# Effect of the Ebola-virus-disease epidemic on malaria case management in Guinea, 2014: a cross-sectional survey of health facilities

*Mateusz M Plucinski, Timothée Guilavogui, Sidibe Sidikiba, Nouman Diakité, Souleymane Diakité, Mohamed Dioubaté, Ibrahima Bah, Ian Hennessee, Jessica K Butts, Eric S Halsey, Peter D McElroy, S Patrick Kachur, Jamila Aboulhab, Richard James, Moussa Keita*

## Summary

**Background** **The ongoing west Africa Ebola-virus-disease epidemic has disrupted the entire health-care system in affected countries. Because of the overlap of symptoms of Ebola virus disease and malaria, the care delivery of malaria is particularly sensitive to the indirect effects of the current Ebola-virus-disease epidemic. We therefore characterise malaria case management in the context of the Ebola-virus-disease epidemic and document the effect of the Ebola-virus-disease epidemic on malaria case management.**

**Methods** **We did a cross-sectional survey of public health facilities in Guinea in December, 2014. We selected the four prefectures most affected by Ebola virus disease and selected four randomly from prefectures without any reported cases of the disease. 60 health facilities were sampled in Ebola-affected and 60 in Ebola-unaffected prefectures. Study teams abstracted malaria case management indicators from registers for January to November for 2013 and 2014 and interviewed health-care workers. Nationwide weekly surveillance data for suspect malaria cases reported between 2011 and 2014 were analysed independently. Data for malaria indicators in 2014 were compared with previous years.**

**Findings** **We noted substantial reductions in all-cause outpatient visits (by 23 103 [11%] of 214 899), cases of fever (by 20 249 [15%] of 131 330), and patients treated with oral (by 22 655 [24%] of 94 785) and injectable (by 5219 [30%] of 17 684) antimalarial drugs in surveyed health facilities. In Ebola-affected prefectures, 73 of 98 interviewed community health workers were operational (74%, 95% CI 65–83) and 35 of 73 were actively treating malaria cases (48%, 36–60) compared with 106 of 112 (95%, 89–98) and 102 of 106 (96%, 91–99), respectively, in Ebola-unaffected prefectures. Nationwide, the Ebola-virus-disease epidemic was estimated to have resulted in 74 000 (71 000–77 000) fewer malaria cases seen at health facilities in 2014.**

**Interpretation** **The reduction in the delivery of malaria care because of the Ebola-virus-disease epidemic threatens malaria control in Guinea. Untreated and inappropriately treated malaria cases lead to excess malaria mortality and more fever cases in the community, impeding the Ebola-virus-disease response.**

**Funding** **Global Fund to Fight AIDS, Tuberculosis and Malaria, and President's Malaria Initiative.**

*Lancet Infect Dis* 2015; 15: 1017–23

Published Online June 24, 2015 http://dx.doi.org/10.1016/S1473-3099(15)00061-4

See Comment page 988

**Malaria Branch, Centers for Disease Control and Prevention, Atlanta, GA, USA** (M M Plucinski PhD, J K Butts MPH, E S Halsey MD, P D McElroy PhD, S P Kachur MD, J Aboulhab MD)**; President's Malaria Initiative, Atlanta, GA, USA** (M M Plucinski, J K Butts, E S Halsey, P D McElroy, J Aboulhab)**; National Malaria Control Programme, Ministry of Health, Conakry, Guinea** (T Guilavogui MD, N Diakité MD, S Diakité MD, M Dioubaté MS, M Keita MD)**; Mafèrinyah Rural Health Research Center, Mafèrinyah, Guinea** (S Sidikiba MD)**; Catholic Relief Services, Conakry, Guinea** (I Bah MS)**; Rollins School of Public Health, Emory University, Atlanta, GA, USA** (I Hennessee MPH)**; and Division of Prevention and Disease Control, Ministry of Health, Conakry, Guinea** (R James MD)

Correspondence to: Dr Mateusz M Plucinski, Malaria Branch, Centers for Disease Control and Prevention, 1600 Clifton Road, Atlanta, GA 30329, USA **mplucinski@cdc.gov**

## Introduction

The Ebola-virus-disease epidemic in Guinea showed three successive waves of transmission during the whole of 2014. Although the first two waves were attributable to localised transmission in Conakry and some prefectures in forested Guinea,[1] the third, most intense wave indicated transmission throughout Guinea.

Although the Ebola-virus-disease epidemic caused an estimated 9976 deaths as of March 8, 2015, of which 2170 were in Guinea,[2] the indirect effects of the epidemic[3,4] might ultimately cause more morbidity and mortality than Ebola virus disease.[5] The effect of the Ebola-virus-disease epidemic on the health-care system in affected countries might adversely affect health-seeking behaviour and thus the delivery of life-saving care to patients, as reported for the severe acute respiratory syndrome (SARS) epidemic.[6] This effect is particularly relevant to malaria control efforts[7] because of an overlap of symptoms for malaria and Ebola virus disease and the dependence of malaria-control efforts on case management delivered at, or coordinated through, health facilities.

Guinea is highly endemic for malaria, with infection prevalence in children younger than 5 years old of 44% in a 2012 survey.[8] Malaria is the main cause of visits to health facilities in Guinea, accounting for more than 30% of visits to public health facilities.[9] An important part of the National Malaria Control Programme's activities is the expansion of access to malaria diagnostics, most commonly rapid diagnostic tests, and antimalarial treatments in the form of artemisinin-based combination therapy for simple malaria and parenteral treatment with artemisinin derivatives for severe malaria. Access to artemisinin-based combination therapy and rapid diagnostic tests is provided through public health facilities and a network of more than 3000 community health workers, each supplied and supervised from a health centre.

Coinciding with the start of the third wave of the Ebola-virus-disease epidemic in Guinea, the National Malaria

## Research in context

### Evidence before this study

We searched PubMed with the search terms "Ebola", "malaria", "impact", "indirect", and "healthcare utilization", in both French and English for the period (from March 1, 2013, to March 15, 2014) since the start of the Ebola-virus-disease epidemic in west Africa. We found one peer-reviewed published report with systematically gathered data about the effect of the Ebola epidemic on health-care delivery, showing a reduction in the use of inpatient services in Sierra Leone. We also found a modelling report of the estimation of excess malaria morbidity and mortality caused by the Ebola epidemic.

### Added value of this study

This study is the first systematic analysis of outpatient health-care use in an Ebola-affected country during the current outbreak. We focused specifically on malaria, the main cause of fever and health-care demand in Guinea. We documented changes in malaria case management practices since the start of the epidemic, quantified the reduction in the delivery of malaria care since the start of the Ebola-virus-disease epidemic, and estimated the excess malaria morbidity and mortality due to the Ebola-virus-disease epidemic, which greatly exceed the morbidity and mortality rates directly due to Ebola virus disease. The large sample size of this study, both in terms of health facilities sampled and patients' records reviewed, comparison of Ebola-unaffected and Ebola-affected prefectures, long retrospective review, and confirmation of national surveillance data with survey data from systematically sampled health facilities contribute to the robustness of the findings.

### Implications of all the available evidence

The indirect effects of the Ebola-virus-disease epidemic, particularly those on malaria care delivery, lend support for strengthening health-care delivery in the context of Ebola virus disease. The significant effect of the Ebola-virus-disease epidemic on malaria morbidity and mortality rates should be considered by ministries of health and donors when allocating sparse health-care resources.

Control Programme began receiving widespread reports of falling attendance at health facilities throughout the country and there was a large-scale collapse of the community malaria case management programme. The National Malaria Control Programme commissioned a nationwide survey of health facilities, complemented by an analysis of surveillance data available nationally, to verify and quantify these anecdotal reports, to characterise malaria case management in the context of the Ebola-virus-disease epidemic, and to document the effect of the Ebola-virus-disease epidemic on malaria case management.

## Methods

### Study design

See Online for appendix

We did a cross-sectional survey of 120 public health facilities in eight prefectures (appendix), including the four prefectures most affected by Ebola virus disease as of mid November, 2014, and another four prefectures selected randomly, stratified by region, from prefectures with no reported cases of Ebola virus disease as of mid November, 2014. 15 health facilities were selected in each prefecture from a list of all public health facilities using a computer-generated random sequence. Sampling was stratified by the type of health facilities, with one hospital, seven health centres, and seven health posts (the most basic structure for health facilities) sampled per prefecture. At each hospital, data gathering and interviews were done separately for the general medicine and paediatric wards. The Guinea Ministry of Health reviewed the activity and classified it as programme evaluation.

Sampled health facilities were visited by one of eight study teams throughout December, 2014. If a health facility was permanently closed, the reason for closure was recorded. Otherwise, study teams abstracted data from registers using standardised forms for data gathering and interviewed at least one health-care worker (the health-care worker most familiar with malaria case management practices in the health facility) and up to five community health workers randomly chosen by systematic sampling from a list of community health workers (for health centres only) using standardised questionnaires. For data abstraction from registers, study teams located registers for Jan 1, to Nov 30, 2013, and Jan 1, to Nov 30, 2014. For each month, study teams counted the number of all-cause outpatient visits, fever cases, malaria diagnostic tests done, confirmed malaria cases, and patients treated with oral and injectable antimalarial drugs, separately for children younger than 5 years and for children aged 5 years and older and adults. Similarly, study teams abstracted the number of antenatal visits and number of pregnant women given sulfadoxine-pyrimethamine for intermittent preventive malaria treatment. For registers from Nov 1–30, 2013, to Nov 1–30, 2014, study teams randomly selected 40 visits by patients, and recorded age, presence of fever, and whether the patient was tested or treated, or both, for malaria.

Selected health-care workers and community health workers were asked about malaria case management practices before and after the Ebola epidemic, specifically use of rapid diagnostic tests and artemisinin-based combination therapy and perceived changes in attendance at health facilities. Workers reporting decreases in attendance were asked to provide possible explanations.

### Statistical analysis

The proportion of operational health facilities was calculated, with stratification by Ebola-unaffected and