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editor.fpm1@gmail.com

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# A Stakeholder Approach to Enhancing Oral Quinine Use in the Treatment of Childhood Malaria in Ghana: The Difficulties and Knowledge Gaps in Malaria Therapy

J Huang, S Ertekin

Department of Pharmaceutics

## Article Info

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### 1. Introduction

Plasmodium is the parasite that causes malaria, a dangerous and sometimes lethal illness. Human sickness is caused by four species of this parasite: *P. falciparum*, *P. vivax*, *P. malariae*, and *P. ovale*. Basically, female Anopheles mosquito bites are how these parasites are spread [1, 2]. In Africa, *P. falciparum*-caused malaria is the most common and deadly type. *P. vivax* is more common but less harmful [3]. Malaria symptoms are typically nonspecific and include fever, lethargy, malaise, and gastrointestinal issues (nausea, neurological symptoms (dizziness, disorientation, and coma), myalgia, and vomiting and diarrhea [4]. Additional symptoms include delirium, convulsions, headache, cold and/or cough, back and joint discomfort, and anemia [5]. Notwithstanding the efforts and advancements made in lowering the number of malaria infections and fatalities, the disease remains a serious public health concern in many nations worldwide. In 2015, there were an estimated 214 million cases of malaria worldwide, with 438,000 deaths from the disease—90% of which were in Africa [6]. The disease load is greatest in underprivileged, rural, and impoverished communities, and it is thought to reduce

economic growth in high-burden nations [7], and lowers productivity [8], decreases school attendance, and hinders children's cognitive development. With today's techniques, malaria can be efficiently prevented and treated [9]. It has been demonstrated that a multifaceted strategy that includes indoor residual spraying (IRS), insecticide-treated nets (ITNs), intermittent preventive treatment (IPT) for children and pregnant women, and early diagnosis and treatment with ACTs and other antimalarial agents like quinine can prevent mortality and drastically lower illness [10]. Therefore, enhancing public education and sensitization, establishing productive partnerships and providing the necessary resources, and expanding access are the paths ahead. Since malaria is primarily a disease of poverty, improving people's living conditions would significantly lessen the disease's impacts. Among these will be the adoption of novel methods for managing and treating malaria. Involving and utilizing community health officers from the social services and healthcare sectors could aid in the creation of malaria strategies and policies that can offer medical, preventive, and promotional services to people and communities. Given that children are the most susceptible group of malaria patients, this study aimed to determine the obstacles and gaps in knowledge related to these interventions that must be filled in order to improve and enhance the results of malaria treatment, particularly when quinine is used in children.

1. Supplies and Procedures  
1.1. Research Design. The study was cross-sectional. A well-structured questionnaire was used as the main research approach. It was thoughtfully crafted such that responders could select from strongly agree, agree, neutral, disagree, and strongly disagree.

1.2. Research Location. This study was conducted in a government children's hospital that was selected due to its significance in the nation's healthcare system. The hospital is situated in the Greater Accra region's Ashiedu Keteke Sub-Metro area. It is conveniently located near the well-known Makola market and the core business district of Accra, the capital of Ghana.

1.3. Research Sample. Parents, guardians, caregivers, and healthcare professionals participated in the study. Due to their involvement in providing pediatric healthcare and their interaction with the kid, these were chosen as the target population. There were 748 participants in all.

Samples (1.4). Men and women who were at least twenty years old at the time of sampling were included in the purposively selected participants.

1.5. Moral Points. The study received ethical approval from Kwame Nkrumah University Science's Committee on Human Research, Publication, and Ethics.

and Komfo Anokye Teaching Hospital, as well as Technology (Ref: CHRPE/AP/017/17). Before beginning the study, participants signed the consent forms and received the participant information leaflet. Before they could take part, those who were illiterate were informed in their own tongue and asked for their permission. The introduction to the online forms provided a thorough explanation of the study's justification as well as all the ethical concerns.

1.6. Data Gathering Method. A self-administered, well-structured questionnaire was used to collect quantitative primary data. Both a paper copy and an online questionnaire were used in the investigation. Internet-based Google forms were used to distribute the online questionnaire for quantitative data collection, and participant emails and web link invites were used to collect data. To increase respondent engagement, emails serving as reminders were issued to the respondents throughout the data collecting period. Participants with poor Internet access and power outages were given printed copies of the questionnaire along with an explanation of the material in the leaflet to get their consent. They were then promptly contacted to pick up the completed questionnaire. The length, suitability, and competency of the survey questionnaires were pretested before they were distributed, and the results showed a Cronbach's alpha reliability statistic of 0.904, indicating that the questionnaires were competent [11, 12]. There were two main sections to the full questionnaire. Part I collected the respondents' biodata. In contrast, Part II was divided into different categories and collected information on the respondents' knowledge of malaria, treatment-seeking behavior and prevention strategies, pediatric medication formulations, antimalarial medication use options, quinine antimalarial therapy, and new quinine formulations for children. The Likert rating scale, which ranges from (1) strongly agree, (2) agree, (3) neutral, (4) disagree, and (5) strongly disagree, was used to develop the questionnaire (Part II). By checking the corresponding option, participants indicated how much they agreed with each section's claims.

1.7. Data Processing through Statistics. The internal consistency of the questionnaires used to elicit the desired responses from the pretest participants was tested using SPSS version 20. After entering data from

20 respondents using Google forms (spreadsheets) into SPSS, the Cronbach's alpha reliability value was calculated.

While the answers from the hard copy questionnaires were physically entered into the Google forms, the online forms were completed and returned. The replies in the Google forms spreadsheet summary for the univariate analysis were used to create percentages for the ongoing data processing of the items in Part I. For univariate analysis, the quantitative data for Part II was automatically prepared and processed into aggregated data plots.

TABLE 1: Sociodemographic distribution of the study participants.

Characteristic	Frequency (n)
<b>Age range in years</b>	
20 – 30	267
31 – 40	256
41 – 50	123
51 – 60	64
61 – 70	17
70 +	3
<b>Gender</b>	
Male	303
Female	455
<b>Marital status</b>	
Single	289
Married	459

**2. Results and Discussion**

3. 1.1. Distribution of Study Participants' Biodata. 748 surveys were successfully completed, with 41% of respondents being men and 59% being women. The majority of respondents (53%) had completed postsecondary education, 35% had completed secondary education, and 12% had dropped out of primary school or other basic education. Parents, guardians, or other caregivers made up the majority of responders (73%) whereas clinicians, nurses, and pharmacists made up the remaining 27%. A larger percentage (79%) of the respondents were either working or self-employed, compared to about 21% who were unemployed (Table 1).

1.2. Malaria Transmission Causes and Mechanisms. According to the study, the majority of respondents were well knowledgeable on the causes of malaria and how it spreads. According to Figure 1, the majority of respondents (68%) linked malaria to the Plasmodium parasite, which spreads the disease through the bites of female Anopheles mosquitoes carrying the infection. This study's level of understanding of the actual causes of malaria is comparable to some prior findings in Nigeria [13], Zimbabwe [14], Cameroon [15], and India [16], all of which showed improvements over some related studies that had been conducted in Ghana and other places. In those earlier results, malaria was mostly linked to ome common myths include consuming fatty foods, drinking contaminated water, and standing in the sun [17, 18].

The majority of participants (75%) agreed that malaria cases increase during the rainy season, and they named pregnant women and children as the most susceptible groups to malarial attacks (65%). Thankfully, the respondents (82%) rejected the idea that witchcraft is the cause of malaria, indicating that the disease is not wicked. Since other findings similarly linked education to awareness of malaria, the high level of knowledge seen can be attributed to the individuals' educational backgrounds [19, 20]. In essence, the pursuit of malaria prevention would benefit from an understanding of the true origins and

routes of transmission of the disease.

1.3. Understanding Malaria Symptoms and Signs. The majority of respondents correctly identified fever (75%), headache and dizziness (74%), overall weakness (73%), nausea and vomiting (62%), loss of appetite (68%), and the resulting anemia (63%), as the signs and symptoms of malaria (Figure 2). These results are consistent with those reported in certain related earlier publications on the topic [21, 22]. Understanding the appropriate symptoms and indicators would primarily affect a person's capacity to act appropriately and promptly when malaria first appears, which would cause

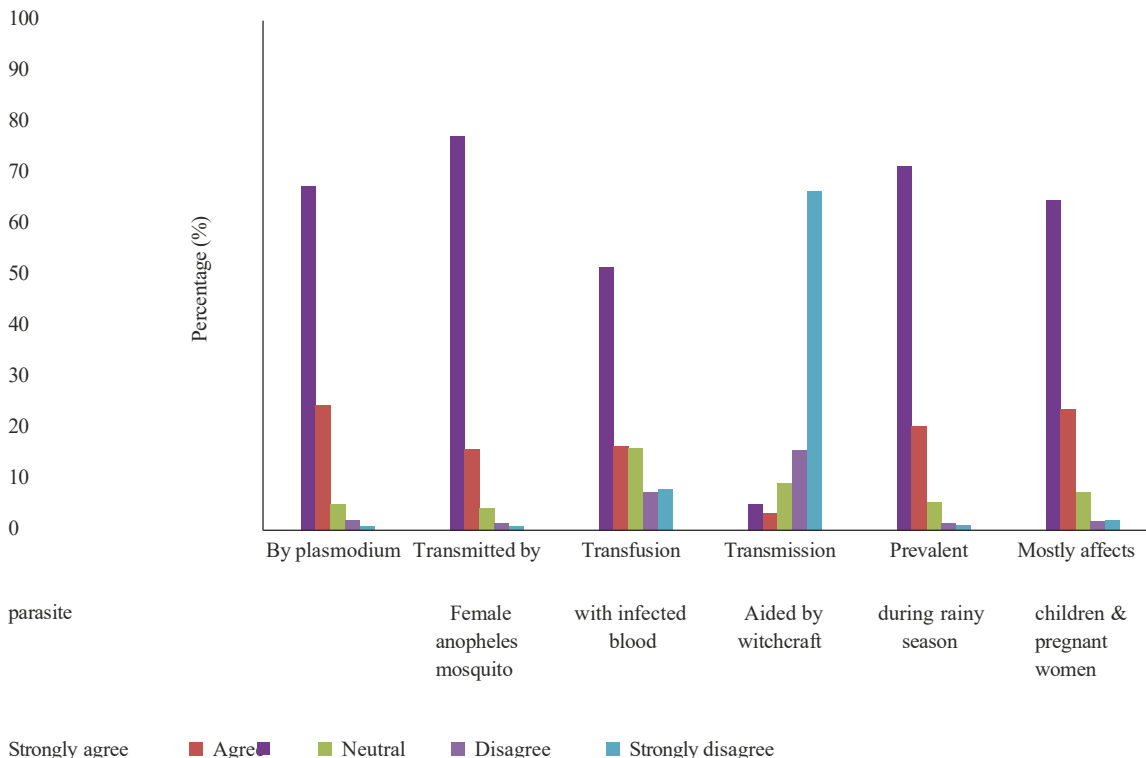


FIGURE 1: Awareness of the causes of malaria.

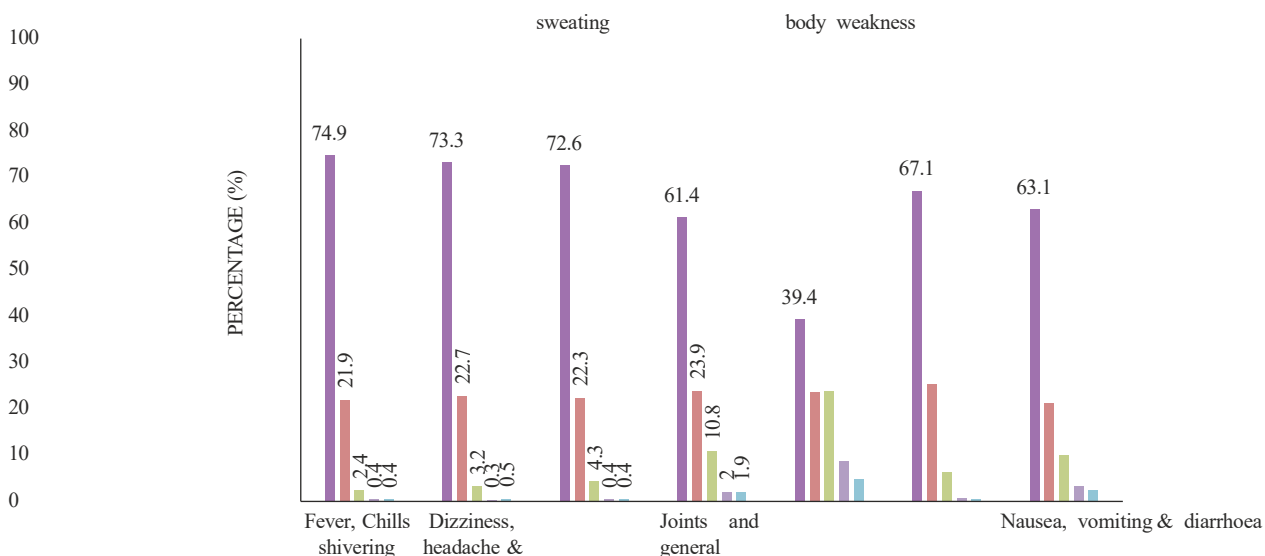


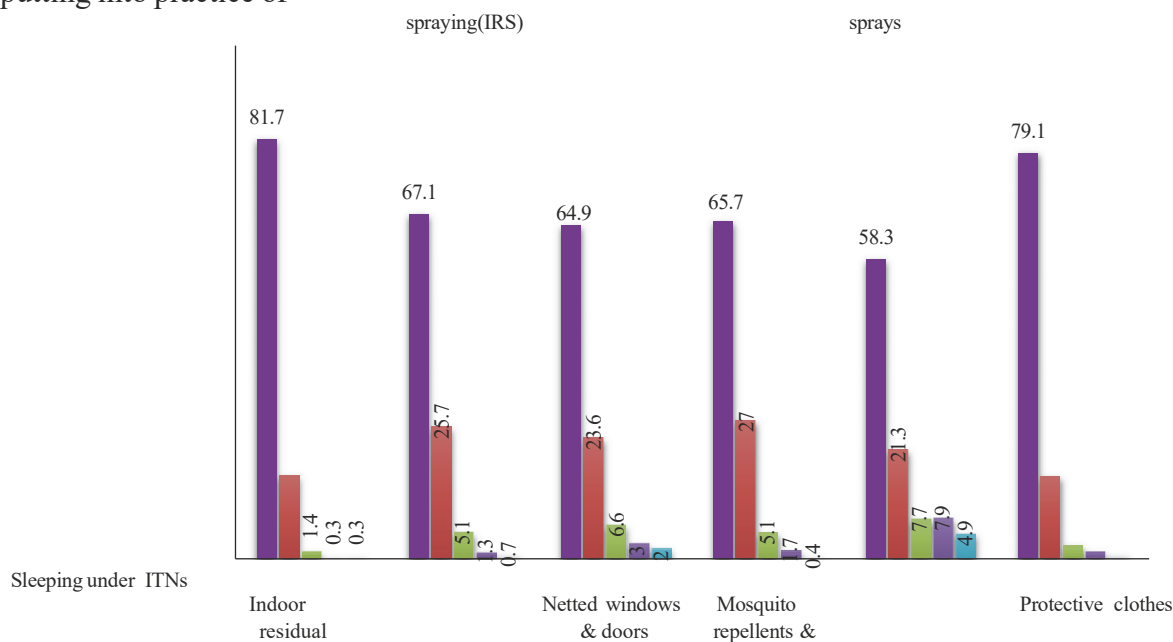


FIGURE 2: Knowledge of the signs and symptoms of malaria.

an appreciable treatment seeking attitude. The WHO and UK malaria treatment guidelines recommend early diagnosis and treatment as very essential in fighting malaria [23, 24].

Substantial understanding of the signs and symptoms of malaria can be crucial for home management of malaria and, hence, reduce severity and mortality. Therefore, even though there was considerable level of awareness of the clinical signs and symptoms of malaria, health authorities would need to intensify educational programmes among the populace aimed at maximum or near maximum malaria management and control.

*Knowledge of the Methods of Malaria Prevention.* Malaria is deadly, yet it is an entirely preventable and treatable disease [2]. Methodologies range from the interference of breeding grounds and larva control to putting into practice of



Environmental cleanliness

Strongly agreed ■ Agreed ■ Neutrals ■ Disagree ■ Strongly disagreed

FIGURE 3: Awareness of the methods of prevention of malaria.

personal and household protective measures [25]. Generally, the knowledge about malaria prevention methods was high among the participants (Figure 3). While 97% agreed on the use of ITNs, 92% indicated IRS as means of preventing malaria. ITNs and IRS as well as environmental cleanliness have been used as malaria control mechanisms over the years [15]. Our study has also identified the use of mosquito repellents and netted windows and doors, while the wearing of protective clothes against mosquito bites was also emphasised, similar to several other study findings [26, 27]. Refreshingly, these measures are relatively cheaper than the use of IRS and ITNs [28] and can be implemented at ordinary household levels. The results established clearly that there is a relationship between the knowledge of the causes of malaria and its prevention. It also seems clear that the education and interventions by the National Malaria Control Programme is yielding the desired impact, and if intensified, the anticipated malaria cases will subside [27]. Therefore, children under 5 years and pregnant women in malaria endemic communities should continue to be targets in the malaria control programmes such as free or subsidized ITNs distribution and effective treatment via maternal and child health clinics.

*3.1. Malaria Disease Management.* The incidence of malaria was high in the study population, especially childhood malaria as 84% of respondents had children who had experienced malaria in the past. Further, 93% agreed that malaria is a serious and life-threatening disease which can kill if not treated promptly. The high level of knowledge of the deadly nature of malaria is encouraging, because proper measures would be taken to prevent or manage it should their

family members get infected. Unfortunately, however, despite the fact that majority of the respondents had high level of knowledge on apt malaria prevention methods, their children (84%) still had episodes of malaria infection at one point or the other.

It therefore appears that the challenges to malaria prevention are still enormous and complicated. Lack of adequate protective clothing, the hot and humid Tropical African weather which does not support or encourage thorough body covering and use of ITNs, abundance of the mosquito vector in the subregion coupled with changes in their feeding times and habits, lack of effective IRSs, or the mere inability to implement the knowledge on malaria prevention exacerbates these challenges. Mboera et al. [29], in a similar study observed that in spite of high levels of knowledge of malaria in Tanzania, its morbidity was still high, and they suggested that misguided application of antimalarial drugs and delayed health seeking attitude as well as reliance on clinical findings in the absence of laboratory confirmation were accountable.

Treatment seeking attitude was good although pockets of participants agreed on undertaking home treatment with either previously bought drugs or herbal products. Essentially, majority of the respondents sought formal healthcare services from hospitals, clinics, or the community health workers [30], although some other studies [31] contradict this in favour of home treatment of some kind.

Interestingly, the study showed that 77% of the participants would seek treatment within 24 hours once symptoms showed up, which is in line with the targets of the Abuja Summit on Malaria which among other things envisaged that at least 60% of those having malaria should seek treatment within 24 hours of the onset of symptoms [32]. Nevertheless, some of the participants identified long distances to health facilities, high transportation, consultation and treatment costs, unfriendly attitude of some healthcare workers, unnecessary delays at the health facilities, and busy work schedules as some of the reasons for not seeking formal healthcare (Table 2).

Some form of continuing health education is still necessary to help these parents understand the need to take their children to healthcare centres for treatment in spite of these difficulties and challenges. Maybe the introduction of some basic incentives for prompt healthcare seeking attitudes, especially with children and pregnant women, could greatly enhance this. Also, since malaria is still a major killer in Africa, there is the need to restructure the health systems to facilitate the use of community health officers (CHOs) to take malaria control to the populace rather than wait and expect them to use the health facilities, in view of the high level of poverty and low literacy in these communities. The use of CHO services has been widely demonstrated to be very effective and have resulted in the elimination of most childhood killer diseases in many communities, improving family planning services and lifestyles of, especially, mothers and children [33].

Meanwhile some health workers in the various centres would need a rethink in attitude towards patients and guardians who seek healthcare services from them. This may require further training and continuous professional development, where some of these findings are conveyed to these practitioners.

*3.2. Desirable Attributes of Paediatric Drug Formulations.* The use of off-label and unlicensed medicines in children is widespread, yet the effects of these medicines on children have not been properly studied. Healthcare professionals, parents, or caregivers are often confronted with the necessity to manipulate an adult medicine for children which has the potential for high levels of dosage errors, instability, poor bioavailability, and unintended side-effects. Children under five years have been the target for antimalarial drug therapies over the years. The availability and suitability of antimalarial drug formulations for the child are essential if the fight against paediatric malaria is to be won.

Suitable formulations for children make it easier for parents and caregivers to administer antimalarial agents effectively, resulting in better therapeutic outcomes [34, 35]. Paediatric formulation ought to satisfy the needs: convenient and reliable administration, acceptability and palatability, minimum dosing frequency, end-user needs of patients of diverse ages, and the preferences of patients including caregivers

in different parts of the world [36, 37].

Age-appropriate dosage forms are necessary to ensure compliance and effective therapeutic outcomes [38]. Liquid formulations hitherto had been the formulation of choice for paediatric use but issues of compliance and safety have been expressed. Liquid formulations can easily undergo microbial contamination if proper storage conditions are not followed. Most antimalarial agents also have unpleasant taste and bitter tasting drugs are usually poorly tolerated by children. A significant proportion (85%) of the study participants were aware of some paediatric antimalarial drug formulations in circulation and showed preference for formulations which are palatable, easily acceptable, and in an attractive packaging (Figure 4).

Palatability and dysphagia persist as the two paramount challenges to paediatric drug product development, because neither is trivial and therefore continues to be major obstacles to the development of ‘child-friendly’ dosage forms [39].

**3.3. Antimalarial Drug Knowledge.** The study uncovered that some antimalarial drugs were more common among the participants than others (Table 3). Quinine came topmost (92%) followed by chloroquine (90%) as the antimalarial agents most of the respondents were familiar with. This may be because of the unique bitter taste of the duo as many people are more likely to remember bad taste. The availability of quinine tonic on the market may have an influence. In addition, quinine has been in use for treating malaria for over two centuries now and so the awareness of it among the respondents is fairly understandable. Unfortunately, chloro- quine, though well known, has fallen into disuse and is no longer recommended due to drug resistance resulting from dosing errors, inappropriate use, or misuse and abuse.

**4. Conclusion**

The study demonstrated the availability of substantial knowl- edge of various aspects of malaria as well as its devastating

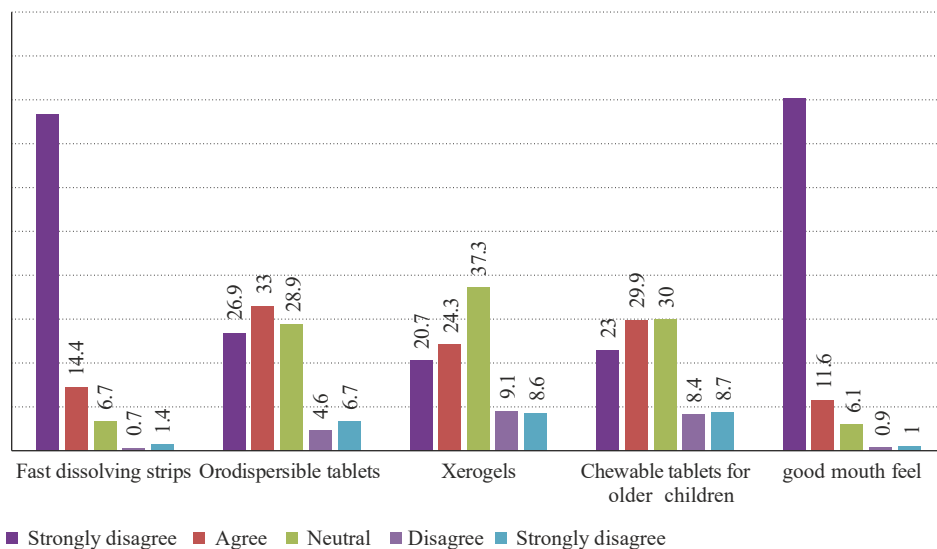


FIGURE 5: Novel paediatric quinine formulations.

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