



Eliminating malaria in NICARAGUA

Nicaragua has reported a 95 percent decrease in malaria cases since 2000 and is making great progress toward achieving national elimination by the 2020 regional goal.

Overview

Malaria in Nicaragua has been on a considerable decline since 2000, dropping from 23,878 cases to just 1,163 cases in 2014. The country's malaria transmission is primarily due to *Plasmodium vivax*.¹ Transmission is increasingly focal, and in recent years more than 95 percent of national cases have been concentrated along the Atlantic coast in the North Autonomous Atlantic Region (RAAN).² Most cases are reported during the rainy season lasting from May to October, peaking during the wettest months at the end of the season. The primary mosquito vector responsible for malaria transmission is *Anopheles albimanus*, with secondary vector *An. pseudopunctipennis* responsible for summer transmission in some areas of the country.^{3,4} Vector control is a challenge in Nicaragua due to the variety of breeding conditions tolerated by *An. albimanus*, high densities of adult vectors during the rainy season, and historically rapid development of resistance to the most commonly used insecticides.⁵

Nicaragua has received Global Fund support for its malaria program since 2003. In 2013, a consolidated grant launched with a goal of moving the country towards pre-elimination, prioritizing the highest risk communities that live in chronic poverty, lack adequate access to health care due to cultural and geographical barriers, and are highly mobile. These communities are concentrated in the remote La Mosquitia rainforest region of RAAN, adjacent to the Gracias a Dios department of Honduras, where some municipalities can only be reached by sea or by air.² Nicaragua is a member of the Amazon Malaria Initiative (AMI), a regional program fostering collaboration in malaria prevention and control supported by the U.S. Agency for International Development (USAID), as well as a participating country of a new regional grant from the Global Fund entitled Elimination of Malaria in Mesoamerica and the Island of Hispaniola (EMMIE). With the support of both initiatives, Nicaragua has begun reorienting its malaria strategy toward one of elimination, aiming to achieve a shared regional goal of elimination by 2020.^{6,7}

At a Glance¹

- 1,163** Reported cases of malaria (86% *P. vivax*)
- 0** Deaths from malaria (last death reported in 2012)
- 50** % population at risk (total population: 6.0 million)
- 0.2** Annual parasite incidence (cases/1,000 total population/year)
- 0.2** % slide positivity rate

Progress Toward Elimination

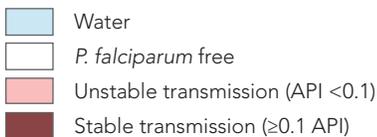
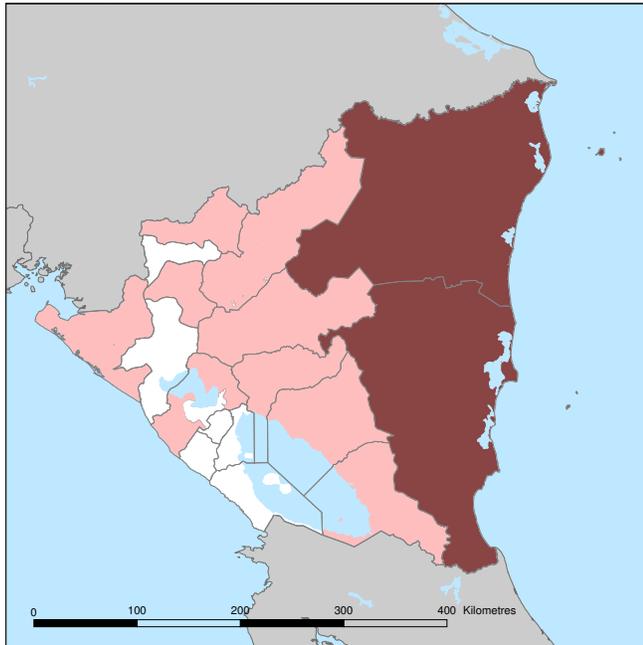
Nicaragua has had a historically high burden of malaria. In the 1930s, up to 60 percent of the population had the disease, and from 1937 to 1948, 22 percent of all registered deaths were due to malaria. The use of environmental engineering, biological larviciding and distribution of antimalarial treatment began during the 1940s, and in 1947, an organized malaria control program was formed within the Ministry of Health (MINSa). Shortly after, the cotton industry in Nicaragua began using DDT on a large scale.^{8,9}

In accordance with the World Health Organization's Global Malaria Eradication Program, MINSa reoriented its malaria control efforts toward elimination in 1957, focusing on indoor residual spraying (IRS) with DDT and active case detection.⁹ Full coverage with DDT of all malarious areas, about 90 percent of the entire country, was reached in 1958. However, resistance to both DDT and dieldrin, an alternative insecticide, had been detected in *An. albimanus* and *An. pseudopuntipennis* by 1959 and continued to spread during

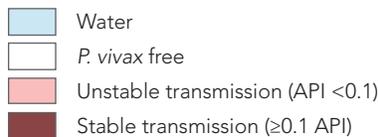
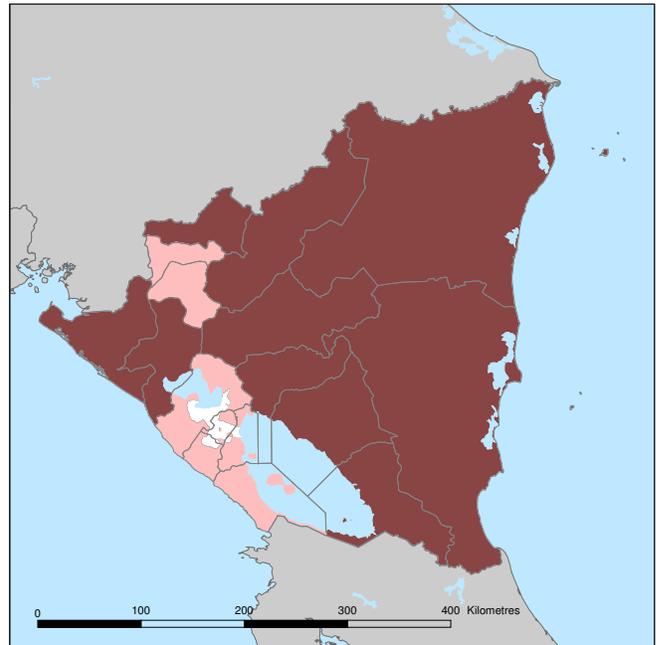


Malaria Transmission Limits

Plasmodium falciparum



Plasmodium vivax



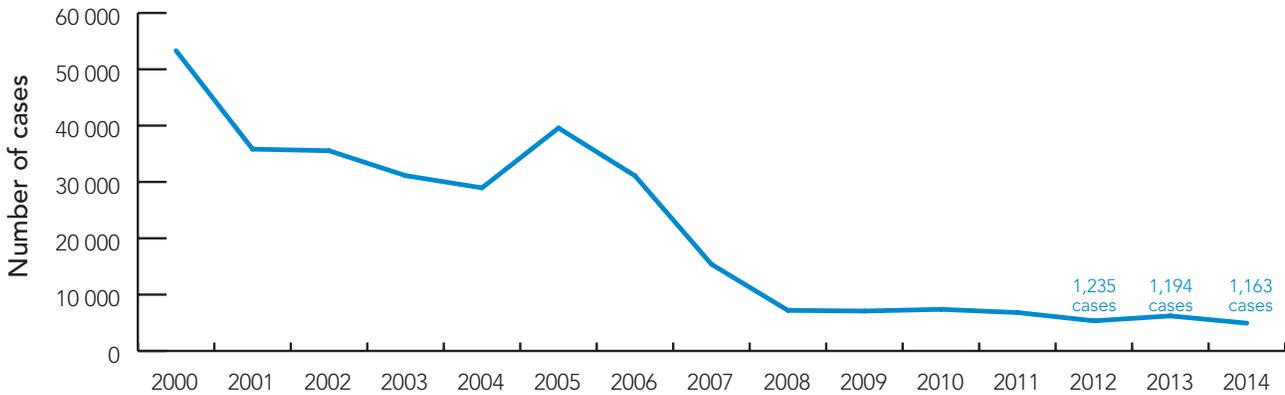
P. falciparum/*P. vivax* malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

the 1960s, particularly in areas with intense agricultural activity. During this same period, major construction projects in the country created new *An. albimanus* breeding places. In response to the waning effectiveness of IRS and increase in vector density in some areas, the malaria program initiated new interventions, including larviciding with Paris Green, trials of malathion, and small-scale mass drug administration (MDA) with chloroquine and primaquine. These interventions on their own had limited impact on the malaria burden, but when used in combination, they were successful in reducing focal transmission. In 1963, Nicaragua reported 10,559 malaria cases.^{10,11}

MDA among a large Nicaraguan population of 230,000 was attempted in 1967, and successfully brought cases in the targeted area down from 7,365 in 1967 to 1,225 in 1968. Yet because malaria transmission persisted, community interest and participation in the MDA program declined in 1969 and cases subsequently resurged.¹² Throughout much of the 1970s, IRS with various insecticides, including DDT, malathion, propoxur, and chlorfoxim, was the primary intervention used by MINSa. Propoxur was very successful in bringing cases down in high transmission areas along the Pacific Coast for a few years after it was introduced in 1970, but propoxur resistance was detected in 1973 and the malaria situation deteriorated from 1974 to 1976. In 1975, with 24,692 cases



Reported Malaria Cases*



*Nicaragua does not distinguish between local and imported when reporting case numbers.

Source: World Health Organization, World Malaria Report 2015

Goal:⁷ Shared goal for Mesoamerica and the Island of Hispaniola of zero local malaria cases in the region by 2020*

*Participating countries include: Belize, Costa Rica, Dominican Republic, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama

reported, MINSA conducted a program review and began diversifying and tailoring interventions according to epidemiological, ecological, and socioeconomic factors. Antilarval measures were scaled up beginning in 1976, and by 1978, cases had dropped to 10,633.¹³

Political unrest as a result of the Sandinista Revolution (1978–1979) led to a full disruption of malaria control interventions until 1981, when a national MDA campaign was conducted by a large network of volunteer collaborators in combination with community-based education, case detection, and environmental sanitation efforts. The campaign was estimated to have reached 70 percent of Nicaraguans and was temporarily successful in reducing transmission, but did not have a lasting effect on the malaria burden.¹² The community-based approach to malaria control did continue, however, with the expansion of the volunteer network and establishment of health posts in high-risk areas to facilitate improved diagnosis and treatment, community engagement in malaria prevention activities, and locally-appropriate vector and

larval control interventions based on transmission potential. These activities were conducted throughout the 1980s, despite the Contra War that lasted for much of the decade and disrupted health services in eight of Nicaragua's 17 departments. Malaria incidence declined considerably in the areas relatively unaffected by the armed conflict, but increased in the eight departments as a result of major population movement and displacement, disruption of malaria interventions, and shortages of supplies and human resources.¹⁴

The malaria situation in Nicaragua got worse in the 1990s as a result of economic decline, defunding and decentralization of government programs, and the privatization of health care, all of which led to a great reduction in capacity and quality of the malaria program. Between 1992 and 1996, malaria incidence tripled, and the country experienced its worst recorded malaria epidemic in 1996, with more than 75,000 cases.^{1,15} Although Nicaragua adopted the new global malaria control strategy in 1992, due to financial restraints, actual implementation did not begin until 1999 when MINSA



was able to plan a comprehensive malaria control program with the support of post-Hurricane Mitch international aid. Then, in 2000, MINSa amended its strategies to align with the Roll Back Malaria Initiative. The strengthened program capacity and improved quality of activities had a dramatic effect on the malaria burden: cases dropped from over 38,000 in 1999 to just 7,695 in 2002.^{1,16}

MINSa received further support for its malaria program through a Round 2 grant from the Global Fund beginning in 2003. The grant sought to reduce transmission in the 36 municipalities with the greatest risk for malaria transmission through a multisectoral approach, incorporating community groups, municipal governments, military, the tourism industry, and organizations representing indigenous people into the planning and implementation process. In order to access the most at-risk populations, primarily indigenous groups living in extreme poverty and very remote geographic locations, community volunteers were deployed to the 36 municipalities to diagnose and treat malaria and educate communities on prevention and environmental sanitation activities. Vector control strategies included focal IRS with etofenprox, spatial fumigation with cypermethrin, distribution of insecticide-treated nets (ITNs), and the use of *Bacillus thuringiensis israelensis* for larval control. This project was extended through subsequent grants from the Global Fund that have helped move Nicaragua to the pre-elimination phase.¹⁷⁻¹⁹ The financial and technical support provided by these grants have had a remarkable impact on the malaria situation in the country: cases have declined by 84 percent since the onset of Global Fund support in 2003, and transmission is now confined almost entirely to the La Mosquitia region in RAAN.^{1,2}

With support from AMI, Nicaragua has recently improved its information system for case reporting and is currently working to establish a malaria early warning system in advance of major construction projects, including the controversial Great Interoceanic Canal project.⁶ Under the EMMIE regional grant, which supports the acceleration toward elimination in the ten participating countries through the provision of results-based financing, Nicaragua is revising its malaria strategy from pre-elimination to elimination. The country will benefit from standardized approaches to diagnostics, treatment and integrated vector management, regional surveillance strengthening and data sharing, and an operational research framework designed to address the common challenges faced by countries in Mesoamerica.⁷

Eligibility for External Funding²⁰⁻²²

The Global Fund to Fight AIDS, Tuberculosis and Malaria	Yes*
U.S. Government's President's Malaria Initiative	No
World Bank International Development Association	Yes

*Nicaragua is eligible for both regional and national malaria grants from the Global Fund.

Economic Indicators²³

GNI per capita (US\$)	\$1,890
Country income classification	Lower middle
Total health expenditure per capita (US\$)	\$155
Total expenditure on health as % of GDP	8
Private health expenditure as % of total health expenditure	46

Challenges to Eliminating Malaria

Limited access to vulnerable groups

The areas of Nicaragua with the highest malaria transmission are also the most difficult to reach, geographically. Populations in the La Mosquitia region are extremely poor, highly mobile, and/or indigenous groups that do not have regular access to health services; thus, coverage with malaria interventions is irregular and community participation is weak. Case increases in Nicaragua in the past few years can be attributed to increases in this region; transmission is now negligible in all other parts of the country. Improved community engagement and cross-border collaboration with the Gracias a Dios department of Honduras will be essential for Nicaragua to achieve elimination.



Conclusion

While the inaccessibility of the La Mosquitia region is a considerable challenge, Nicaragua has made great progress in reducing its malaria burden since 1996 and has eliminated

malaria in most of its municipalities. With the significant boost in financial and political support for malaria elimination within the region, Nicaragua is in an excellent position to achieve national elimination in accordance with the regional 2020 goal.

Sources

1. Global Malaria Programme. World Malaria Report 2015. Geneva: World Health Organization; 2015.
2. Federacion Red NicaSalud. Program Grant Agreement for Single Stream of Funding: Nicaragua, all united holding the achievements and consolidating the actions aimed at pre-elimination and elimination of malaria. The Global Fund to Fight AIDS, Tuberculosis and Malaria; 2013.
3. Manguin S, Carnevale P, Mouchet J, editors. Biodiversity of Malaria in the World. London: John Libbey Eurotext; 2008.
4. Pan American Health Organization. Report on the Situation of Malaria in the Americas, 2008. Washington, DC: PAHO; 2008.
5. Garfield R. Malaria control in Nicaragua: social and political influences on disease transmission and control activities. *Lancet* 1999; 354(9176): 414–418.
6. US Agency for International Development. Amazon Malaria Initiative Quarterly Bulletin. Volume 2, Issue 2; 2015.
7. Population Services International. The Global Fund to Fight Aids, Tuberculosis and Malaria Program Grant Agreement: Elimination of Malaria in Mesoamerica and the Island of Hispaniola; 2014.
8. Republica de Nicaragua Ministerio de Salud. Diagnostico Situacional del Uso del DDT y el Control de la Malaria. Managua: Direccion de Enfermedades Transmitidas por Vectores; 2001.
9. Garfield RM, Vermund SH. Health education and community participation in mass drug administration for malaria in Nicaragua. *Soc Sci Med* 1986; 22(8): 869–877.
10. Pan American Health Organization. Report on the Status of Malaria in the Americas – VIII Report. Havana, Cuba: CD12/6; 1960.
11. Babione RW. Epidemiology of Malaria Eradication in Central America: A Study of Technical Problems. *Am J Public Health* 1966; 5(1): 76–90.
12. Garfield RM, Vermund SH. Changes in malaria incidence after mass drug administration in Nicaragua. *Lancet* 1983; 2(8348): 500–503.
13. Pan American Health Organization. Hemispheric Plan for the Promotion and Support of Malaria Programs. Washington, DC: CD26/12; 1979.
14. Garfield RM, Prado E, Gates JR, Vermund SH. Malaria in Nicaragua: Community-Based Control Efforts and the Impact of War. *Int J Epi* 1989; 18(2): 434–439.
15. Garfield R. Malaria control in Nicaragua: social and political influences on disease transmission and control activities. *Lancet* 1999; 354(9176): 414–418.
16. Sequeira M, Espinoza H, Amador JJ, Domingo G, Quintanilla M, de los Santos T. Malaria in Nicaragua: A review of control status, trends, and needs. Seattle, Washington: PATH; 2010.
17. Federacion Red NicaSalud. Round 2 Proposal: Commitment and Action Against Malaria. Nicaragua: The Global Fund to Fight AIDS, Tuberculosis and Malaria; 2002.
18. Nicaragua Country Coordinating Mechanism. Round 7 Proposal: Using a humanistic and social approach from the community, to contain HIV/AIDS and malaria and eliminate Tuberculosis in Nicaragua, 2008–2013. Nicaragua: The Global Fund to Fight AIDS, Tuberculosis and Malaria; 2007.
19. Nicaragua Country Coordinating Mechanism. Round 9 Proposal: Stop the local transmission of malaria, focused upon pre-elimination in 37 of the country's municipalities. Nicaragua: The Global Fund to Fight AIDS, Tuberculosis and Malaria; 2009.
20. The Global Fund to Fight AIDS, Tuberculosis and Malaria. 2014 Eligibility List. 2014. [Available from: www.theglobalfund.org/documents/core/eligibility/Core_EligibleCountries2014_List_en/].
21. President's Malaria Initiative. PMI Focus Countries. 2014. [Available from: <http://www.pmi.gov/where-we-work>]
22. International Development Association. IDA Borrowing Countries. 2014. [Available from: <http://www.worldbank.org/ida/borrowing-countries.html>].
23. The World Bank. World Development Indicators Database. 2014. [Available from: <http://data.worldbank.org/data-catalog/world-development-indicators>].



Transmission Limits Maps Sources

Guerra CA, Gikandi PW, Tatem AJ, Noor AM, Smith DL, Hay SI and Snow RW. (2008). The limits and intensity of *Plasmodium falciparum* transmission: implications for malaria control and elimination worldwide. *Public Library of Science Medicine*, 5(2): e38.

Guerra CA, Howes RE, Patil AP, Gething PW, Van Boeckel TP, Temperley WH, Kabaria CW, Tatem AJ, Manh BH, Elyazar IRF, Baird JK, Snow RW and Hay, SI. (2010). The international limits and population at risk of *Plasmodium vivax* transmission in 2009. *Public Library of Science Neglected Tropical Diseases*, 4(8): e774.

About This Briefing

This Country Briefing was developed by the UCSF Global Health Group's Malaria Elimination Initiative (MEI). To send comments or for additional information about this work, please email Anne.Bulchis@ucsf.edu.



The **Global Health Group** at the University of California, San Francisco is an 'action tank' dedicated to translating new approaches into large-scale action that improves the lives of millions of people. Launched in 2007, the UCSF Global Health Group's **Malaria Elimination Initiative (MEI)** works at global, regional, and national levels to accelerate progress toward malaria elimination in countries and regions that are paving the way for global malaria eradication. The MEI believes that global eradication of malaria is possible within a generation.

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malaria atlas project

The **Malaria Atlas Project (MAP)** provided the malaria transmission maps. MAP is committed to disseminating information on malaria risk, in partnership with malaria endemic countries, to guide malaria control and elimination globally.

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