INSIGHTS

LETTERS

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Malaria in Venezuela requires response

The Americas have witnessed a substantial decline in malaria-related morbidity (62%) and mortality (61%) during the past 15 years as part of the implementation of the Global Malaria Action Plan (*1*). Venezuela, the first World Health Organization (WHO)–certified country to eradicate malaria in 1961 (*2*), has been the alarming exception in the region, displaying an unprecedented 365% increase in malaria cases between 2000 and 2015 (*1*). In 2016 alone, 240,613 malaria cases were officially reported (*3*). Worryingly, 2017 witnessed an increase of 68% in the cumulative number of cases compared to the previous year, totaling 319,765 malaria cases by 21 October (*4*). The disease has spread to areas where malaria was eradicated previously (such as near the capital, Caracas), prompting alarm in the health sector. Moreover, malaria cases have overloaded frontier health care infrastructure in Brazil and Colombia, where 78 and 81%, respectively, of imported malaria cases in 2016 originated in Venezuela (*5*).

Economic and political mismanagement have precipitated a general collapse of Venezuela's health system, creating an ongoing humanitarian crisis with severe social consequences (*6*, *7*). The malaria epidemic has been fueled by financial constraints for procurement of malaria commodities (such as insecticides, drugs, diagnostic supplies, and mosquito nets) and surveillance activities, internal human migration associated with illegal gold mining, and lack of provision and implementation of services (*2*, *3*). The continued

Venezuelans wait outside a health center for malaria treatment in November, 2017.

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the use of new compounds will likely lead to the development of new mechanisms to resist them. Integrated vector management programs should therefore devote equal attention to noninsecticide methods.

Numerous biological control agents, from viruses to predatory fish, have been evaluated for effectiveness in controlling malaria mosquitoes. Foremost, the use of the bacterium *Bacillus thuringiensis* var. *israelensis* has substantially diminished malaria when applied to aquatic habitats, such as in urban areas of Tanzania (*1*) and highland villages in Kenya (*2*). Adult mosquitoes can also be controlled with entomopathogenic fungi (*3*). Research has focused on the development of innovative delivery platforms of fungal spores (*4*) as well as genetic modification of the fungus to increase effectiveness (*5*).

People affected by malaria often reside in poorly constructed houses with opportunities for mosquito entry. Improved housing and living conditions protect against malaria (*6*), as well as providing