USE OF ANTIMALARIAL DRUGS IN MALI: POLICY VERSUS REALITY

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Abstract. Inappropriate use of antimalarial drugs undermines therapeutic efficacy and promotes the emergence and spread of drug-resistant malaria. Strategies for improving compliance require accurate information about current practices. Here we describe Knowledge-Attitude-Practice surveys conducted among health providers and consumers in two Malian villages, one rural and one periurban. All sanctioned providers limited their first choices of antimalarial drug to those recommended by the national malaria control program and reported using correct dosing regimens. However, the majority of consumers in the two villages chose non-recommended treatments for malaria and reported suboptimal treatment regimens when they did use recommended drugs. Antimalarial drugs were also widely available from unsanctioned sources, often accompanied by erroneous advice on dosing regimens. This study demonstrates that even when the most peripheral health providers are well-trained in correct use of antimalarial drugs, additional measures directly targeting consumers will be required to improve drug use practices.

With no effective malaria vaccine on the near horizon and insufficient resources to sustain vector control programs, early detection and treatment of clinical cases has emerged as a main focus of malaria control in Africa. The correct use of antimalarial drugs is key not only to therapeutic success but to deterring the spread of drug-resistant malaria. In studies of knowledge, attitudes, and practices regarding malaria and its treatment, miscalculations about the disease, the use of ineffective treatments, and the incorrect use of effective treatments are all common. Most such studies have examined consumers of antimalarial treatments. However, providers also play a critical role in determining how treatments are used. Understanding the actions of those who prescribe and supply antimalarial drugs and the relationships between how drugs are recommended and prescribed and how they are actually used will aid in devising strategies to increase the correct use of antimalarials.

Where discrepancies exist between malaria control and treatment policies and the actual usage patterns of antimalarial drugs, effective corrective measures will depend on precise identification of the points where deviations occur along the pathways of information from policy makers to providers to consumers. Here we present results of surveys of therapeutic knowledge, attitudes, and practices of both providers and consumers of antimalarial treatments in periurban and rural communities in Mali, a west African country where Plasmodium falciparum malaria is a major public health problem. To fully describe drug prescription habits, modes of distribution, and usage patterns, all sources of antimalarial drugs were targeted for study, including market places, shops, and itinerant dealers as well as pharmacies and dispensaries.

STUDY SITES AND METHODS

Setting. Plasmodium falciparum malaria is epidemic in the northern Saharan regions of Mali and holoendemic throughout the central Sahel and southern savannah regions, accounting for 13% of overall mortality and up to 25% of childhood mortality. The National Malaria Control Program in Mali recommends chloroquine as the first drug for uncomplicated malaria and for chemoprophylaxis in pregnancy. Pyrimethamine-sulfadoxine is the second-line antimalarial, and quinine is the recommended treatment for severe and complicated malaria. Chloroquine remains effective in most settings and significant pyrimethamine-sulfadoxine resistance was absent at the time of these studies (Djimde A, unpublished data). Information about the efficacy of other antimalarial drugs in Mali is not available.

Study villages. Bougoula (population = 3,200), located 5 km from the city of Sikasso (population = 75,000), is a village with a pharmacy depot and a health care center run by a nurse and a midwife. Bougoula has a mixed cash-based and subsistence farming economy, and its residents have easy access to the urban markets of Sikasso. Kolle (population = 2,500) is a rural village 60 km south of Bamako, the capital city of Mali. The primary economic activity in Kolle is subsistence farming, and the nearest health care facility is in a larger village 5 km away. In both villages, traditional Malian village and family structures are present. A head man and council of elders provide local leadership, and male-headed families, often with two to four wives, live in compounds.

The epidemiology of malaria is similar at both sites (Doumbo O, unpublished data). Plasmodium falciparum malaria is holoendemic and seasonal, with parasitemia prevalence rates of 70–85% in the July–October rainy season and 40–50% during the dry season. Most severe disease and death occurs in children less than five years of age. Although older children and adults living in these areas have acquired partial immunity to P. falciparum malaria and are often asymptomatically parasitemic, symptomatic malaria leading to treatment occurs at all ages.

Survey. Knowledge, Attitude, and Practice studies were performed in March 1994 by a study team consisting of a medical anthropologist and two medical students. To assess antimalarial drug prescription habits, structured interviews were conducted with physicians, nurses, trained midwives, lay midwives, and lay health workers who worked at clinics and medical stations at the study sites. Although they are not officially permitted to prescribe medications, pharmacists (who hold doctoral level degrees) and pharmacy sellers (who
are trained at a level comparable to practical nurses) were also interviewed in recognition of the common practice of direct treatment-seeking at pharmacies and pharmacy-depots. Each drug provider was asked a series of specific questions about malaria therapeutic practice.

To identify unsanctioned sources of antimalarial drugs, market places and private vendors were also surveyed. To encourage candid responses, interviews were conducted by one of the authors (AD, a pharmacist) dressed in cognito in traditional farmer’s garb, who requested treatments from vendors for symptoms consistent with malaria.

Residents of Kolle and Bougoula were interviewed about their use of antimalarial drugs. Based on 1990 census data, all 66 families residing in Kolle, and 50 of 150 families residing in Bougoula (chosen by random drawing) were interviewed. Women between the ages of 15 and 45 and men between the ages of 18 and 55 were interviewed to target the individuals most likely to have obtained antimalarial treatment for themselves or for other family members. Visitors and family members not permanently residing in the village were excluded. Interviewers visited families several times to interview nearly all subjects.

Villagers were asked in their own language whether they had used any measures against symptoms consistent with malaria (fever, headache, prostration, vomiting) or sumaya (the local name of malaria) during the preceding five months. Specific measures or treatments were identified, including dosage and treatment duration. The interviewers then named each antimalarial drug commercially available in Mali and asked whether it had been used. Women were asked whether they use any antimalarial prophylaxis during pregnancy.

Village head men and heads of families were informed of the aims of the study and their consent was obtained in advance of the study, and all interviewed subjects were again asked for their consent. Study protocols were reviewed and approved by Institutional Review Board at the National School of Medicine and Pharmacy in Bamako.

Statistical methods. The chi-square test (Epi Info 6; Centers for Disease Control and Prevention, Atlanta, GA) was used for comparisons of proportions with two-tailed significance tested at $P < 0.05$.

RESULTS

Sanctioned providers. Twenty-eight sanctioned drug providers in the Bougoula area were identified and interviewed: seven physicians, eight nurses, six pharmacists, four pharmacy sellers, and three midwives. All Bougoula providers were located in the urban district of Sikasso. Nine providers in the Kolle area were identified and interviewed: one physician, three pharmacy sellers, three midwives, and two nurses. All Kolle providers were located within 10 km of the village. There were no significant differences between the two sites in the prescription patterns of health care providers and drug dispensers. Overall, 46% (17 of 37) of providers used chloroquine as a first-choice antimalarial drug and another 46% chose quinine (Figure 1). Eight-two percent of users in the Kolle area reported prescribing the correct dose of quinine for cases of severe malaria; 25 mg/kg/day administered parenterally in three divided doses daily until the patient is able to tolerate a change to oral therapy, continued at the same dose for a total of seven days. All other providers, most of whom were not physicians, used a dosing regimen of 10 mg/kg of quinine intramuscularly once a day for three days, an unsanctioned regimen that is commonly used to treat noncerebral malaria.

Unsanctioned providers. Availability of antimalarial drugs through illegal vendors was assessed by visits to two markets in Bougoula and three markets in Kolle. Five stall keepers and two itinerant vendors were interviewed in the Bougoula markets and three stall keepers were interviewed in Kolle. All had chloroquine in stock at a standard price of $0.02 per 100-mg tablet. These vendors suggested a single dose of two tablets for an adult. Proguanil was available from one stall keeper. Although no other antimalarial drugs were for sale from these unsanctioned sources, all vendors suggested 500 mg tablets of paracetamol (daga, smuggled

![Figure 1](image-url)
from neighboring Guinea) when asked for medicine to ease the symptoms of sumaya (the local term for malaria). The recommended dose was 2.5 tablets for an adult at a cost of $0.05 per tablet.

In addition to the stall-keepers or itinerant vendors more or less specialized in illegal drug selling, chloroquine was also sold by purveyors of various goods such as shoes, clothing, beauty products, candy, motorcycle parts, and cookies.

Consumers. Interviews were conducted with 323 members of 66 families in Kolle and 209 members of 50 families in Bougoula. All targeted families and 95% of eligible individuals were interviewed. The mean number of persons interviewed per family was 4.9 in Kolle and 4.2 in Bougoula. More females than males were interviewed (63.5% female in Kolle, 62.7% in Bougoula) reflecting a polygamous society.

Chloroquine was the malaria treatment used by 39% of consumers overall (Figure 1). Pyrimethamine-sulfadoxine and quinine were each cited by only 4% of the consumers who reported using any antimalarial remedies, whereas 53% used other remedies: 23% preferred herbs or other traditional materials; 20% analgesics and antipyretics; 6% commercial medicines other than standard antimalarial drugs; and 4% used miscellaneous products. The only significant difference in consumer preferences between the two study sites was that 9% (19 of 208) of Bougoula residents but only 0.3% (1 of 295) of Kolle residents reported using antifolate drugs including pyrimethamine-sulfadoxine. Table 1 lists all products and measures other than the recommended antimalarial treatments reported as preferred for treating malaria.

Consumers’ knowledge of the use of chloroquine was determined by asking the dosage and treatment schedule used by each person who reported using this drug (Figure 2). Most consumers responded “don’t know” to these questions, although significantly more Kolle residents offered a response. At both sites, only 2.5% of the consumers who reported having used chloroquine could identify the correct daily adult dose of six tablets (chloroquine is commonly available in 100-mg tablet size). All others reported taking fewer than six tablets a day. Similarly, of those who responded to the question of duration of chloroquine therapy, the majority responded incorrectly, erring most often on the side of shorter treatment duration. Significantly more Kolle residents than Bougoula residents (25% versus 7.7%) correctly identified the three-day course of treatment.

Sixty-six percent (213 of 323) of women who had been pregnant reported having used malaria chemoprophylaxis during pregnancy. Significantly more women from the peri-urban region of Bougoula (76%, 96 of 126) reported using chemoprophylaxis than did women of rural Kolle (59%, 117 of 197). Of those who used chemoprophylaxis, significantly more Kolle women (91%) than Bougoula women (49%) used chloroquine. Use of proguanil by 39% of Bougoula women, most of whom were enrolled in a study of prenatal malaria prophylaxis, accounted for much of this difference since no Kolle women reported using proguanil. In contrast to the high use of alternative traditional remedies for malaria by the general population, only 14% of the women in Bougoula and 9% in Kolle reported the use of prophylaxis with compounds other than chloroquine or proguanil.

DISCUSSION

This study illustrates the wide gulf between carefully formulated malaria treatment and prevention policies, and the actual knowledge, attitudes, and practices of consumers. We have found that in both a rural village and a peri-urban village in Mali, legitimate health providers of all levels of training prescribe correct treatment regimens for the recommended drugs chloroquine and pyrimethamine-sulfadoxine. There is some variation in compliance with the recommended order
of drugs used as first-, second-, and third-line treatments, and in the regimens used for quinine treatment. Despite these relatively good prescribing practices, the majority of consumers use none of the recommended treatments for malaria, relying instead on alternative treatments, most commonly antipyretics and traditional herbal remedies, some of which alleviate symptoms of malaria. In semi-immune adults, these measures and noncurative regimens of chloroquine may offer symptomatic relief without parasitologic cure.

Even when the recommended antimalarial drugs are used, inappropriate treatment regimens, usually under-treatment, are common. While the retrospective survey method may have led to an overestimation of incorrect drug use, the disparity between prescribing advice and actual usage seen in this study is consistent with other recent studies in Mali, which found that the majority of individuals could not correctly remember the dosing schedule of prescribed drugs immediately after leaving a physician’s office and that adults were reluctant to take a full dose regimen of chloroquine even when prescribed by a physician, citing fear of side effects and the cost of a full treatment (Doumbia S, Doumbo O, unpublished data). In addition to noncompliance with correctly prescribed regimens, much incorrect usage can be ascribed to the practice of purchasing medications directly from unsanctioned sources without the benefit of any medical or prescribing advice. In our experience, this practice is common and is motivated by cost concerns.

The high frequency of chloroquine chemoprophylaxis reported by pregnant women is probably valid, based on a recent study finding that 80% of women from Bougoula who reported taking chloroquine for prophylaxis tested positive for chloroquine metabolites in the urine. The use of proguganil only in Bougoula is related to a study of chloroquine and proguganil prenatal prophylaxis that was being conducted at this site during the study period.

The study villages were chosen in anticipation of possible differences in compliance with recommended treatment regimens. Kolle is served by only one physician, who adheres closely to national malaria treatment policies and practices in a dispensary where medications are available at a subsidized cost, thus reducing the incentive to seek treatment from commercial sources. This dispensary has been proposed as a model for controlling antimalarial drug use in a strategy to deter the emergence and spread of drug resistant malaria. In Bougoula, there are more providers, more sources of medications, and no attempt is made to restrict use of second and third-line drugs. These differences in drug prescribing and availability patterns may be reflected in the somewhat better knowledge of chloroquine dosing regimens seen in Kolle residents. However, the findings that at both sites under-treatment is frequent and illegal commercial drug vendors usually recommend only a single dose of chloroquine highlight the potential contribution of incorrect drug administration to the genesis of drug resistant malaria in these settings.

This study shows that official malaria treatment policies may have little impact at the village level even when the most peripheral health providers are educated and compliant. The failure of correct prescribing habits to result in correct usage of antimalarials by consumers reflects a need to intervene directly with consumers to change their attitudes and practices. This will be a highly challenging task, and will require understanding local practices and customs and the nature of authority and influence at the village level.

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REFERENCES


