Knowledge, attitudes and practices of expatriates towards malaria chemoprophylaxis and personal protection measures on a mine in Mali

Stefanus Jutea, Stephen Tooveyb,*

aMorila Gold Mine, Mali
bRoyal Free Hospital Medical School London, UK Travel Clinic, Cape Town, South Africa

Received 27 April 2006; accepted 4 May 2006
Available online 13 June 2006

KEYWORDS
Malaria; Expatriate; Long term traveler; Doxycycline; Mefloquine; Atovaquone-proguanil

Summary
A questionnaire survey of malaria chemoprophylaxis knowledge, attitudes, and practices of 90 expatriates on a Mali mine yielded 68 (75.5%) responses. A total of 49 (72%) subjects took perennial chemoprophylaxis, 6 (9%) were children <5 years. Out of 68, 13 (19%) took chemoprophylaxis during the high transmission season only and 10 (15%) never took chemoprophylaxis. Reasons advanced for not taking chemoprophylaxis were concern over adverse effects, presumed immunity from long term residence in Africa, and on site access to quality medical care. Chemoprophylactics used were: atovaquone-proguanil 1 (2%); chloroquine and proguanil 15 (30%); doxycycline 16 (33%); mefloquine 17 (35%). Thirteen out of 49 (27%) subjects admitted to missing chemoprophylaxis doses and 15/68 (22%) had suffered malaria while on chemoprophylaxis. Fifteen out of 49 (31%) low season chemoprophylaxis users and 4/19 (21%) non-users contracted low season malaria (x², p = 0.63). A total of 46 (68%) used insect repellants, 50 (74%) used insecticide sprays or coils in rooms, 9 (13%) slept under insecticide treated nets. Malaria control in expatriates requires improvement; additional strategies for consideration that require reduced compliance requirements by expatriates are suggested, including residual spraying, seasonal chemoprophylaxis use, and emergency stand by medication.

© 2006 Elsevier Ltd. All rights reserved.

Introduction
Malaria is the disease in sub-Saharan Africa with the highest rates of morbidity and mortality. In the occupational health setting it results in many lost man hours.¹ Non-immune individuals such as expatriate workers in Plasmodium falciparum endemic areas are at high risk of severe disease or death should they become infected. Studies in malaria-endemic areas show that malaria risk is associated with both the duration and intensity of exposure.²,³ Expatriates, a group likely to endure long term exposure, should therefore be offered efficacious protection against P. falciparum.

¹Corresponding author.
E-mail address: malaria@freesurf.ch (S. Toovey).
Advice on chemoprophylaxis for long-term expatriates is a problematic area bedeviled by poor compliance, mis-apprehension, and sparse data. Additionally, all available chemoprophylactic agents may cause adverse events, a fact which may create compliance problems.

Although the use of personal protection measures against Anopheles mosquitoes should always be encouraged, compliance with their application may be suboptimal. Given the problematic nature of long term chemoprophylaxis in expatriates, and the paucity of data, a study was undertaken on the use of chemoprophylaxis by expatriate employees at a mine in Mali.

Study objectives

The study was conducted to ascertain expatriate employees’ compliance with, and attitudes to chemoprophylaxis. The intention was to obtain information to assist in the control of malaria amongst expatriate employees at the mine.

Materials and methods

The study was undertaken by the occupational health service at Morila, Mali, during the dry season in 2003, a period of lowered malaria risk. Morila is an open cast gold mine 280 km south east of Bamako, the capital of Mali. A questionnaire was sent electronically to all expatriate employees at the mine. Responses for minors were completed by their parents.

Chemoprophylaxis, individually tailored, was available free of charge to all employees at the mine. Responses for minors were completed by their parents.

Chemoprophylaxis, individually tailored, was available free of charge to all employees at the mine. Chemoprophylactic agents available were mefloquine, doxycycline, atovaquone-proguanil, and chloroquine and proguanil. The latter was provided in free combination; recent work has shown this combination effective for prophylaxis in Mali.

Results

Ninety employees and dependents were polled. Sixty eight (76%) expatriates completed and returned the questionnaire. Sixty two (91%) of responses were for expatriates aged 5 years or more; 6 (9%) were aged 5 years or less. Nineteen (28%) responses were for females, 2 of whom were pregnant. Four subjects (6%) had concomitant cardiovascular disease.

Chemoprophylaxis use and compliance

Results with respect to chemoprophylaxis use patterns are presented in Table 1.

All 6 children aged less than 5 years were taking appropriate chemoprophylaxis. The reasons advanced for non-use by the 10 (15%) subjects who reported never taking chemoprophylaxis were: severe adverse effect profile of chemoprophylactic agents, 5 (7%); long term residence in Africa, 3 (4%); controversy regarding long-term chemoprophylaxis, combined with proximity to good medical care and awareness of the signs and symptoms of malaria, 2 (3%). Nineteen (28%) subjects believed that chemoprophylaxis was 100% effective in preventing clinical malaria.

The usage rates of the various chemoprophylactic agents are presented in Table 2.

Nineteen of 68 (28%) subjects were not using chemoprophylaxis at the time of this study.

Thirteen of 49 (27%) respondents admitted to missing doses of their chemoprophylaxis: this may explain why 15 of 68 (22%) respondents had suffered malaria in the past while taking chemoprophylaxis.

Although a comparison of present chemoprophylaxis choice against use in the preceding season appeared to show a shift away from mefloquine, there were no statistically significant differences when assessed as percentage of total (\(\chi^2\)). A comparison of agent use with the preceding year is shown in Table 3.

Adverse effects

No significant adverse effects were reported by any users of chemoprophylaxis. Of importance, no user stopped chemoprophylaxis as a result of any adverse effect.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Reported chemoprophylaxis use by expatriates.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemoprophylaxis use</td>
<td>Number (N = 68)</td>
</tr>
<tr>
<td>Perennial</td>
<td>49</td>
</tr>
<tr>
<td>Seasonal</td>
<td>9</td>
</tr>
<tr>
<td>Never</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Chemoprophylactic agents in use by expatriates.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemoprophylactic agent</td>
<td>Number (N = 49)</td>
</tr>
<tr>
<td>Atovaquone-proguanil</td>
<td>1</td>
</tr>
<tr>
<td>Chloroquine and proguanil</td>
<td>15</td>
</tr>
<tr>
<td>Doxycycline</td>
<td>16</td>
</tr>
<tr>
<td>Mefloquine</td>
<td>17</td>
</tr>
<tr>
<td>Homeopathic</td>
<td>0</td>
</tr>
</tbody>
</table>
48% in expatriates resident workers on a Ghanaian mine, with compliance dropping to 64% compliance with chemoprophylaxis amongst expatriate amongst expatriates in Brazzaville.4 Fegan et al. reported spraying, may be one answer to this problem. Individual compliance e.g. air conditioning, residual indoor appropriate, of vector control measures that do not require the potential for the adverse effects that chemoprophylaxis measures are appealing as they generally do not have the potential for the adverse effects that chemoprophylaxis has, there appears nevertheless to be a compliance problem amongst expatriates. The adoption, where appropriate, of vector control measures that do not require individual compliance e.g. air conditioning, residual indoor spraying, may be one answer to this problem. There have been very few studies that examined expatriate acceptance of chemoprophylaxis. Carme showed decreasing compliance with increasing length of residence amongst expatriates in Brazzaville.8 Fegan et al. reported 64% compliance with chemoprophylaxis amongst expatriate workers on a Ghanaian mine, with compliance dropping to 48% in expatriates resident ≥ 5 years.10

Table 3 Present versus past chemoprophylactic agent use by expatriates.

<table>
<thead>
<tr>
<th>Chemoprophylactic agent</th>
<th>Present use</th>
<th>Past use</th>
<th>p χ²*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atovaquone-proguanil</td>
<td>1</td>
<td>2</td>
<td>NS</td>
</tr>
<tr>
<td>Chloroquine and proguanil</td>
<td>15</td>
<td>15</td>
<td>NS</td>
</tr>
<tr>
<td>Doxycycline</td>
<td>16</td>
<td>9</td>
<td>NS</td>
</tr>
<tr>
<td>Mefloquine</td>
<td>17</td>
<td>23</td>
<td>NS</td>
</tr>
<tr>
<td>Homeopathic</td>
<td>0</td>
<td>0</td>
<td>NS</td>
</tr>
</tbody>
</table>

*NS = not significant, p > 0.05.

Table 4 Personal protection measure usage by expatriates.

<table>
<thead>
<tr>
<th>Personal protection measure</th>
<th>Users (N = 68)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insecticide treated nets</td>
<td>9 (13%)</td>
</tr>
<tr>
<td>Insect repellent application to skin</td>
<td>46 (68%)</td>
</tr>
<tr>
<td>Insecticide spraying of rooms</td>
<td>46 (68%)</td>
</tr>
<tr>
<td>Mosquito coils</td>
<td>4 (6%)</td>
</tr>
</tbody>
</table>

There has been more study of short term travellers’ attitudes and practices towards chemoprophylaxis. Schlegenhauf et al.’s study reported that 85% of short term travelers complained of symptoms they believed attributable to their use of chemoprophylaxis, despite chemoprophylaxis being as well tolerated as placebo in the run-in phase of the study.11

The compliance failure rate, self reported by respondents in this study, is likely an indication of just how difficult it is to obtain compliance with long term chemoprophylaxis. Fegan et al. even suggested abandonment of expatriate chemoprophylaxis use in favor of early treatment. Given the risks of falciparum malaria to non-immunes, total abandonment of chemoprophylaxis seems rash: a more prudent approach would be to encourage chemoprophylaxis but to recognize that compliance is problematic, and to provide rapid on site diagnosis and treatment.

The fact that the low season malaria incidence rate was not significantly different between users and non-users may call the practice of low season use into question, but is probably again an indicator of suboptimal compliance. It might be easier to obtain compliance during the high season, when malaria is more visible, than during the low season when it appears less of a threat.

Seasonal chemoprophylaxis use, although appealing to some, should only be considered when competent medical care and quality medication are available. It will not be appropriate in most circumstances for high risk individuals, such as pregnant women and children aged less than 5 years.

The use of chloroquine and proguanil was probably not a contributory factor to the malaria incidence in chemoprophylaxis users, with a recent study having shown it to be efficacious in the region if taken properly,9 although the more complicated nature of the regimen could possibly lead to higher non-compliance.

This survey of expatriate attitudes towards chemoprophylaxis exposed two erroneous and concerning views: a belief that chemoprophylaxis is 100% effective, and the view that adverse effects preclude its use. The belief that chemoprophylaxis is 100% effective may prove dangerous: individuals deluded that they cannot contract malaria may fail to report timeously for investigation and therapy. The total incidence of non-compliance will almost certainly be higher than the self-reported figure, as it will need to include inadvertent non-compliance. Inadvertent non-compliance may increase the hazard created by the belief that chemoprophylaxis is 100% effective.

The belief that chemoprophylactic adverse effects preclude their use is not evidence based, as the risk-benefit ratio in most African falciparum endemic areas clearly
favors non-immunes using chemoprophylaxis. The view that chemoprophylaxis is not sufficiently effective, or that it is associated with severe adverse events, is traditionally countered with calls for more education. For reasons not well understood, the best efforts of the medical profession to promote compliance through education are not as successful as generally hoped.\(^5\,6\) The population reported upon in this study had virtually no barriers to chemoprophylaxis, which was freely available from a dedicated on site medical service. The adoption of workplace health and safety policies promoting chemoprophylaxis use, as occurs in sectors of the oil industry, might be one way counteract this negative attitude.

Given that chemoprophylaxis and personal protection measure compliance are unlikely to ever reach 100%, except in the most strictly supervised situations, consideration should be given to several additional malaria control measures that require either no, or minimal, compliance by expatriates e.g. residual spraying, mosquito proofing of accommodation, environmental control, air conditioning, and rapid diagnosis and treatment.

While the occupational health service at Morila mine is able to provide rapid diagnosis and treatment, there are undoubtedly many expatriate situations where such treatment is not available. Practitioners preparing travelers for such expatriate postings should consider the provision of emergency stand by treatment (ESBM) for self medication.\(^6\) ESBM does not replace competent medical care, but may prove lifesaving in remote situations where competent care and appropriate medication are not readily available.

**Conclusion**

Expatriate knowledge, attitudes and practices toward malaria at a remote West African setting demonstrate that alternative or supplementary strategies to continual chemoprophylaxis may be appropriate, including the selective recommendation of seasonal chemoprophylaxis, the prompt diagnosis and treatment of malaria, and the use of emergency stand by medication. Consideration should be given to personal protection methods that are non-intrusive and which do not demand individual compliance, e.g. vector control measures such as residual indoor spraying where entomologically appropriate.

**Conflicts of interest**

ST has been reimbursed by a number of antimalarial manufacturers. He is married to a former Novartis employee who was closely associated with artesether-lumefantrine. SJ was employed at the Morila mine during the course of this study.

**References**

1. Toovey S, Jamieson A. Co-artemether has been used in ambulatory treatment of falciparum malaria. BMJ 2002; 324(7353):1585.