



## BRIEF COMMUNICATION

## Cluster of Imported Vivax Malaria in Travelers Returning From Peru

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We report a cluster of imported vivax malaria in three of five Chilean travelers returning from Peru in March 2015. The cluster highlights the high risk of malaria in the Loreto region in northern Peru, which includes popular destinations for international nature and adventure tourism. According to local surveillance data, *Plasmodium vivax* is predominating, but *Plasmodium falciparum* is also present, and the incidence of both species has increased during recent years. Travelers visiting this region should be counseled about the prevention of malaria and the options for chemoprophylaxis.

Travel-associated malaria usually occurs as single sporadic cases in travelers returning from endemic areas. Most imported malaria cases are diagnosed in travelers returning from sub-Saharan Africa and the predominating species is *Plasmodium falciparum*.<sup>1,2</sup> Imported malaria affecting various members of a travel group has occasionally been reported from high-risk areas in Africa. In regions with lower risk, clusters in travelers might serve as a surveillance tool for changes in the local epidemiology, indicating an increased risk for tourists and the local population.<sup>3</sup> Here we report a cluster of malaria caused by *Plasmodium vivax* in a group of Chilean travelers returning from northern Peru.

### The Cases

In March 2015, five Chilean backpackers, all aged 21 to 22 years, returned to Santiago after a 5-week trip to northern Peru. Within the first week of their return, two group members presented with high fever and chills accompanied by malaise, headache, and myalgia. Two

weeks later, a third traveler presented with similar symptoms. All three were diagnosed with *P. vivax* malaria by microscopical examination of thin and thick blood films, which was later further confirmed by molecular methods (such as polymerase chain reaction) in the national reference laboratory (Instituto de Salud Pública, Santiago, Chile). Two patients had grade 3 thrombocytopenia (platelet counts of 37,000/ $\mu$ L and 30,000/ $\mu$ L) and all were initially hospitalized in three different health centers. Two patients were treated with atovaquone-proguanil (Malarone) and one with chloroquine; all recuperated without complications. Parasitological follow-up during and after treatment revealed an adequate clearance of blood parasites. Patients were tested for glucose-6-phosphate dehydrogenase (G6PD) deficiency before receiving a 2-week course of primaquine (30 mg once daily) to avoid recurrence of vivax malaria. The two remaining asymptomatic travelers were contacted to inform them on the risks and symptoms of malaria. One of them responded and agreed to receive preemptive therapy with primaquine after exclusion of G6PD deficiency.

During the 5 weeks in Peru, the group had mainly stayed in the Loreto region in a little village 25 km southwest of Iquitos called Nina Rumi located on the banks of the Nanay River (Figure 1). The travelers slept in tents and hostels using few antimosquito measures such as repellents and mosquito nets. Daily activities

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included hiking, canoeing, bathing in river ponds, and daytrips to nearby national parks. At the end of their trip, the group traveled by boat about 100 km down the Marañón River to Nauta, then to Yurimaguas and to Chiclayo before returning by plane from Lima to Chile. All members of the group were vaccinated against yellow fever, but none used malaria chemoprophylaxis or had received pre-travel advice on malaria prevention and other travel vaccinations.

## Discussion

Iquitos is located in the rainforest of northern Peru. It is the capital of the Loreto region and represents the largest city worldwide that is not accessible by land. A growing number of tourists—in 2014, more than 220,000—arrive at Iquitos by air or by river. The malaria risk in the urban areas of Iquitos is considered to be low. Still, for most tourists, the city serves as a starting point for a variety of jungle activities and many lodges located within the jungle offer transfer and housing. In a survey published by the Peruvian Ministry of Foreign Trade and Tourism, the main reasons for travelers to visit the region were cultural experiences (99%), nature activities (91%), and adventure (77%). Frequent activities were visits to native communities (67%) and national parks (83%), boat trips (42%), trekking (26%), and camping (9%).<sup>4</sup> More and more tourists are also interested in alternative medicine and spiritual experiences that bring them into contact with the populations living outside Iquitos. According to data from 2014, 94% of all malaria cases in Peru occurred in the Loreto region and approximately 80% of those were caused by *P. vivax*. In contrast with other regions in Peru, incidence rates have increased significantly over the last year.<sup>5</sup>

Clusters of imported malaria have previously been reported. Most of them affected travelers to sub-Saharan Africa with a high risk for *P. falciparum* transmission and were associated with noncompliance or ignorance regarding the use of malaria chemoprophylaxis.<sup>6–12</sup> In other regions, clusters in travelers have served as a surveillance tool to indicate increased risks of malaria transmission, eg, in 1999, when several European tourists acquired falciparum malaria in the Dominican Republic.<sup>13</sup> To report such clusters is important in order to notice local changes of epidemiology and to modify travel recommendations.<sup>3</sup> To our knowledge, this is the first cluster reported in travelers to endemic regions in South America and only the second cluster in travelers caused by *P. vivax*.<sup>11</sup>

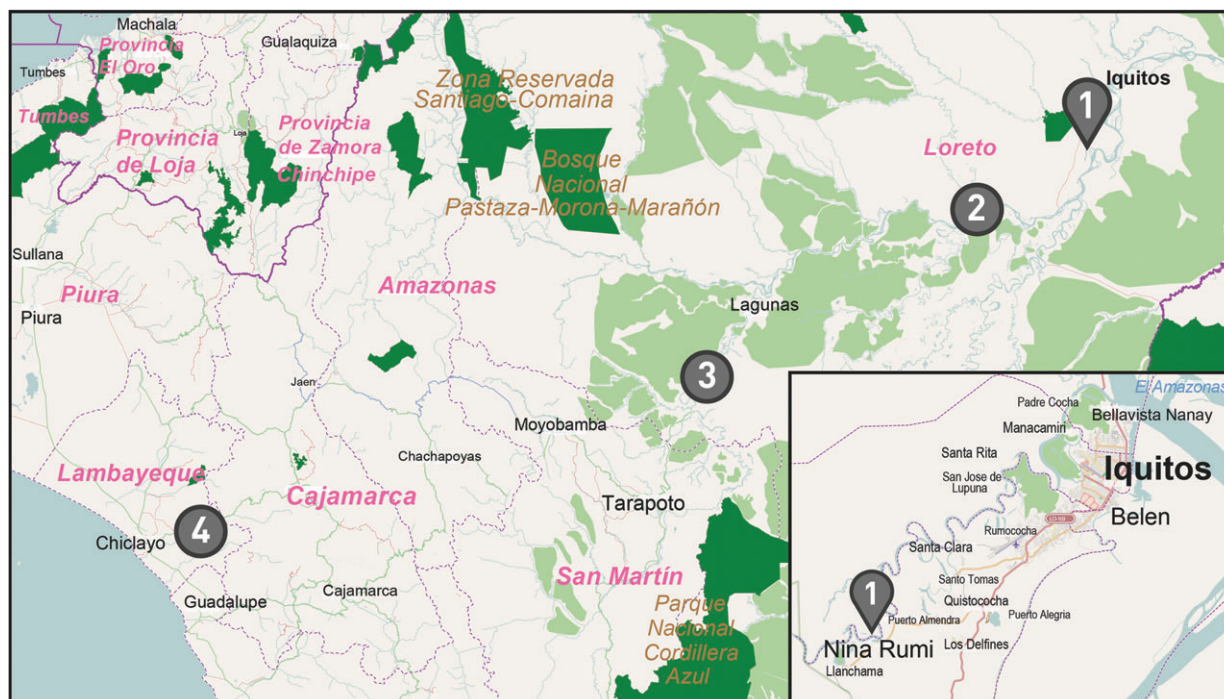
Clusters and case series are not able to provide exact epidemiological data. Still, we believe that the attack rate of 60% in our group of travelers indicates that currently there is a very high risk of vivax malaria in the Loreto region in northern Peru, most probably in the vicinity of Iquitos, where the group stayed most of their time. This finding is in accordance with recent epidemiological data of this region. Surveillance

data of cases within the local population from 2013 and 2014 showed API (annual parasite incidence per 1,000 inhabitants) rates >10 for *P. vivax* and *P. falciparum* in many districts from Loreto, including the San Juan Bautista district visited by our travelers.<sup>5</sup> More recent data from the regional health authorities (Dirección de Epidemiología, DIRESA Loreto) demonstrate that during the first 3 months of 2015, the numbers of malaria cases in Loreto stayed above the alarm threshold, that *P. vivax* predominated, and that the San Juan Bautista district had the highest number of vivax cases ([www.diresaloreto.gob.pe](http://www.diresaloreto.gob.pe)). Reasons for the increased malaria cases in this region might include climatic changes with increasing amounts of precipitation and flooding. Another factor might be the growing number of fish ponds (pisciculture), which have been associated with malaria cases in the Loreto Amazon region<sup>14</sup>; many of these fish ponds exist in the vicinity of the village visited by our travelers (Martín Casapía, June 2015, personal communication). Furthermore, a study carried out in the same district proved that surveillance data based on passive case detection might underestimate the true incidence of both malaria species.<sup>15</sup>

Although malaria clusters might occur in relation to a single high-exposure incident, eg, infection by a single mosquito while sleeping under the same bed net,<sup>6</sup> this seems improbable in our group of travelers, since mosquito prevention measures were not consistently used and exposure was therefore high.

Malaria prevention for travelers includes protection against mosquito bites and chemoprophylaxis. The latter mainly targets *P. falciparum* and is used in regions of high risk, eg, for trips to areas with API rates >10, as recommended by a recent risk analysis.<sup>16</sup> As the malaria risk in most tourist destinations in Latin America is low, the usefulness of chemoprophylaxis is controversial.<sup>17–20</sup> Furthermore, there is no international consensus on chemoprophylaxis targeting *P. vivax*, which is predominating in most regions in South America. For this species, the commonly used drugs for malaria chemoprophylaxis (except primaquine) only prevent the primary attack, but not its characteristic relapses caused by dormant liver forms (hypozoites). Vivax malaria was traditionally considered to be harmless, but there are increasing reports on complications and severe manifestations caused by this species.<sup>21</sup> Therefore, the Centers for Disease Control and Prevention promotes the prophylactic use of primaquine in regions of *P. vivax* predominance,<sup>22</sup> but this strategy is not supported by other international guidelines or by the World Health Organization.<sup>19</sup>

The Loreto region in northern Peru is a destination of increasing popularity among international travelers. Most of those visits include Iquitos and its vicinity. As shown above, *P. vivax* is predominating in this area, but there is also a relevant risk of *P. falciparum*. For Chilean travelers staying overnight in areas surrounding Iquitos, we usually recommend the use of Malarone chemoprophylaxis, for its convenience. As this drug



**Figure 1** A map showing the itinerary of the travelers, who were involved in the cluster of vivax malaria. For the majority of their time, the group stayed in the vicinity of Iquitos in a small village called Nina Rumi (1). Then they traveled down the Marañón River to Nauta (2), then to Yurimaguas (3), and to Chiclayo (4) before returning to Chile (Source: OpenStreetMap®, www.openstreetmap.org).

does not prevent recurrent attacks of vivax malaria, all travelers should be informed about the possibility of late attacks. Terminal prophylaxis or post-travel preemptive therapy with primaquine is recommended on an individual basis considering several aspects such as duration, conditions of travel, exact geographical location, or—as in our cases—infections within the same group of travelers, especially if the travelers at risk return to countries with limited facilities of malaria diagnosis and treatment. Our report also demonstrates that South American travelers are often not aware of the necessity of pre-travel advice, especially in countries such as Chile, where Travel Medicine is a relatively young discipline.

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### Declaration of Interests

The authors state that they have no conflicts of interest to declare.

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