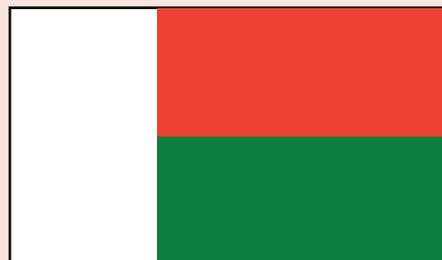
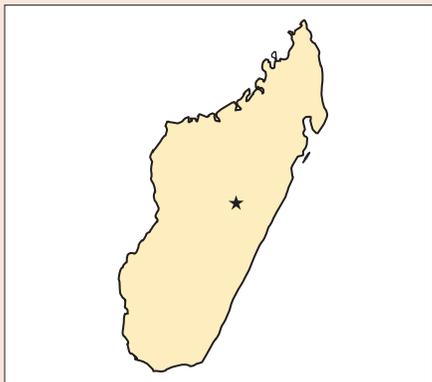


# Madagascar



- **Capital:** Antananarivo
- **Area:** 587,041 sq km
- **Population:** 22,585,517 (July 2012 est.)
- **Age Structure:** 0-14 years: 43.1% (male 4,762,589/female 4,693,259); 15-64 years: 53.8% (male 5,864,520/female 5,938,029); 65 years and over: 3% (male 295,409/female 372,415) (2011 est.)
- **Life Expectancy at Birth:** Total population: 64 years; male: 61.97 years; female: 66.1 years (2012 est.)
- **Infant Mortality Rate:** Total: 50.09 deaths/1,000 live births; male: 54.8 deaths/1,000 live births; female: 45.24 deaths/1,000 live births (2012 est.)
- **Literacy Rate:** Total population: 68.9%; male: 75.5%; female: 62.5% (2003 est.)
- **GDP:** \$20.6 billion (2011 est.)
- **GDP per Capita:** \$900 (2011 est.)

## Highlights

- Implemented SARI surveillance in two more hospitals (Antananarivo and Moramanga). These hospitals recruit all patients with SARI. This surveillance aims to describe viral etiology of SARI and risk factors for hospitalization.
- Supported the training of rapid response teams at the national and provincial level in order to develop responsiveness to influenza A (H5N1) and other influenza viruses. A total of 150 staff members attended, including epidemiologists and clinicians from the Ministry of Health and veterinarians from the Ministry of Livestock.

## U.S. CDC Direct Country Support

Fiscal Year 2011 is the second year of the U.S. Centers for Disease Control and Prevention's (CDC) cooperative agreement with Pasteur Institute of Madagascar (IP-Madagascar). The agreement *Developing Seasonal, Pandemic, and Influenza Surveillance Networks* provides support to substantially sustain the capacity of the National Influenza Center (NIC) and health authorities for surveillance and diagnosis of influenza-like illnesses (ILI) and severe acute respiratory infections (SARI) (including highly pathogenic avian influenza (HPAI) in humans) in Madagascar. The cooperative agreement, awarded by CDC, has also increased the capacity of the central, regional and district health authorities in Madagascar to provide rapid public health intervention in response to pandemic outbreaks, and to implement appropriate disease containment measures. It aims to support national efforts to address a possible pandemic of avian influenza from a disease prevention and control standpoint. In addition, the project intends to address preparedness in the following ways for other SARI that could emerge:

- Monitor the emergence of pandemic viruses (including HPAI in humans).

- Reduce morbidity and mortality due to possible emerging respiratory infectious diseases, both through rapid detection and containment.
- Reduce economic effects and social upheaval/unrest due to a pandemic.

## Surveillance

To date, the ILI sentinel surveillance system encompasses 33 sites. All these sites send daily epidemiological information regarding influenza. Nine of them send respiratory specimens for analysis to the NIC on a weekly basis. A sentinel network for SARI surveillance is functional and encompasses 17 hospitals. Nevertheless, in order to implement virological surveillance of hospitalized cases, we selected two hospitals (Antananarivo and Moramanga) that recruit all SARI cases. We hired two clinicians in situ that are dedicated to this surveillance. Since the majority of the population cannot afford hospitalization and to ensure full compliance of the patient, the current project supports all costs associated with hospitalization. This will be an opportunity for us to estimate economic burden of SARI for resource-poor countries.

### Surveillance Activities

- The cooperative agreement supported training for national and regional task forces.
- The NIC expanded its influenza surveillance network to include 33 ILI sites.
- The NIC expanded its SARI surveillance, including sampling and analyses, in two hospitals.
- Two clinicians dedicated to SARI surveillance (sample collection, data capturing at the pediatric and intensive care unit wards, coordination and monitoring of SARI surveillance in their respective sites) were recruited.
- All costs of hospitalization for the SARI surveillance project were supported.
- IP-Madagascar held the Second Annual Sentinel Surveillance Network Meeting.
- IP-Madagascar held the second “Workshop on Epidemiological Surveillance and Outbreak Investigation.”
- Weekly data was shared with the Ministry of Health (MOH), World Health Organization (WHO) and other partners.

## Laboratory

Before the cooperative agreement, the NIC in Madagascar already had the capacity for performing diagnostic tests, but there was room to improve diagnostic capacity and additional ways to prepare for a surge in testing during future pandemics. The cooperative agreement supported the laboratory through the acquisition of new equipment and sampling material, which allowed for an increase in the number of specimens that could be processed.

In order to implement improved diagnostic capacity, the MOH gave its agreement to implement two regional laboratories for influenza detection. We



*A technician working in the BSL-3 laboratory of Madagascar's NIC.*

visited and selected two hospitals—one in Mahajanga (West Coast) and another in Toamasina (East Coast). These two cities are provincial capitals and are potential ports of entry for new pathogens (via the harbor or direct international flight).

The Malagasy NIC developed an assay for the detection of 14 respiratory viruses. This aimed to perform research on etiology of respiratory infections. All SARI cases are routinely tested for all the 14 viruses.

### **Laboratory Activities**

- The MOH gave its agreement to set up two regional laboratories for influenza detection.
- All SARI cases (222) were tested at the NIC for the in-house panel of 14 respiratory viruses.
- NIC tested a total of 1,546 influenza specimens.
- NIC of Madagascar submitted a total of 56 positive isolates and 49 positive swabs to the WHO Collaborating Center in London as part of the WHO Influenza Program.
- The NIC participated in the WHO External Quality Assessment Project (EQAP) and scored 100% for quality assurance.
- Several staff from IP-Madagascar, including one technician from NIC, received their International Air Transport Association (IATA) certificates for the shipment of infectious substances.

### **Preparedness**

CDC support has allowed the NIC to implement ILI surveillance through the increase of sentinel sites, and SARI surveillance through the set-up of two active SARI surveillance sites in two hospitals.

The project also will increase laboratory capacity due to the set-up of two regional laboratories for influenza detection (Toamasina and Mahajanga).

CDC support enabled the NIC to train 22 rapid response teams at the national and provincial (regional) level as part of implementing responsiveness to pandemic influenza viruses. Each team at the regional level includes 6–7 members including clinicians, epidemiologists, diseases surveillance officers, veterinarians and communication officers.

### **Preparedness Activities**

- Implemented ILI and SARI surveillance.
- Selected two hospitals where two regional laboratories will be implemented for influenza detection.

### **Training**

- Between November 2010 and February 2011, 150 staff from the MOH were trained with veterinarians in Mahajanga, Toamasina, Fianarantsoa and Toliara, Madagascar on surveillance and response to pandemics.
- IP-Madagascar staff were trained on IATA certification during July 2011 in Antananarivo, Madagascar.
- During May 2011, the second “Workshop on Epidemiological Surveillance and Outbreak Investigation” was held in Antananarivo, Madagascar by IP-Madagascar for staff involved in sentinel surveillance.
- During March 2011, the Second Annual Meeting of the Sentinel Surveillance Network was held by IP-Madagascar in Antananarivo, Madagascar.

- From February 28–March 4, 2011, trainees attended workshops on bioinformatics and sequencing and laboratory management at the National Institute for Communicable Diseases (NICD) in Johannesburg, South Africa.
- May 30–June 3, 2011, a writing workshop was held in Moramanga, Madagascar.
- Staff participated in the Second Annual African Network for Influenza Surveillance and Epidemiology (ANISE) Meeting, January 11–12, 2011 in Accra, Ghana.
- Staff participated in the WHO global technical consultation for global standards and tools for influenza surveillance, March 8–10, 2011, Geneva, Switzerland.

## Publications

- Rajatonirina S, Heraud JM, Randrianasolo L, Razanajatovo N, Ramandimbisoa T, Ratsitorahina M, Richard V. Pandemic influenza A(H1N1) 2009 virus outbreak among boarding school pupils in Madagascar: compliance and adverse effects of prophylactic oseltamivir treatment. *Journal of Infections in Developing Countries*. 2011;5(3):156-62.
- Razanajatovo NH, Richard V, Hoffmann J, Reynes JM, Razafitrimo GM, Randremanana RV and Heraud JM. Viral etiology of influenza-like illnesses in Antananarivo, Madagascar, July 2008 to June 2009. *PLoS ONE*. 2011;6(3):e17579.
- Van Kerkhove MD, Vandemaele KA, Shinde V, Jaramillo-Gutierrez G, Koukounari A, Donnelly CA, Carlino LO, Owen R, Paterson B, Pelletier L, Vachon J, Gonzalez C, Hongjie Y, Zijian F, Chuang SK, Au A, Buda S, Krause G, Haas W, Bonmarin I, Taniguichi K, Nakajima K, Shobayashi T, Takayama Y, Sunagawa T, Heraud JM, Orelle A, Palacios E, van der Sande MA, Wielders CC, Hunt D, Cutter J, Lee VJ, Thomas J, Santa-Olalla P, Sierra-Moros MJ, Hanshaoworakul W, Ungchusak K, Pebody R, Jain S, Mounts AW, on behalf of the WHO Working Group for Risk Factors for Severe H1N1pdm Infection. Risk factors for severe outcomes following 2009 influenza A (H1N1) infection: A global pooled analysis. *PLoS Med*. 2011;8(7):e1001053.

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