

Malaria from monkeys now dominant cause of human malaria hospitalizations in Malaysia

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The majority of malaria hospitalizations in Malaysia are now caused by a dangerous and potentially deadly monkey-borne parasite once rarely seen in humans, and deforestation is the potential culprit in a growing number of infections that could allow this virulent malaria strain to jump from macaque monkeys to human hosts, according to research presented today at the American Society of Tropical Medicine and Hygiene (ASTMH) Annual Meeting.

An analysis of [malaria](#) patients hospitalized in Malaysian Borneo in 2013 showed that 68 percent had been sickened by *Plasmodium knowlesi*, said Balbir Singh, PhD, director of the Malaria Research Center at the University of Malaysia in Sarawak. The parasite is increasingly associated with malaria deaths and is three times more frequent as a cause of [severe malaria](#) in Borneo than the more common *P. falciparum* parasite that is currently considered the world's most deadly form of the disease.

The main host of knowlesi malaria has been the long-tailed and pig-tailed macaques found in the tropical forests of Malaysia and elsewhere in Southeast Asia. The infections are concentrated in areas of Malaysia where over the last decade massive loss of native forest to timber and palm oil production has led to substantially increased human interactions with macaques. That puts knowlesi malaria in the company of a growing list of dangerous emerging and re-emerging diseases—including Ebola

and AIDS—that are being passed from animals to humans as development peels back more and more layers of tropical forest previously uninhabited by humans.

"This is a form of malaria that was once rarely seen in people, but today, in some remote areas of the country, all of the indigenous malaria cases we are seeing are caused by the *P. knowlesi* parasite," Singh said. "If the number of cases continue to increase, human-to-human transmission by mosquitoes becomes possible. In fact, this may already have happened, which would allow *P. knowlesi* malaria to spread more easily throughout Southeast Asia."

Evidence to date has strongly suggested that victims of *P. knowlesi* malaria have been bitten by mosquitoes that had first bitten an infected macaque, making humans a dead-end host for the parasite. Of concern, however, is recent research that the parasite could change so that it can jump from person to person via mosquito bites, without requiring a monkey as part of its life cycle. Laboratory tests in the 1960s indicated that a mosquito variety in Malaysian Borneo that carries the two most common human malaria parasites—*P. falciparum* and *P. vivax*—also can spread the knowlesi parasite. Moreover, *P. knowlesi* was recently found in Vietnam in mosquitoes that transmit falciparum and vivax malaria, raising the possibility that human-to-human transmission is already occurring.

P. knowlesi is the fifth species of malaria known to infect humans in nature. The parasite causes only mild malaria in macaques, Singh said, but in people it is the fastest replicating malaria parasite, multiplying every 24 hours in the blood.

The majority of the macaques carrying the parasite once lived in remote forested regions that saw little human activity or settlements. This has changed over the last ten years as a result of significant deforestation in

Malaysia. According to a [2013 study in the journal *Science*](#), Malaysia lost about 47,000 square kilometers of forest between 2000 and 2012, or about 14 percent of its total land area, which [environmentalists blame on logging](#) and conversion of native forests to palm oil plantations.

At the ASTMH meeting, a team from the London School Hygiene and Tropical Medicine is presenting preliminary findings from an ongoing study that is outfitting people in the Sabah region of Malaysia with GPS tracking devices to explore the role of human movements into different macaque and mosquito habitats on the spread of *P. knowlesi* infections.

Researchers have been warning for decades that more frequent human incursions into undeveloped tropical forests will significantly increase the threat from diseases that could spread far beyond the forest canopy. The current Ebola outbreak is linked to a growing number of people living and hunting in forested areas and consuming "bush meat" from infected animals, chiefly chimpanzees. Meanwhile, illegal mining operations in tropical forests have been linked to the recent resurgence of malaria in Venezuela and may have intensified the rise of drug resistant malaria in Thailand.

These interactions are prompting a growing interest in research that probes the threat of disease from multiple vantage points—including economical, biological, and anthropological—an approach known as [One Health](#).

Singh said that *P. knowlesi* malaria is currently a major public health problem in Malaysia, as it is causing illness serious enough to require medical treatment in about two thousand people a year.

"But the *P. knowlesi* strain of malaria should stay within Southeast Asia as there are no mosquitoes outside the region capable of carrying these parasites," he said.

Singh also pointed out that, in terms of overall burden of disease, knowlesi malaria still ranks far behind dengue fever. [Infections and deaths with that mosquito-borne disease](#) have more than tripled in Malaysia in just the last year. The rising threat of the *P. knowlesi* parasite, however, which is carried by mosquitoes that prey on humans when they are outdoors, presents a new challenge for the broader effort to control and eliminate malaria in Southeast Asia—a fight that has been focused on using bed nets and indoor spraying to prevent malaria infections caused mainly by mosquitoes that attack indoors and at night. Malaria control campaigns also have not faced a malaria strain that is entrenched in a large animal population.

"Controlling a zoonotic—meaning an animal-to-human infection—carried by outdoor feeding mosquitoes is almost impossible with currently used methods," Singh said.

"These intriguing results are yet another example of the complexity and diversity of the interaction between man, his activities, parasites, and mosquitoes. *P. knowlesi* is now a significant cause of human malaria in Malaysian Borneo that must be addressed across multiple levels: research, development, implementation, funding and evidence-based policies," said Alan J. Magill, MD, FASTMH, president of the American Society of Tropical Medicine and Hygiene.

Provided by University of Malaysia

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