Survey of use of malaria prevention measures by Canadians visiting India

Evidence

Études

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Abstract

Background: Imported malaria is an increasing problem, particularly among new immigrant populations. The objective of this study was to determine the malaria prevention measures used by Canadians originating from a malaria-endemic area when returning to visit their country of origin.

Methods: A 35-item English-language questionnaire was administered by interview to travellers at a departure lounge at Pearson International Airport, Toronto, between January and June 1995. Information was collected on subject characteristics, travel itinerary, perceptions about malaria, and pretravel health advice and malaria chemoprophylaxis and barriers to their use.

Results: A total of 324 travellers departing on flights to India were approached, of whom 307 (95%) agreed to participate in the study. Participants were Canadian residents of south Asian origin with a mean duration of residence in Canada of 12.8 years. Most of the respondents were returning to visit relatives for a mean visit duration of 6.8 weeks. Although 69% of the respondents thought malaria was a moderate to severe illness and 54% had sought advice before travelling, only 31% intended to use any chemoprophylaxis, and less than 10% were using measures to prevent mosquito bites. Only 7% had been prescribed a recommended drug regimen. Family practitioners were the primary source of information for travellers and were more likely to prescribe an inappropriate chemoprophylactic regimen than were travel clinics or public health centres (76% v. 36%) ($p = 0.003$). Respondents who had lived in Canada longest and those with a family history of malaria were more likely to use chemoprophylaxis ($p < 0.01$).

Interpretation: Few travellers were using appropriate chemoprophylaxis and mosquito prevention measures. Misconceptions about malaria risk and appropriate prevention measures were the main barriers identified.

Résumé

Contexte : Le paludisme importé est un problème croissant, surtout chez les nouveaux immigrants. Cette étude visait à déterminer les mesures de prévention du paludisme qu'utilisent les Canadiens originaires d'une région où le paludisme est endémique lorsqu'ils retournent en visite dans leur pays d'origine.

Méthodes : Un questionnaire de 35 questions en anglais a été administré au moyen d'entrevues réalisées auprès de voyageurs dans un salon de départ à l'Aéroport international Pearson, à Toronto, entre janvier et juin 1995. On a recueilli des renseignements sur les caractéristiques du sujet, son itinéraire de voyage, sa façon de percevoir le paludisme, les conseils sur la santé avant le voyage, la chimioprophylaxie contre le paludisme et les obstacles à son utilisation.

Résultats : Au total, on a abordé 324 voyageurs qui partaient pour l'Inde, dont 307 (95 %) ont consenti à participer à l'étude. Les participants d'origine sud-asiatique étaient résidents du Canada depuis 12,8 ans en moyenne. La plupart des répondants retournaient visiter des membres de leur famille pendant 6,8 semaines en moyenne. Même si 69 % des répondants considéraient le paludisme comme une maladie de gravité moyenne à sérieuse et que 54 % avaient consulté avant de voyager, 31 % seulement avaient l'intention d'utiliser une chimioprophylaxie et

moins de 10 % utilisaient des mesures de prévention des piqûres de moustiques. Seulement 7 % s'étaient vu prescrire une pharmacothérapie recommandée. Les médecins de famille étaient les principales sources d'information des voyageurs et étaient plus susceptibles de prescrire un régime chimioprophylatique inadéquat que les cliniques de voyageurs ou les centres de santé publique (76 % c. 36 %) (p = 0,003). Les répondants qui vivaient au Canada depuis plus longtemps et ceux qui avaient des antécédents familiaux de paludisme étaient plus susceptibles d'utiliser une chimioprophylaxie ($p < 0,01$).

Interprétation : Peu de voyageurs utilisaient une chimioprophylaxie et des mesures de prévention des piqûres de moustiques appropriées. Les principaux obstacles cernés étaient les conceptions erronées au sujet du risque posé par le paludisme et des mesures de prévention appropriées.

Malaria is the most important parasitic disease in the world, accounting for an estimated 300 million new cases and 2 million deaths annually.[1–3] There has been a global resurgence of malaria, attributable in large part to the development and spread of drug-resistant *Plasmodium falciparum* parasites.[1–8] According to the World Tourism Organisation, an estimated 40 million people visit malaria-endemic areas from nontropical countries each year,[2,9] and as many as 30 000 of these travellers will contract malaria,[2,10] with an increasing number acquiring drug-resistant infections.[2,8,11–17] Preventing malaria-associated illness and death among travellers requires measures to prevent mosquito bites and effective chemoprophylaxis for high-risk travellers.[12–17]

Canada has a high rate of imported malaria. In 1997, 1036 cases were reported in this country, an increase of 141% from the 430 cases seen in 1994.[18] The reported rate of malaria in Canada is now 5 to 10 times the reported per-capita rate in the United States.[19] Moreover, the number of cases reported annually to health authorities is likely an underestimate because of underreporting.[20–23] Previous studies indicate that people from malaria-endemic areas now living abroad are more likely to contract malaria when they travel than are other travellers. [18,24–28] These populations may not perceive themselves at risk and, as such, do not seek medical advice before travelling or do not comply with such advice.[29–33] Accordingly, they tend to account for most cases of imported malaria.[24,26–28,30–33] Recent studies indicate that immigrant populations account for 50% to 88% of all cases of imported malaria in Canada.[12,34]

People originally from the Indian subcontinent constitute one of the largest ethnic groups in Canada. In 1996 there were 420 295 people of south Asian origin living in Canada, of whom about 30 000 return to visit south Asia annually (Immigration Canada;[35] Ethnocultural Data Base Office, Ministry of Citizenship, Publications Ontario). According to Health Canada's Committee to Advise on Tropical Medicine and Travel, the World Health Organization (WHO) and the US Centers for Disease Control and Prevention, the risk of chloroquine-resistant malaria in India is year round in both rural and urban areas.[6,21,36] In Canadian studies 30% to 80% of cases of imported malaria were acquired by travellers to India.[12,34]

Numerous studies have shown that the appropriate use of chemoprophylactic agents is effective in preventing malaria.[5,11,15–17,21,25] However, in a recent study in Toronto, 97% of subjects who contracted malaria had used either inadequate or no chemoprophylaxis.[12] The reasons why immigrant populations fail to comply with standard recommendations to prevent malaria have not been carefully evaluated. We performed a study to determine the extent of pretravel health advice and use of chemoprophylaxis among Canadians originating from a malaria-endemic area who were visiting India.

Methods

Canadian travellers departing for India on regularly scheduled flights from Pearson International Airport, Toronto, between January and June 1995 were eligible for inclusion in the study. Flight selection was determined by authorization from specific airline companies, passenger distribution and convenience. Approximately every third adult traveller waiting to embark on a flight to India was asked to complete a 5- to 10-minute English-language questionnaire administered by 1 of 2 investigators (C.C.D.S. or A.A.). In cases in which the traveller approached was not eligible to answer the questionnaire (not a resident of Canada or under age 16 years), the subsequent traveller was approached. Arrangements were made with several airlines so that the questionnaire could be administered in the departure lounge. Travellers were first asked about their residency status, and only Canadian residents and citizens were included. Passengers were read each question in the questionnaire. When necessary, interpretative services were obtained. No compensation was offered to participants.

The questionnaire was based on a survey that had been previously validated and shown to be reproducible in travellers.[17,33] The questionnaire was updated and modified slightly to include new antimalarial drug regimens and to reword questions for departing travellers instead of returning trav-

ellers. It was pretested among 50 randomly selected subjects to ensure that the questions elicited appropriate responses.

Travellers were interviewed immediately before their departure in order to determine more accurately actual travel practices and pretravel preparation. The questionnaire consisted of 35 multiple-choice and short-answer questions divided into 4 sections: subject characteristics, travel itinerary, perceptions about malaria, and pretravel health advice and chemoprophylaxis and barriers to their use. Information about the subjects included age, sex, birthplace, employment status and education. Travel information included final destination, rural or urban travel, purpose of travel, duration of travel, number of previous trips and type of accommodation. Perceptions about malaria included questions about past medical history and family history of malaria, general knowledge of malaria, perception of the severity of malaria, perceived risk of malaria at the final destination and effective methods of preventing malaria. The section on pretravel health advice and chemoprophylaxis included questions about sources of pretravel health information, use of malaria chemoprophylaxis and intended use of personal protection measures against mosquito bites, and barriers to obtaining pretravel advice and to using chemoprophylaxis.

The travel destination was classified according to the risk for malaria. High-risk areas included Orissa, Maharashtra (Bombay), Andhra Pradesh, Gujarat, Rajasthan, Bihar, Assam and Madhya Pradesh; moderate-risk areas included Punjab, Delhi, Haryana, Karnataka (Bangalore), West Bengal (Calcutta), Tamil Nadu (Madras) and Uttar Pradesh; and low-risk areas included Kerala (Trivandrum), Jammu and Kashmir, Goa, Arunachal Pradesh, Himachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, Andaman and Nicobar Islands, Chandigarh, Dadra and Nagar Haveli, Daman and Diu, Lakshadweep, Pondicherry and Coaldfields (Dr. V.S. Orlov, Senior Regional Advisor, WHO Regional Office for South East Asia, World Health House, New Delhi: personal communication, 1997).

This project underwent ethical review by the Toronto Hospital, and the questionnaire was reviewed for content, style and validity by the Centre for Bioethics at Sunnybrook Health Science Centre, Toronto.[37,38] (A copy of the questionnaire is available from us on request.)

The questionnaire responses were entered into a standardized database and analysed. We performed statistical analysis using Statistix software (version 3.1, NH Analytical Software, Tallahassee, Fla.). The data were analysed by means of the χ^2 test with Yates' correction for discrete variables and the Mann–Whitney rank-sum test (2-tailed) for continuous variables.

Results

Of the 927 passengers boarding 14 flights to Bombay or New Delhi, 324 (35%) were asked to participate in the study. This study population represented approximately 10% of all Canadians of south Asian origin flying from Toronto to India during the study period. Of the 324 travellers 307 completed the questionnaire, for a response rate of 95%. The main reason provided by the 17 people who refused to participate was late arrival at the departure gate (16 [94%]).

The respondents were Canadian citizens or landed immigrants who originated primarily from India (272/307 [89%]) or Africa (15/307 [5%]). They had resided in Canada for a mean of 12.8 years (95% confidence interval [CI] 11.8 to 13.8 years). The mean age was 41.1 (95% CI 39.4 to 42.8) years, and the male:female ratio was 1:1.1. The average traveller was well educated, 91% (275/302) having completed at least secondary school and 65% (196/302) having a university degree. A total of 84% (259/307) were fluent in English.

Twenty-five percent of the respondents (70/283) planned to visit an area defined by the WHO as high risk for malaria, and 69% (195/283) planned to visit an area with moderate risk (Table 1). The average length of stay was 6.8 (95% CI 6.1 to 7.5) weeks. Most of the respondents (87% [266/307]) were going to visit family. Overall, 95% (292/307) were going to stay in a private residence, in either a city (69% [212/307]) or a town (25% [77/307]); only 6% (18/307) intended to visit a rural area.

Most of the respondents believed they would be at no risk for malaria exposure (41% [126/307]) or were unaware of the risk (23% [70/307]); 27% (83/307) felt they would be at definite risk for contracting malaria, and 9% (28/307) believed that the risk was seasonal. Overall, 69% (212/307) thought that malaria was a moderate to serious disease, and 6% (17/307) recognized that the severity depended on the type of malaria. One-third of the respondents reported that they (16% [50/307]) or a family member (18% [55/307]) had contracted malaria in the past.

Overall, 54% (167/307) of the respondents had obtained medical advice before travelling, of whom 70% (117) had consulted their family physician; other reported sources of advice were travel clinics (11% [19]), public health offices (11% [18]), travel agents (3% [5]), the media (2% [3]), infectious disease specialists (1% [2]) and other sources (2% [3]). The 140 travellers who did not obtain pretravel advice indicated that they had not done so be-

Table 1: Destination of Canadians travelling to India, by malaria risk

Travel destination*	No. (and %) of respondents†
High-risk area	70
Moderate-risk area	195
Low-risk area	18
Total	283

*See the Methods for specific locations by risk category.
†The number of respondents does not total 307 because some were not sure of their final destination and some were visiting more than one area.

cause they knew enough about malaria to protect themselves (31% [43]), were unaware of the need for malaria precautions or advice (19% [26]), believed they were at no or minimal risk (16% [23]), had insufficient time to seek advice before departure (10% [14]), assumed they had immunity to malaria (8% [11]), were unsure where to obtain advice (4% [5]) or planned to obtain advice in India (1% [2]), or gave some other reason (11% [16]).

Overall, 31% (94/307) of the respondents intended to use malaria chemoprophylaxis while in India. Among those using prophylaxis, chloroquine was the drug most commonly prescribed (41% [39]); the next most commonly prescribed drugs were mefloquine (20% [19]), doxycycline (3% [3]) and sulfadoxine–pyrimethamine (1% [1]); 30% (28) did not know what drug(s) they were taking. The types of malaria chemoprophylaxis prescribed by travel clinics or public health offices and by general practitioners differed. The latter were more likely to prescribe chloroquine than were travel clinics or public health centres (76% v. 36%) ($p = 0.003$) and were less likely to prescribe mefloquine (18% v. 46%) ($p = 0.03$). Of note, 6 (4%) of the 140 respondents who did not seek advice before travelling were taking an antimalarial agent, either from a previous trip or acquired abroad.

Of the 213 respondents who did not intend to use chemoprophylaxis, 34% (72) believed they were not at risk for contracting malaria, 17% (36) were unaware that precautions were needed, 14% (30) thought they were immune to malaria, and 2% (4) stated that they had been "vaccinated" against malaria. Twelve percent (26) stated that they were going to obtain antimalarial drugs once in India. Few people reported problems with the drugs themselves as a barrier to chemoprophylaxis use: 3% (7) said the drugs were ineffective, 1% (3) were concerned about side effects, and one person (0.5%) reported that the drugs were too expensive.

Less than 10% of the 307 respondents indicated any intention to use at least 2 of the common measures recommended to prevent mosquito bites (e.g., bed nets, insect repellents, long-sleeved clothing and reduced evening outdoor activity). Respondents who sought advice before travelling were no more likely than other travellers to use these measures.

Sex, country of birth, planned accommodation, proficiency in English, education and occupation were not associated with increased use of pretravel advice or chemoprophylaxis. Although the risk for contracting malaria increases during and shortly after the monsoon season in India (June to October),[22,23,39–41] the proportion of respondents who sought advice before travelling or who were using antimalarials did not vary over the study period, which included the beginning of the monsoon period.

Respondents who went to visit family or who perceived malaria as a moderate to serious illness were more likely to seek advice before travelling than were business travellers and those who perceived malaria as a less severe illness (Table 2). People who obtained advice before travelling were more likely than other travellers to take trips of shorter duration (mean duration 6.3 v. 7.5 weeks) ($p = 0.002$).

Factors associated with increased use of chemoprophylaxis were a family history of malaria (Table 2), increased age (mean age 44.4 years v. 39.7 years for nonusers) ($p = 0.005$) and a longer duration of residence in Canada: 58% (42/73) of the respondents who had lived in Canada for

Table 2: Factors associated with the use of pretravel advice and malaria chemoprophylaxis among the 307 respondents

Factor	No. (and %) of respondents*		
	Total *n = 307*	Obtained pretravel advice	Intended to use chemoprophylaxis
Purpose of trip			
Visit relatives	266 (87)	153 (58)†	86 (32)
Other	41 (13)	14 (34)†	8 (20)
Perceived malaria exposure risk			
Yes	83 (27)	52 (63)	32 (39)
No/unsure	224 (73)	115 (51)	62 (28)
Perceived severity of malaria			
Moderate to serious	212 (69)	124 (58)‡	69 (33)
Mild/unsure	95 (31)	43 (45)‡	25 (26)
Family history of malaria			
Yes	55 (18)	26 (47)	26 (47)†
No	252 (82)	141 (56)	68 (27)†

*Percentages in the first data column relate to the total population of 307 respondents. Percentages in each row of the second and third data columns relate to the value in the first data column in that row. For example, 266 (87%) of the 307 respondents were travelling to visit relatives; of these, 153 (58%) obtained pretravel advice and 86 (32%) were intending to use chemoprophylaxis.
†$p \leq 0.009$, for specific population attribute and use of pretravel advice or chemoprophylaxis.
‡$p \leq 0.05$ for specific population attribute and use of pretravel advice.

more than 20 years intended to use chemoprophylaxis, as compared with 22% (52/234) of those who had immigrated more recently ($p < 0.001$).

Interpretation

To our knowledge, the present study is the first to describe the use and barriers to use of pretravel advice and chemoprophylaxis by Canadians originating from a malaria-endemic area before they visit their country of origin.

We believe that the design of our study — random interviews of travellers in an airport departure lounge — provides a more accurate assessment of actual travel practices than that of surveys in travel clinics or the community. Potential limitations to our study include the fact that most of the passengers arrived 30 to 60 minutes before boarding, which limited the time available to administer the questionnaires and tended to exclude people who arrived immediately before boarding.

Falciparum malaria attack rates among travellers to India vary significantly between people who are returning to visit friends and family (331 per 100 000) and business travellers (38 per 100 000).[28] Several studies indicate that travellers returning to their country of origin may be more likely to acquire malaria than local inhabitants and tourists because they are more unaware of their susceptibility, are less informed about the need to obtain advice before travelling, visit malarious areas for longer periods and adopt higher-risk behaviours.[7,13,16,21,25–29] Furthermore, the risk may be escalating as the malaria situation in India deteriorates.[1,22,23,39–43] The proportion of cases caused by *P. falciparum* reached a peak of 43% in 1993, up from about 5% in the 1970s.[1,22,23,40–43]

Nine states in India account for 84% of reported malaria cases in that country: Orissa, Gujarat, Madhya Pradesh, Maharashtra, Karnataka, Tamil Nadu, Assam, Uttar Pradesh and Rajasthan.[22,23] About one-third of our respondents were planning to visit one of these areas. Moreover, urban malaria has become an important problem in India.[44,45] Nearly 80% of the reported malaria cases in a recent urban survey occurred in the following cities: Bombay, New Delhi, Calcutta, Madras, Bangalore, Ahmedabad, Kanpur, Hyderabad and Jaipur.[22] About 60% of our respondents indicated that they would visit at least one of these centres.

Obtaining medical advice before travelling is an important determinant of appropriate antimalarial use.[5,15,17,25,28–30,32] In our study 54% of the respondents sought pretravel advice. This rate is lower than that reported from the United States and Britain (80% to 95%).[15,24–26,29,30,32] However, those study populations are not comparable to ours since they consisted of tourists, not immigrants returning to visit their country of origin.

In our study most (95%) of the respondents who intended to use antimalarial drugs sought advice before travelling. However, the converse was not true: of the people who sought advice, nearly half (47%) did not intend to use chemoprophylaxis. Of those who did intend to use antimalarial drugs, only 24% had been prescribed a drug regimen recommended by Health Canada's Committee to Advise on Tropical Medicine and Travel, the US Centers for Disease Control and Prevention or WHO.[6,21,36] Family physicians were the primary source of information for most travellers (70%) and were more likely than travel clinics or public health centres to prescribe an inappropriate drug regimen.

In summary, the situation for malaria prevention in Canadian travellers does not seem to have improved since the last survey published in *CMAJ* 20 years ago.[46] At that time a Canadian traveller had little better than a 50–50 chance of getting accurate information on what preventive measures to take. Our results show that, although over 50% of people returning to visit India sought advice before travelling, only 7% were taking a recommended drug regimen and less than 10% were using measures to prevent insect bites. Educational measures should be targeted at Canadians originating from malaria-endemic areas who return to visit their country of origin. Physicians who advise these travellers must more effectively communicate ways to prevent infection. As drug-resistant malaria continues to evolve and spread, accurate advice will become increasingly important to prevent malaria-associated sickness and death among Canadians.[47]

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The order of the first two authors was decided by the toss of a coin.

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