

# Knowledge of Malaria, Risk Perception, and Compliance with Prophylaxis and Personal and Environmental Preventive Measures in Travelers Exiting Zimbabwe from Harare and Victoria Falls International Airport

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**Background:** Travel associated malaria is a major health risk for visitors to malaria endemic destinations. To examine the knowledge of malaria prevention, risk perception, current prophylactic behavior, and compliance with chemoprophylaxis and personal and environmental protection measures we conducted a study in a cohort of travelers exiting Zimbabwe from two international airports during a peak malaria transmission period.

**Methods:** Data were collected by pretested self-administered questionnaires from 595 adults in the departure lounges of Harare and Victoria Falls International airports. Excluded were children and travelers from the African continent. A multilingual research assistant supervised data collection.

**Results:** The majority of travelers obtained health advice prior to travel. Patterns of protective behavior and compliance with prophylaxis were inconsistent with a high perception of malaria threat and good knowledge. About 23% of travelers failed to use chemoprophylaxis during their visit. In the group of travelers who used chemoprophylaxis, 18% were noncompliant. Fifteen drug combinations were in use. Full compliance with medication plus use of personal preventive measures always was estimated as 13%. Forgetfulness was the main cause of noncompliance, followed by deliberate omission due to side effects. Of 57 travelers who reported side effects from current medication, over half used mefloquine.

**Conclusions:** There is a need to examine how people process personal risk and communications about risk. We must recognize the competition between precautionary measures against malaria and other life demands that are imposed by travel, especially in young long stay travelers and persons visiting primarily for business purposes. Mediating a protective response will also depend on judgments about the effectiveness of the action, strengthening travelers' intentions toward adherence, and increasing efficacy perception by individuals and their peers. Conflicts in prophylactic recommendations need to be resolved. As ecotourism develops in Zimbabwe and other malaria regions, stakeholders in this rapidly growing industry must be made aware of the important role they can play in protecting clients from malaria.

Imported malaria is increasing in Europe and the United States.<sup>1</sup> Human migration coupled with attractive travel opportunities for visitors to malaria endemic countries contribute to this phenomenon. The potential consequence of malaria to a tourist industry of a host country can be devastating. For example, in Kenya it was estimated that a malaria fatality in a tourist and subsequent media attention led to a loss of tourism and foreign earnings of around £70 million to the economy.<sup>2</sup>

Quantifying knowledge, risk perception, and patterns of prophylactic and protective behavior in travelers are therefore important.

In Zimbabwe, the national outpatient rate for malaria is estimated to be around 160/1000 in a population of 12.5 million people.<sup>3</sup> With an increase in the number of visitors to zones of year round transmission, it is important to ascertain what travelers know about malaria prevention and how well they follow advice. The objectives of this study were to describe the characteristics of a cohort of international travelers to Zimbabwe with respect to (1) their knowledge about malaria transmission and prevention, (2) their perception of risk and seriousness of malaria threat, and (3) prophylactic behavior and compliance with personal and environmental protection measures (P&EPM).

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## Materials and Methods

### Design and Study Population

A descriptive cross sectional study design was used. The subjects comprised a multinational cohort of 595 adults of both sexes from northern European countries,

the United States, Canada, and Australia. Children under the age of 18 were excluded on the assumption that parents probably influence their health seeking behavior. The study was conducted in the departure lounges of Harare and Victoria Falls International airports during February 2000, which was a peak period of malaria transmission in Zimbabwe. Excluded, were travelers from the African continent and VIP travelers who exited through special departure lounges.

### Data Collection

Data were collected by a self-administered questionnaire in English that had 27 questions and took about 10 minutes to complete. Questions measured the demographic characteristics of the study population, travel itinerary, and purpose of visit. Travelers marked precise locations of places visited on a map. Knowledge about prophylaxis needs of children and the elderly were measured. Preventive behavior was assessed through frequency of missed prophylaxis and use of P&EPM. Risk perception was measured on a three-point scale and a question about the traveler's perception of the three most important health threats on his/her trip to Zimbabwe was asked.

A multilingual research assistant supervised data collection. The nonresponse rate was about 10% ( $n = 65$ ), with the main reason being the short transit time of some travelers. Data entry and analysis were performed using SPSS 8.0. Chi-square and logistic regression were used to measure significant differences on items that measured compliance. For this study,  $p < .05$  was considered statistically significant.

### Results

Table 1 shows the demographic characteristics of the study population. In total, 55 travelers (9%) recorded a history of malaria. Of these, less than half experienced an attack within the last 4 years.

#### Length of Stay

Table 2 shows length of stay, purpose of visit, and frequency of visits by travelers to risk and nonrisk areas. Most travelers (54%) stayed for up to 1 week; younger travelers stayed for longer periods. Females (20%,  $n = 52$ ) stayed longer ( $p < .001$ ) than males (11%,  $n = 38$ ).

#### Purpose of Visit and Sources of Health Advice Obtained Prior to Travel

In total, 157 (26%) travelers visited Zimbabwe for business purposes only; most of these were male. Overall, 389 travelers (66%) visited malaria risk areas. Younger travelers less than 30 years (77%,  $n = 105$ ) and travelers over 60 years (79%,  $n = 73$ ) were more likely ( $p < .001$ )

**Table 1** Demographic Characteristics of the Study Population

	Sex		<i>p</i> -Value
	Male	Female	
( <i>N</i> = 595)	<i>n</i> = 336	<i>n</i> = 259	
Age			
< 30	63 (19%)	73 (28%)	
30–45	116 (35%)	83 (32%)	
46–60	96 (29%)	71 (27%)	< .027
> 60	61 (18%)	32 (12%)	
Mean	43.1		
SD	14.6		
Range	18–80 years		
Ever had Malaria			
Yes	40 (12%)	15 (6%)	< .018
No	294 (88%)	240 (94%)	
Nationality			
United Kingdom	137 (41%)	101 (39%)	
Ireland	70 (21%)	52 (20%)	
North America	45 (13%)	37 (14%)	
Australia	63 (19%)	50 (19%)	
Western Europe	21 (6%)	19 (7%)	
Scandinavia			
Education			
Below university	119 (36%)	121 (48%)	
University	210 (64%)	130 (52%)	< .005

to visit malaria risk areas when compared with travelers aged between 31–60 years (58%,  $n = 211$ ). Females (75%,  $n = 192$ ) were more likely than males (59%,  $n = 197$ ) to visit malaria risk areas ( $p < .001$ ).

Most travelers (85%) obtained health advice before leaving home. However, travelers from the UK and Ireland (21%,  $n = 49$ ) were less likely ( $p = .022$ ) to obtain health advice before departure than travelers from other countries. Fewer ( $p < .001$ ) business travelers obtained health advice (27%,  $n = 42$ ) than vacation travelers (8%,  $n = 21$ ). Long stay travelers (> 4 weeks) were also less likely ( $p = .010$ ) to obtain pretravel health advice (22%,  $n = 9$ ) when compared with short stay travelers i.e., up to 1 week, (19%,  $n = 59$ ), between 1–2 weeks (8%,  $n = 12$ ), and between 2–4 weeks (10%,  $n = 9$ ). Travelers with a past history of malaria (see Table 1) were less likely ( $p = .008$ , OR:2.33, 95% Confidence Interval (CI) 1.22–4.42) to obtain pretravel advice (27%,  $n = 15$ ) when compared with travelers without a history of malaria (14%,  $n = 74$ ). Of 137 travelers who did not take malaria chemoprophylaxis during their stay in Zimbabwe, 55 (40%) also failed to seek pretravel health advice. In total, 38 (31%) travelers who failed to use P&EPM during their stay also failed to obtain pretravel advice.

#### Knowledge about Transmission

In response to the question, "In your opinion how is malaria contracted?" 465 (78%) travelers answered cor-

**Table 2** Length of Stay, Purpose of Visit, and Places Visited

Variables	Frequency	Valid Percent
Length of stay in Zimbabwe	(N = 592)	
1 week or less	317	54
8 days to 2 weeks	144	24
15 days to 4 weeks	90	15
More than 4 weeks	41	7
Purpose of visit to Zimbabwe	(N = 595)	
Study and business	157	26
Vacation	278	47
Vacation/visit friends/relatives	120	20
Combination of reasons	40	7
Places visited in Zimbabwe	(N = 589)	
No risk area	200	34
Risk area	389	66

rectly. Incorrect answers about malaria transmission included washing in water with mosquito larva ( $n = 66$ ), contact with the blood of an infected person ( $n = 51$ ), washing in stagnant water ( $n = 27$ ), and any biting insects ( $n = 24$ ). Travelers with an education below university level (see Table 1) were significantly more likely ( $p = .016$ ) to hold misconceptions about malaria transmission (26%,  $n = 63$ , OR:1.63, 95% CI 1.09–2.43) when compared with university graduates (18%,  $n = 61$ ). Of those travelers who recorded misconceptions, significantly more ( $p < .048$ , OR: 2.35, 95% CI 0.98–5.60) had no history of malaria (22%,  $n = 119$ ) when compared with travelers who had suffered malaria in the past (11%,  $n = 6$ ).

### Knowledge about Prevention

Younger travelers (<30 years) were significantly ( $p = .003$ ) less well informed about prophylaxis (47%,  $n = 47$ ) than travelers aged 46–60 (64%,  $n = 57$ ), and travelers >60 years (77%,  $n = 36$ ). On the statement “It is not necessary to take antimalarial tablets if I only stay in Zimbabwe for a week,” about 18% of travelers incorrectly agreed or somewhat agreed. On the statement “Pregnant women should take antimalarial tablets in Zimbabwe,” less than half the travelers (44%,  $n = 190$ ) agreed. Above 63% ( $n = 291$ ) agreed that children under 5 years should take antimalarials during a visit to Zimbabwe.

### Personal and Environmental Protection Measures (P&EPM)

A majority of travelers (64%,  $n = 375$ ) mentioned at least one or more correct P&EPM. Incorrect P&EPMs included bath regularly, drink purified water at all times, protect food from mosquitoes, wear strong perfume, and/or get a vaccination. University educated travelers (see Table 1) were less likely ( $p < .001$ , OR: 1.95, 95% CI 1.37–2.75) to give incorrect answers about P&EPM

(29%,  $n = 98$ ) when compared with nonuniversity educated travelers (44%,  $n = 105$ ). Further analysis showed that significantly ( $p = .016$ ) more travelers from the United Kingdom, including Ireland, gave incorrect responses (42%,  $n = 98$ ) when compared with travelers from other countries (for example, North America 40%,  $n = 48$  and Western Europe 30%,  $n = 33$ ).

### Threat and Risk Perception

On the item, “What did you consider to be the most serious health threat during your visit to Zimbabwe?” malaria was cited by over 75% of travelers, followed by traffic accidents (58%) and sunburn (37%). AIDS ranked fourth (28%). Risk perception was measured through levels of concurrence with the two statements, “I felt at risk of getting malaria in Zimbabwe” and “The risk of my becoming ill with malaria when I get home is high.” The sum score was calculated. Interestingly, 471 (81%) travelers did not perceive themselves to be at risk of malaria or becoming ill on returning home.

### Risk Perception and Preventive Behavior

Travelers who perceived themselves to be at high risk (73%,  $n = 80$ ) were more likely to be compliant with chemoprophylaxis ( $p = .027$ , OR: 1.67, 95% CI 1.05–2.64) compared with low risk perceivers (62%,  $n = 287$ ). Similarly, when we examined risk perception by compliance with P&EPM, we found that high risk perceivers were more likely ( $p = .001$ , OR: 2.39, 95% CI 1.44–3.95) to comply with P&EPM (30%,  $n = 30$ ) when compared with low risk perceivers (5%,  $n = 63$ ). Significantly ( $p = .001$ , OR: 2.49, 95% CI 1.42–4.36) more high risk perceivers (23%,  $n = 23$ ) were compliant with a combination of chemoprophylaxis and P&EPM when compared with low risk perceivers (11%,  $n = 44$ ).

### Patterns of Medication

Fifteen drug combinations were in use. In total, 137 respondents (23%) did not take chemoprophylaxis on this visit. Of those who took chemoprophylaxis, 184 (40%) used mefloquine, 111 (24%) used a combination of chloroquine and proguanil, and 37 (8%) used dapsone and pyrimethamine only. Combination regimens included doxycycline and mefloquine; chloroquine; proguanil; dapsone; pyrimethamine and mefloquine; chloroquine and dapsone; and pyrimethamine and mefloquine.

Travelers from North America, Western Europe, and Scandinavia tended to use mefloquine during their stay in Zimbabwe, whereas Australian travelers more commonly used doxycycline. Travelers from the UK and Ireland more commonly used a combined regimen of chloroquine and proguanil. Whereas 64 (11%) said they would not take any medication when next traveling to a malaria area, 419 (74%) said they would request the same

**Table 3** Compliance by Sex, Education, Past History of Malaria, Access to Health Advice Pretravel and Chemoprophylaxis Used

Variable	Compliance with Prophylaxis (n = 591)*		p-Value	Odds Ratio (95% CI)
	Compliant (%)	Noncompliant (%)		
Sex				
Male	195 (58.2)	140 (41.8)		0.62
Female	177 (69.1)	79 (30.9)	< .008	(0.43–0.89)
Education				
Below University	163 (68.2)	76 (31.8)		1.52
University	197 (58.5)	140 (41.5)	< .022	(1.06–2.19)
Ever had malaria				
Yes	15 (27.3)	40 (72.7)		0.19
No	354 (66.8)	176 (33.2)	< .001	(0.10–0.36)
Access to pretravel advice				
Yes	345 (68.7)	157 (31.3)		5.24
No	26 (29.5)	62 (70.5)	< .001	(3.11–8.87)
Chemoprophylaxis regimen				
Chloroquine	34 (85.0)	6 (15.0)		
Doxycycline	38 (79.2)	10 (20.8)		
Proguanil	12 (80.0)	3 (20.0)		
Dapsone and pyrimethamine	32 (86.5)	5 (13.5)		
Mefloquine	163 (89.6)	19 (10.4)		
Chloroquine and proguanil	75 (68.2)	35 (31.8)	< .001	

\*Study population N = 595.

CI = Confidence Interval.

prophylaxis again. Of the 57 travelers who said they would request another drug in future, 34 (62%) said this was because they had experienced side effects from their current medication. Fewer (5%, n = 30), said their decision would be situation dependent. Interestingly, among those who cited side effects, 20 (59%) took mefloquine. Nine travelers cited a preference for weekly rather than daily medication.

### Compliance

Table 3 shows compliance by sex, education, history of malaria, access to health advice pretravel, and chemoprophylaxis used. Full compliance, i.e., regular medication with no missed doses plus use of P&EPM always, was estimated to be 13% (n = 67).

### Compliance with Medication

The majority of travelers (63%, n = 372) reported full compliance with prescribed regimens of medication. However, mefloquine users (90%, n = 164) were more likely (p < .001) to be compliant when compared with users of other drug combinations, for example, chloroquine and proguanil (68%, n = 75). In total 81 (18%) users were noncompliant with chemoprophylaxis and of those, 37 (46%) reported missing one dose, 30 (37%) missed the dose twice, with the remainder “missing frequently.” Slightly over half the travelers who missed a dose

took the normal dose as soon as they remembered. Thirty-three travelers (40%) waited until the day that the next dose was due, and 6 (8%) took a double dose as soon as they remembered. Forgetfulness was the main cause (63%, n = 51) of missing a dose, with 8 (10%) citing deliberate omission due to side effects, or a perception that the drug was unnecessary (8%, n = 6).

### Compliance with P&EPM

In total 476 (80%) travelers reported “some” use of P&EPM, with around 81 (17%) reporting “always.” Females (22%, n = 51) were found to be significantly more compliant (p < .026, OR: 1.67, 95% CI 1.05–2.60) than males (14%, n = 42). Long stay travelers (more than 4 weeks) were less likely (p < .030) to be compliant (30%, n = 11) than short stay travelers (11%, n = 15).

### Discussion

Our study shows that in a cohort of international travelers exiting Zimbabwe after varying lengths of stay, a high percentage of visitors travel to areas that have some risk for malaria. Most travelers draw on health advice prior to departure from their country of origin. Age and education positively predicted knowledge about malaria transmission, which was good overall. Malaria was perceived as an important health threat by the majority of

travelers. Surprisingly however, in our cohort, patterns of protective behavior and compliance with prophylaxis were inconsistent with high perceptions of malaria threat and good knowledge. On the contrary, we found that while full compliance in users of chemoprophylaxis, with the best adherence in mefloquine users, was 63%, full compliance with P&EPM was only 17%. Attention is also drawn to the low percentage of travelers (13%) who reported full compliance with chemoprophylaxis and anti-mosquito precautions.

Our findings concur with those of previous studies which report problems of incomplete and no prophylaxis and varying adherence to personal protection measures.<sup>4-7</sup> Many explanations have been advanced for nonprotective action.<sup>6-9</sup> These include past dosing frequency,<sup>6,8</sup> adverse drug reactions,<sup>7-13</sup> multiple prescribing and confusion about recommendations,<sup>12</sup> predisposition such as age,<sup>11</sup> level of education,<sup>14</sup> past travel experience,<sup>12</sup> and low risk appraisal. Understandably, many of these observations have led to conclusions which frequently call for an improvement in the quality of information about malaria prevention.

Although malaria prevention may appear to be mostly a matter of educating travelers,<sup>7</sup> we concur with the position that information in itself is unlikely to initiate protective behavior. Recent studies<sup>6,15</sup> indicate for example, that in addition to a trusted source of understandable information, mediating a protective response will also depend on (1) judgments about the effectiveness of the action, (2) strengthening travelers' intentions toward adherence, and (3) increasing efficacy perception by individuals and their peers

This leads us to suggest that if in the past, increasing knowledge was the issue in malaria prevention, we now need to accelerate its dissemination and place it more strategically in our target population. Additionally, we need to examine how people process personal risk<sup>16</sup> and communications about risk. We also recognize the competition between precautionary measures against malaria and other life demands that are imposed by travel, especially in young long stay travelers and persons visiting primarily for business purposes. Strong, valid arguments that support recommended protective action during travel and sustained adherence on return must be made. Conflicts in prophylactic recommendations need to be resolved. An evidence-based approach should be used to dispell myths and perceptions about drug side effects and every effort must be made to enhance perceived control over all forms of prophylaxis.

One way is to improve the consistency of national recommendations. The next is to ensure that the quality and content of pretravel advice is reliable, persuasive and comprehensible. Access to information through

interactive media must be improved. As ecotourism develops in Zimbabwe and other malaria regions, stakeholders in this rapidly growing industry must also be made aware of their role in protecting their clients from malaria.

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Petrol lamps on the main market in Sao Tome. Submitted by Danielle Gyurech, MD and Julian Schilling, MD.