Cell phone data of people movement found effective way to control malaria spread

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New research that combines cell phone data from 15 million people in Kenya with detailed information on the regional incidence of malaria has revealed, on the largest scale so far, how human travel patterns contribute to the disease's spread. The findings from researchers at Harvard School of Public Health (HSPH) and seven other institutions indicate that malaria, in large part, emanates from Kenya's Lake Victoria region and spreads east, chiefly toward the capital, Nairobi.

The study appears in the October 12, 2012 issue of the journal *Science*.

"This is the first time that such a massive amount of cell phone data—from millions of individuals over the course of a year—has been used, together with detailed infectious disease data, to measure human mobility and understand how a disease is spreading," said senior author Caroline Buckee, HSPH assistant professor of epidemiology.

Malaria kills about 1 million people each year—90% are children under age 5 in sub-Saharan Africa—and threatens over 3 billion globally.

To estimate malaria's potential spread, it's important to factor in not only information about the location of the mosquitoes that carry the malaria parasite, but also the behavior of the people who might be infected, said Buckee. Since many infected people have no symptoms, they can unintentionally carry the parasite during their travels and infect hundreds of others.

Between June 2008 and June 2009, the researchers mapped every call or text made by each of 14,816,521 Kenyan mobile phone subscribers to one of 11,920 cell towers located in 692 different settlements. Every time an individual left his or her primary settlement, the destination and duration of each journey was calculated. Then, using a 2009 malaria prevalence map provided by co-authors at the Kenya Medical Research Institute (KEMRI) and the Malaria Atlas Project to estimate the disease's prevalence in each location being studied, they inferred each resident's probability of being infected and the daily probability that visitors to particular areas would become infected.

They found that a surprisingly large fraction of "imported" infections—that is, infections that are carried by people moving from one place to another—wind up in Nairobi, with infected residents returning there after journeys to spots such as Lake Victoria or the coast.

By using disease prevalence data, added Buckee, researchers can estimate the probability that each person is carrying malaria parasites and build a map of parasite movements between "source" areas (areas that mostly emit disease) and "sink" areas (areas that mostly receive disease).

This kind of research—coupling "big data" from mobile phones with detailed malaria incidence information—will be an important tool for understanding the spread of the disease, said Buckee. The information available from these new types of analyses holds promise for helping public health officials decide where and how to control imported cases of malaria. For instance, Buckee said, officials could send text message warnings to the phones of people traveling to high-risk areas, suggesting that they use a bednet.

More information: "Quantifying the impact of human mobility on malaria," Amy Wesolowski, Nathan Eagle, Andrew J. Tatem, David L.

Smith, Abdisalan M. Noor, Robert W. Snow, Caroline O. Buckee, *Science*, October 12, 2012.