0
Chloroquine
Quinine
Halfan
Chloroquine and quinine
Chloroquine and halfan
Anti-malarial medicines

Table 1 Characteristics of interviewees

Variable	Description	%	Mean
Educational level	The interviewee educational level		
	No formal education	0	
	Primary school	51	
	Secondary school	45	
	Post-secondary school	4	
Occupation	The main occupation of interviewee		
	Trading	55	
	Tailoring/hairdressing	15	
	Unskilled e.g. cleaning	6	
	Student	5	
	Housekeeping	17	
	Civil servant	2	
Marital status	The interviewee marital status		
	Married	85	
	Never married	7	
	Divorced	8	
Medicine source	Place where interviewee mostly buy medicines		
	Pharmacy	76	
	Patent medicine store	24	
Income	Interviewee annual disposable income in NGN		16330
Children	Number of children ≤ 5 years at home		4
Age	The interviewee age in years		36
Child age	The average age of children ≤ 5 years at home		3

NGN is Nigerian Naira: 1US$ = 142NGN in the year 2002.

Table 2 Profile of anti-malarial medicines given to children in relation to some characteristics of interviewees

Variable	Chloroquine (%)	Quinine (%)	Halfan (%)
Educational level:			
Primary school	44	58	0
Secondary school	54	42	33
Post-secondary	2	0	67
Occupation:			
Trading	35	59	67
Tailoring/hairdressing	19	35	0
Unskilled e.g. cleaning	15	6	0
Student	10	0	0
Housekeeping	20	0	0
Civil servant	1	0	33
Marital status:			
Married	79	71	100
Never married	7	0	0
Divorced	14	29	0
Medicine source:			
Pharmacy	52	0	100
Patent medicine store	48	100	0
Income:			
< NGN16330 (average income)	59	24	0
≥ NGN 16330 (average income)	41	76	100
Interviewee age:			
≤ 36 years (average age)	53	35	33
> 36 years (average age)	47	65	67
Child age:			
≤ 3 years (average age)	57	10	0
> 3 years (average age)	43	90	100

NGN is Nigerian Naira: 1US$ = 142NGN in the year 2002.