

ELIMINATING MALARIA

Case-study 6

Progress towards subnational
elimination in the Philippines

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UCSF GLOBAL HEALTH SCIENCES

THE GLOBAL HEALTH GROUP

From evidence to action



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ACRONYMS AND ABBREVIATIONS

ACD	Active case detection
ACT	Artemisinin-based combination therapy
ACTMalaria	Asian Collaborative Training Network for Malaria Foundation
ARMM	Autonomous Region of Muslim Mindanao
BHW	Barangay/Village Health Workers
CHD	Center for Health Development
DDT	Dichloro-diphenyl-trichloroethane
DFAT	Department of Foreign Affairs and Trade of Australia
DHO	District Health Office
DOH	Department of Health
EQA	External Quality Assurance
GDP	Gross domestic product
GFATM	Global Fund to Fight AIDS, Tuberculosis and Malaria
GMEP	Global Malaria Eradication Programme
G6PD	Glucose-6-phosphate dehydrogenase
HSRA	Health Sector Reform Agenda
IEC	Information, Education, and Communications
IRS	Indoor residual spraying
IPHO	Integrated Provincial Health Office
ITN	Insecticide-treated net
JICA	Japan International Cooperation Agency
KAP	Knowledge, attitude and practice
LGU	Local Government Unit
LLIN	Long-lasting insecticidal net
M&E	Monitoring and evaluation
MASUVECCO	Malaria Surveillance and Vector Control Council
MBS	Mass Blood Survey
MCS	Malaria Control Service
MDTU	Mobile Diagnostic and Treatment Units

MES	Malaria Eradication Service
METC	International Malaria Eradication Training Centre
MOH	Ministry of Health
MOP	Manual of Procedures
NAMRU	Naval Medical Research Unit
NMCP	National Malaria Control Programme
OFWs	Overseas Filipino workers
PAR	Population at risk
PCD	Passive Case Detection
PHDP	Philippine Health Development Project
PhilMIS	Philippine Malaria Information System
PHO	Provincial Health Office
PIDSR	Philippine Integrated Disease Surveillance and Response
PIPH	Provincial Investment Plans for Health
PHTO	Provincial Health Team Office
PPY	Per person at risk per year
QAS	Quality assurance system
RBM	Roll Back Malaria
RCC	Rolling Continuation Channel
RDT	Rapid Diagnostic Test
RHU	Rural Health Unit
RITM	Research Institute for Tropical Medicine
RMCs	Regional Malaria Coordinators
SP	Sulfadoxine-pyrimethamine
SPR	Slide Positivity Rate
TWG	Technical Working Group
USAID	United States Agency for International Development
WHO	World Health Organization

GLOSSARY

Active case detection

The detection by health workers of malaria infections at community and household level in population groups that are considered to be at high risk. Active case detection can be conducted as fever screening followed by parasitological examination of all febrile patients, or as parasitological examination of the target population without prior fever screening.

Case definition (control programmes)

confirmed malaria

Suspected malaria case in which malaria parasites have been demonstrated in a patient's blood by microscopy or a rapid diagnostic test.

presumed malaria

Suspected malaria case with no diagnostic test to confirm malaria but nevertheless treated presumptively as malaria.

suspected malaria

Patient illness suspected by a health worker to be due to malaria. Fever is usually one of the criteria.

Case definition (elimination programmes)

autochthonous

A case locally acquired by mosquito-borne transmission, i.e. an indigenous or introduced case (also called "locally transmitted").

imported

A case the origin of which can be traced to a known malarious area outside the country in which it was diagnosed.

indigenous

Any case contracted locally (i.e. within national boundaries), without strong evidence of a direct link to an imported case. Indigenous cases include delayed first attacks of *Plasmodium vivax* malaria due to locally acquired parasites with a long incubation period.

induced

A case the origin of which can be traced to a blood transfusion or other form of parenteral inoculation but not to normal transmission by a mosquito.

introduced

A case contracted locally, with strong epidemiological evidence linking it directly to a known imported case (first generation from an imported case, i.e. the mosquito was infected from a case classified as imported).

locally transmitted

A case locally acquired by mosquito-borne transmission, i.e. an indigenous or introduced case (also called "autochthonous").

malaria

Any case in which, regardless of the presence or absence of clinical symptoms, malaria parasites have been confirmed by quality-controlled laboratory diagnosis.

Case investigation

Collection of information to allow classification of a malaria case by origin of infection, i.e. imported, introduced, indigenous or induced. Case investigation includes administration of a standardized questionnaire to a person in whom a malaria infection is diagnosed.

Case management

Diagnosis, treatment, clinical care and follow-up of malaria cases.

Case notification

Compulsory reporting of detected cases of malaria by all medical units and medical practitioners, to either the health department or the malaria elimination service (as laid down by law or regulation).

Certification of malaria-free status

Certification granted by WHO after it has been proved beyond reasonable doubt that the chain of local human malaria transmission by *Anopheles* mosquitoes has been fully interrupted in an entire country for at least 3 consecutive years.

Elimination

Reduction to zero of the incidence of infection by human malaria parasites in a defined geographical area as a result of deliberate efforts. Continued measures to prevent re-establishment of transmission are required.

Endemic

Applied to malaria when there is an ongoing, measurable incidence of cases and mosquito-borne transmission in an area over a succession of years.

Epidemic

Occurrence of cases in excess of the number expected in a given place and time.

Eradication

Permanent reduction to zero of the worldwide incidence of infection caused by human malaria parasites as a result of deliberate efforts. Intervention measures are no longer needed once eradication has been achieved.

Evaluation

Attempts to determine as systematically and objectively as possible the relevance, effectiveness and impact of activities in relation to their objectives.

Focus

A defined, circumscribed locality situated in a currently or former malarious area containing the continuous or intermittent epidemiological factors necessary for malaria transmission. Foci can be classified as endemic, residual active, residual non-active, cleared up, new potential, new active or pseudo.

Incubation period

The time between infection (by inoculation or otherwise) and the first appearance of clinical signs.

Intervention (public health)

Activity undertaken to prevent or reduce the occurrence of a health condition in a population. Examples of interventions for malaria control include the distribution of insecticide-treated mosquito nets, indoor residual spraying with insecticides, and the provision of effective antimalarial therapy for prevention or curative treatment of clinical malaria.

Local mosquito-borne malaria transmission

Occurrence of human malaria cases acquired in a given area through the bite of infected *Anopheles* mosquitoes.

Malaria-free

An area in which there is no continuing local mosquito-borne malaria transmission and the risk for acquiring malaria is limited to introduced cases only.

Malaria incidence

The number of newly diagnosed malaria cases during a specified time in a specified population.

Malaria prevalence

The number of malaria cases at any given time in a specified population, measured as positive laboratory test results.

Monitoring (of programmes)

Periodic review of the implementation of an activity, seeking to ensure that inputs, deliveries, work schedules, targeted outputs and other required actions are proceeding according to plan.

Parasite prevalence

Proportion of the population in whom *Plasmodium* infection is detected at a particular time by means of a diagnostic test (usually microscopy or a rapid diagnostic test).

Passive case detection

Detection of malaria cases among patients who, on their own initiative, go to a health post for treatment, usually for febrile disease.

Population at risk

Population living in a geographical area in which locally acquired malaria cases occurred in the current year and/or previous years.

Rapid diagnostic test

An antigen-based stick, cassette or card test for malaria in which a coloured line indicates that plasmodial antigens have been detected.

Rapid diagnostic test positivity rate

Proportion of positive results among all the rapid diagnostic tests performed.

Receptivity

Relative abundance of anopheline vectors and existence of other ecological and climatic factors favouring malaria transmission.

Re-establishment of transmission

Renewed presence of a constant measurable incidence of cases and mosquito-borne transmission in an area over a succession of years. An indication of the possible re-establishment of transmission would be the occurrence of three or more introduced and/or indigenous malaria infections in the same geographical focus, for two consecutive years for *P. falciparum* and for three consecutive years for *P. vivax*.

Sensitivity (of a test)

Proportion of people with malaria infection (true positives) who have a positive test result.

Slide positivity rate

Proportion of microscopy slides found to be positive among the slides examined.

Specificity (of a test)

Proportion of people without malaria infection (true negatives) who have a negative test result.

Surveillance (control programmes)

Ongoing, systematic collection, analysis and interpretation of disease-specific data for use in planning, implementing and evaluating public health practice.

Surveillance (elimination programmes)

That part of the programme designed for the identification, investigation and elimination of continuing transmission, the prevention and cure of infections, and the final substantiation of claimed elimination.

Transmission intensity

Rate at which people in a given area are inoculated with malaria parasites by mosquitoes. This is often expressed as the “annual entomological inoculation rate”, which is the number of inoculations with malaria parasites received by one person in one year.

Vector control

Measures of any kind against malaria-transmitting mosquitoes intended to limit their ability to transmit the disease.

Vigilance

A function of the public health service during a programme for prevention of reintroduction of transmission, consisting of watchfulness for any occurrence of malaria in an area in which it had not existed, or from which it had been eliminated, and application of the necessary measures against it.

Vulnerability

Either proximity to a malarious area or the frequency of influx of infected individuals or groups and/or infective anophelines.

EXECUTIVE SUMMARY

History of malaria control

Malaria has been documented as a public health problem in the Philippines since 1521. The organization of the malaria control programme and the beginning of data collection began in 1902. The National Malaria Control Programme (NMCP) participated in the WHO-led Global Malaria Eradication Programme (GMEP) from 1956 to 1960, with support from the United States Government. Beginning in 1958, a series of reforms decentralized and subsequently, from 1960 to 1970, re-centralized malaria control services between the national government and local government units (LGUs). These organizational changes created managerial and personnel challenges, which affected the implementation of malaria control measures.

From 1960 to 1970, morbidity declined by 50%, with indoor residual spraying (IRS) with DDT as the main malaria control strategy. In the early 1980s, another reorganization of health services led to the integration of malaria field operations into provincial level services, and although case management was supposed to be conducted by local rural health units, the provincial offices maintained these activities. There was a 75% decline in morbidity from 1950 to 1980, notwithstanding an increase in population movement and the withdrawal of support for the malaria control programme by the United States in 1973.

By 1983, the Philippines had shifted away from a goal of eradication to a goal of malaria control. In 1987, national policy reinforced the decentralized structure of health services. Field offices continued to deliver services, while the national malaria control service focused on policy formulation, standards setting, and programme development, mainly in a technical advisory role. However, there

was a limited amount of funding for commodities, operations support or capacity building. In 1991, the Local Government Code further codified decentralization, and it was initially planned that responsibilities for malaria control would be formally transferred from national government to LGUs. However, because capacity of the LGUs was limited, the national programme instead created a region-based structure, which made the Regional Health Offices responsible for overseeing and maintaining service delivery instead of the LGUs taking on this role. This precluded the need for many LGUs to expand their own malaria efforts. From 1989 to 1998, malaria morbidity declined by 64%, despite a ban on DDT for IRS during this period.

The country launched a malaria elimination initiative in 1997, aiming for a malaria-free Philippines by 2020. By 2007, the support for declaration of malaria-free provinces, defined by the national programme as provinces with an absence of cases for five years, had grown and procedures were formalized in 2011. By 2013, 27 of 80 provinces were considered free of malaria. The evaluative criteria for declaring a province malaria-free include: there being no indigenous cases detected in last five years; a malaria surveillance system being put in place; epidemiological investigation and epidemic preparedness; availability of vector control in the event of outbreaks; and continued health education and advocacy on malaria control. The elimination agenda was bolstered by financial support for intensified malaria control from the Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM), which began in 2002 and is expected to continue until the end of 2014. This funding supported expanded diagnosis and treatment, IRS, distribution of insecticide-treated nets (ITNs) and long-lasting insecticidal nets (LLINs), and awareness-raising activities.

In addition, WHO in the Philippines, through funding from the Australian Government from 1998 to 2012, has provided key technical and capacity building support to the NMCP and its partners. It has introduced many innovative solutions and procedures, such as case-based reporting through the malaria information system, piloting the use of malaria rapid diagnostic tests, setting up proficiency training and quality assurance systems for malaria microscopy, setting up routine malaria drug efficacy testing, establishing cross-border operation activities and supporting community-based malaria control activities.

Because of reductions in malaria morbidity since 2004, the Philippines re-oriented its strategy towards malaria elimination in 2008. Artemisinin-based combination therapy for *P. falciparum* became first-line treatment in 2009 (it had already been introduced as second-line treatment in 2003) and the national stratification scheme was redefined in 2010, with specific vector control activities assigned to each category of endemicity. The malaria elimination strategy lays out a subnational, progressive elimination approach that continuously monitors malaria caseloads and reassesses appropriate application of control measures every three years.

A costing analysis of malaria programme efforts in four sample provinces shows a range of costs across geographical and epidemiological contexts. The elimination phase expenditures range from US\$ 1.81 (Cavite Province) to US\$ 12.24 (Laguna Province) per person at risk per year, the latter figure reflecting an outbreak that required intensified case finding and vector control efforts.

Lessons learned

Malaria morbidity in the Philippines has been heavily impacted by major changes in the organizational and functional structure of the NMCP. When decentralization took place, there was inadequate preparation of peripheral health staff and LGUs, frequently leading to malaria control interventions being disrupted.

The application and coverage of active case detection and IRS with DDT contributed to early declines in malaria incidence during 1950–1960. From the early 1980s onwards, training in microscopy in highly endemic areas improved access to diagnosis in at-risk communities. Stratification allowed for more focused targeting of activities and resources. Distribution of ITNs, starting in 1996, and LLINs, starting in 2008, were more cost-effective vector control interventions than IRS. Improvements in programme strategy and implementation, with technical guidance from the WHO, also contributed to reductions in incidence. Research and the involvement of national and international partners, such as the Research Institute for Tropical Medicine and the University of Philippines, primarily through the Malaria Technical Working Group, have led to evidence-based strategies and scale-up in coverage of effective measures. For example, the Philippines benefited from the experiences of other countries in the use of geographical reconnaissance to apply focused vector control measures. Training of provincial teams in the use of GIS mapping was organized by WHO, with trainers invited from the Pacific. A continued focus on research, and on monitoring and evaluation (M&E) aims to directly inform and shape policy as malaria is progressively eliminated. In addition, community awareness building and ownership, which has been facilitated by the delegation of services to LGUs, has contributed to declines. Sustaining localized political will remains an essential factor.

The Philippines has received substantial external funding to support malaria control activities. This support was essential as domestic funding was often inadequate to meet malaria control needs. Funding from the United States Agency for International Development and WHO during the GMPEP era, from the Department of Foreign Affairs and Trade of Australia, formerly known as AusAID, from 1998 to 2012 (through WHO), from the World Bank beginning in the late 1990s, and from GFATM beginning in 2003, increased the reach of the malaria control programme. National funding also increased in 2008, and strong political commitment along with budget allocations at both the national and local levels helped strengthen the programme.

Given the country's geographic and topographic diversity and correspondingly varied level of malaria risk, the sub-national elimination strategy, unique to the Philippines, is appropriate for interrupting transmission. It has been shown that, in certain settings, provinces using this strategy can achieve and maintain malaria-free status, provided that political commitment, funding, and use of effective policies and malaria control interventions are sustained.

Outlook for the future

The Department of Health continues to standardize the process for evaluating and certifying provinces as malaria-free, currently laid out in a Manual of Procedures. The Malaria Medium-term Development Plan 2011–2016 supports the coverage of remaining endemic and at-risk provinces in order to reduce and eventually halt transmission. The success of these procedures and plan of action is dependent upon advocacy to secure continued political and financial support and sustained capacity building, particularly in the areas of entomological surveillance and case management. Integration of vector-borne disease control efforts is also being pursued as a cost-effective means to maintain efforts for elimination.

The Philippines must take on the challenges that remain, particularly that of expanding the malaria case-based surveillance system and ensuring quality-assured case management throughout the country, including in remote hard-to-reach areas. These efforts will require increased participation of private sector health care providers in diagnosis, quality assurance, case management and case notification. A malaria elimination database and an independent national committee are to be established. Turnover of health staff and declining interest and motivation of communities to remain vigilant for malaria when there are few to zero cases can impede elimination efforts and must be addressed. Greater logistics management will be needed to ensure and maintain adequate stocks of antimalarial drugs and other commodities in the event of outbreaks.

Reaching and maintaining malaria elimination will require substantial financial commitment during a period in which it is anticipated that external support will be reduced. The country is currently devising strategies to mobilize domestic funding and secure assistance from international and bilateral donors in anticipation of the GFATM grant closure in 2014.

INTRODUCTION

The malaria elimination case-study series

Malaria mortality and morbidity have declined significantly in the last decade, with more than a 17% reduction in malaria incidence worldwide (1). Although the burden remains high in areas within sub-Saharan Africa and Southeast Asia, considerable progress is being made to reduce transmission and disease burden globally.

Increased international funding has resulted in additional procurement and delivery of vital commodities (1) and massive scale-up of malaria control interventions such as long-lasting insecticidal nets (LLINs) and indoor residual spraying (IRS). These factors may have influenced transmission patterns in many countries.

As malaria transmission continues to decline, many countries have established goals of national or subnational malaria elimination, defined as zero indigenous cases (i.e. locally contracted cases) in a specific geographical area (2). The movement towards malaria elimination not only has important public health implications for local, regional and global malaria control programmes, but is also an important step towards eventual global eradication of malaria.

The Roll Back Malaria Global Malaria Action Plan outlines a three-part strategy for achieving elimination worldwide: 1) strengthening and expansion of control programmes in countries with the highest disease burdens; 2) progressive elimination of malaria in the endemic margins; and 3) research to inform the development of improved tools and technologies to aid elimination efforts (2).

The WHO's Global Malaria Programme and the Global Health Group of the University of California, San Francisco (UCSF), in partnership with malaria endemic countries and other key stakeholders, are conducting a series of case studies on malaria elimination. The aim is to document the experiences and lessons learned in countries moving toward elimination and in those that have already achieved it.

The UCSF Global Health Group and WHO collaborated with the Philippines on this malaria elimination case study in order to record the country's experiences as it achieves substantial reductions in malaria incidence. The case study looks closely at the national strategy of subnational elimination, in which provinces are certified malaria-free by the Philippines National Malaria Control Program (NMCP.) In order to understand the cost of malaria control and elimination over time in selected provinces that are currently pursuing or have recently achieved elimination, the case study contains descriptions of epidemiology, programme management and strategy choices.

Malaria in the WHO Western Pacific Region

Malaria cases in the WHO Western Pacific Region have substantially declined over the last decade, with reductions of more than 50% registered in China, Philippines, Republic of Korea, Solomon Islands, Vanuatu and Vietnam between 2000 and 2010 (3). However, transmission still remains high in Cambodia, Papua New Guinea, Solomon Islands and Vanuatu. *Plasmodium vivax* and *Plasmodium falciparum* are responsible for the majority of malaria cases in the region, but *Plasmodium knowlesi* has also been recognized as an important malaria parasite in humans in some countries (3).

Various interventions have been identified as having contributed to malaria decline in these countries, including insecticide-treated nets (ITNs) and IRS. These activities have been facilitated by effective case management and an increase in external funding from sources such as the Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM), the World Bank, the United States Agency for International Development (USAID) and other bilateral agencies (1, 3).

Malaria in the Philippines

The Philippines's path from malaria control toward elimination is complex. With 80 provinces scattered over more than 7 000 islands, the country has a wide variety of geographic and socioeconomic features that impact malaria transmission patterns. Because of this diversity, the country aims to eliminate malaria through a subnational approach, one island or province at a time.

The Philippines has a long history of malaria control and prevention efforts. Records indicate that malaria was present before the early 1900s, during the period of Spanish colonial occupation (4), and that it continued to pose significant threats throughout World War II and up to the mid-2000s.

Control measures were present as early as 1906, and included the distribution of quinine and bed nets, as well as educational campaigns, targeted toward haciendas (i.e. mining sites or plantation estates) and army bases (4). During this time, malaria was thought to be responsible for 10 000 to 20 000 deaths annually in an average population size of about 13 million (4). Malaria remained one of the leading causes of morbidity and mortality in the country for most of the 20th century.

Since the early 1900s, various government malaria control programmes have been established at different times to catalyze activity, including the Malaria Control Service (MCS) of the Bureau of Health in 1926, the development of the Department of Health's Malaria Control Programme in 1953, and the national eradication campaign in 1956 (5). These programmes received additional support from WHO and other funding partners.

Control efforts led by these organizations, including IRS with dichloro-diphenyl-trichloroethane (DDT), which was the primary vector control measure from 1967 to 1982 (5), and scale up of case finding and treatment, are believed to be among the contributing factors that led to the eventual decline of overall malaria morbidity in the country (5).

Malaria cases have been on the decline since the late 1980s, from 201 per 100 000 population in 1989 to 50 in 1999 (6). In the mid-2000s there was a further decline in reported cases—from 46 342 cases in 2005 to 9 375 in 2011 (7). Higher malaria incidence occurs in some remote areas and varies according to geo-physiographic environment. Higher incidence is present in mountainous areas, agricultural highlands and coastal regions, and in areas with migrant and indigenous populations.

In 2010, 20% of the country's population was living in malaria-free areas (i.e. zero indigenous cases), 73% in low transmission areas (<1 case per 1 000 population per year) and the remaining 7% in areas of high transmission (>1 case per 1000 population) (1). Remaining areas of high transmission include the provinces of Palawan, Occidental Mindoro, Zambales, Sulu and Tawi-Tawi, as well as the borders of Puerto Princesa City (in Palawan Province) and Olongapo (7).

With recent declines in malaria incidence and interruption of local transmission in an increased number of provinces, the NMCP, in partnership with key stakeholders, has developed a strategy for malaria elimination, with a goal of declaring 40 provinces malaria-free by 2016. Planned strategies to achieve this goal are surveillance, early diagnosis of cases, prompt treatment, and intensive vector control. Local capacity will be enhanced to maximize community-led control efforts (8, 9).

This case study reflects on the Philippines malaria programme at the national level and focuses on five selected provinces (Apayao, Benguet, Sorsogon, Cavite and Laguna). The epidemiology of malaria and the impact of vector control, surveillance, education campaigns and community strategies on the national, provincial and

local levels are reviewed. See [Annex 1](#) for details on case study data sources and methods.

In addition to an analysis of malaria epidemiology and programmatic elements, an overview of malaria programme expenditures in four provinces is presented

to show how cost per capita at risk may change over time and at different phases of elimination. The costing examples from some provinces reflect proactive elimination efforts, and all examples describe the activities and associated costs that have led to significant reduction and interruption of malaria transmission.

COUNTRY BACKGROUND

Geography, climate, population and economy

The Philippines is an archipelago in Southeast Asia, located south of Taiwan, east of Vietnam, and northeast of Malaysia in the western Pacific Ocean. The country is made up of 7 107 islands with an area of 300 000 km², clustered into three main island groups: Luzon, Visayas, and Mindanao. The capital city of Manila is located on Luzon (10, 11).

Due to its volcanic origins, the Philippines archipelago is mostly mountainous with lowlands along coastal areas. The country sits on the edge of the Pacific Ring of Fire, making it prone to earthquakes and eruptions from nearly 20 active volcanoes (10, 12). The climate is tropical and maritime with high temperatures and humidity throughout the year, except at higher altitudes where the climate is more temperate. The Philippines has three seasons based on temperature and rainfall: the rainy season from June through November, the cool dry season from December through February, and the hot dry season from March through May. Malaria transmission occurs throughout the year, but is typically highest in rural, mountainous areas during the rainy season (10, 13). Rainfall patterns are a consequence of the northeast monsoon (November to April) and southwest monsoon (May to October), as well as typhoons originating in the western Pacific. On average, 19 typhoons affect the country each year (10, 13).

The Philippines has a population of 105.7 million people, 49% of which live in urban areas (10). The capital region is home to 11.4 million people. The urban population is growing at an average annual rate of 2.3%, while overall population growth is 1.9%. The major ethnic groups in the Philippines are Tagalog (28.1%), Cebuano (13.1%),

Ilocano (9%), Bisaya/Binisaya (7.6%), Hiligaynon Ilonggo (7.5%), Bikol (6%), Waray (3.4%), and other/unspecified (25.3%). The official languages are Filipino and English (10, 11).

An estimated 14 to 17 million indigenous peoples belong to ethnic tribal groups in the Philippines, mostly concentrated in the remote uplands of the Northern Luzon Cordillera Administrative Region (33%), and in many of the remote regions of Mindanao (61%). These groups are situated in geographically isolated areas with little access to basic social services and are considered to be marginalized (14).

The Philippines is a lower-middle-income country. In 2011, the gross domestic product was US\$ 224.8 billion and gross domestic product per capita was US\$ 4 100 (15). The total labour force is estimated at 40 million people, with a 7% unemployment rate (11, 15). One-third of the labour force works in agriculture, 15% in industry, and 52% in services, according to 2010 estimates (11). The primary agricultural products are sugarcane, coconuts, and rice. Major industries include electronics assembly, garments and footwear, pharmaceuticals, chemicals, and wood products (10, 15). Remittances from approximately 2.2 million overseas Filipino workers (OFWs) were a significant source of income in 2011, amounting to US\$ 20.1 billion (16, 17). The tourism sector is on the rise, with 3.9 million visitors in 2011, an increase of 11% from 2010 (18, 19).

The country is divided into 16 administrative regions, one autonomous region, and 80 provinces (see [Figure 1](#)), 27 of which are considered malaria-free (9, 10). Each province is further subdivided into municipalities, which in turn are composed of barangays (villages), the smallest geopolitical unit.

The Autonomous Region in Muslim Mindanao (ARMM) is notable because of its challenging security situation. The ARMM was created in August 1989 when Lanao del Sur and Maguindanao provinces from Western Mindanao, and Sulu and Tawi-Tawi provinces from Central Mindanao joined to form a new region (20). It is the only region with its own autonomous government, yet health services remain centralized at the national level. There is reduced access to basic services in the ARMM and coverage of control interventions has been lower than in other parts of the country. Two of the four provinces in this region are among the most malaria endemic in the country (7).

Population health profile and health system

Infant mortality and under-five mortality rates have decreased markedly in the past twenty years in the Philippines, with death rates per 1 000 dropping from 40.2% and 57.0%, respectively, in 1990 to 20.2% and 25.4%, respectively, in 2011 (15). Life expectancy at birth has increased from 65.2 years in 1990 to 68.8 years in 2011 (15). Maternal mortality has also fallen from 170 to 99 deaths per 100 000 live births between 1990 and 2010, respectively (15). Total fertility rate in 2012 was estimated at 3.15 children per woman (10, 15). See [Annex 2](#) for additional demographic, health, social and economic indicators.

The Philippines' health system was decentralized in 1993 under Local Government Code RA 7160 of 1991 (22). Under the decentralized structure, provincial and municipal local government units (LGUs) were given responsibility for the planning, funding, and implementation of all health programmes, including malaria control. LGUs receive technical assistance and some financial resources from the national Department of Health (DOH) via regional Centers for Health Development (CHDs). The DOH is primarily responsible for the development of policies and guidelines on treatment, diagnostics, vector control, and elimination strategies that inform LGU malaria programmes (22).

Every municipality in the Philippines has a rural health unit (RHU) that provides primary care and public health services. Provincial governments fund secondary care at provincial and district hospitals, and help coordinate service delivery with RHUs (22). In many remote areas, health stations in barangays (neighbourhood units) are staffed by trained volunteers, known as Barangay/Village Health Workers, or BHWs, and these serve as the first point of contact with patients. In addition to the government-run health system, the private sector provides services to one-third of the population through for-profit and non-profit hospitals and health clinics (22). A national health insurance corporation, PhilHealth, was established through the National Health Insurance Act of 1995 with the goal of providing universal medical coverage by 2010. Both government and private sector facilities and individual practitioners can become accredited providers under the PhilHealth insurance plan (22).

Over the last twenty years, health expenditure per capita in the Philippines has more than doubled, from US\$ 37 in 1990 to US\$ 77 in 2010, yet it does not come close to the developing countries in East Asia and the Pacific, which spent an average of US\$ 183 per capita on health in 2010 (15). Moreover, health expenditure as a total percentage of gross domestic product (GDP) has remained stable in the Philippines since 1995, increasing only slightly from 3.45% to 3.61% in 2010. In contrast, the entire region of East Asia and the Pacific spent an average of 6.89% of total GDP on health in 2010 (15).

External organizations, including WHO, USAID, the United States Naval Medical Research Unit Two (NAMRU-2), Japan International Cooperation Agency (JICA), the Department of Foreign Affairs and Trade (DFAT) of Australia, formerly AusAID, ACTMalaria, and GFATM have played very important roles throughout the history of the malaria control programme (1, 5, 9). These organizations support and augment the DOH in providing technical assistance, resources, and funding to LGUs.

Figure 1: Map of Philippines, Administrative Divisions (21)



HISTORY OF MALARIA AND MALARIA CONTROL IN THE PHILIPPINES

Overview of parasites and vectors in the country

The most common form of malaria in the Philippines is *P. falciparum* (approximately 70% of malaria infections as of 2013), followed by *P. vivax* (approximately 30% of infections). Less common infections are due to *P. malariae* (less than 1%) and *P. ovale*, which is rarely found. Mixed infections of both *P. falciparum* and *P. vivax* comprise less than 1% of cases (23, 24). The distribution of these species, particularly of *P. falciparum* and *P. vivax*, varies across endemic provinces. *P. vivax* is predominantly found in the provinces of Apayao, Zamboanga del Norte, and the cities of General Santos and Zamboanga. An isolated imported case of *P. ovale* from Africa was reported in Negros Oriental province in 2007 (24).

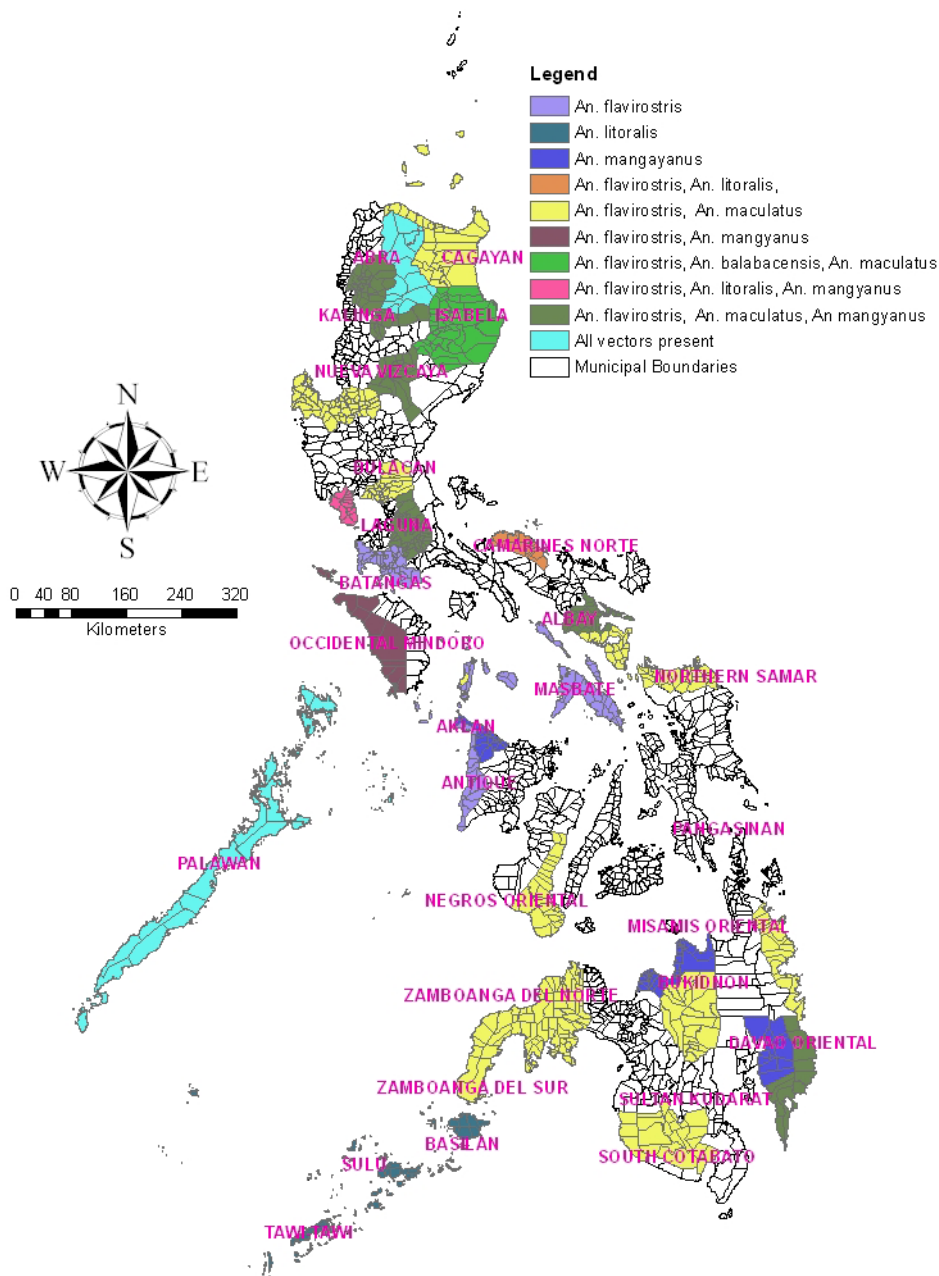
In 2006, for the first time, the simian species *P. knowlesi* was isolated among infected patients in the province of Palawan (25). Palawan is the only place outside of Brunei Darussalam, Indonesia, Malaysia, Myanmar, Singapore and Thailand where this parasite has been found to infect humans. Studies are underway to determine the epidemiology of *P. knowlesi* in the Philippines.

Malaria in the Philippines is mainly transmitted by *Anopheles flavirostris*, which breeds in clear, slow flowing waters and shaded areas (26, 27). This mosquito species is widely distributed and has been shown to survive in various ecological settings, making it a primary vector. *An. flavirostris* is both anthropophilic (feeds on humans) and zoophilic (feeds on animals), and bites outdoors most of the year. During the hot season, it displays mostly endophagic (indoor biting) behaviour. Secondary vectors include *An. maculatus*, *An. litoralis*, *An. balabacensis*, and *An. mangyanus* (see [Figure 2](#) for a map showing the distribution of malaria vectors in the Philippines).

Malaria transmission in the Philippines generally increases during wet or rainy months, starting in June, peaking from July to September, and generally phasing out by October. However, rainfall occurs year round in rural, hilly, mountainous, or forested areas (24, 26).

Malaria disproportionately affects people in rural areas, with a geographic distribution that is highly focal and follows the distribution of vectors. Population groups most at risk include forest workers, subsistence farmers, indigenous peoples, migrant workers, and settlers in frontier lands (see [Lessons learned](#) chapter for more information).

Figure 2. Distribution of malaria vectors in the Philippines (26)



The Philippines Malaria Control Program
Report of an External Review, 1993

Early malaria control efforts (1920–1955)

Malaria has been documented as a major public health problem since the early years of the Spanish (1521–1898) and US (1898–1946) occupations (28, 29). Minimal epidemiologic data are available from earlier time periods, but the organization of the health sector and malaria data collection began improving from 1902 onwards. These advances created a base for strategic planning and implementation of malaria control (28). In 1901, during the American occupation, the Board of Public Health was established to facilitate improvement of the health situation in the country through service delivery and health education. Another government entity, the Bureau of Government Laboratories, undertook investigation of tropical diseases and provided diagnostic services (28, 29).

The Philippine Health Service (the precursor to the DOH) was established in 1922 to collect malaria surveillance data, and was supported by the International Health Board of the Rockefeller Foundation. The Malaria Control Section and the Advisory Committee for Malaria Control were public programmes created in 1926 and 1927, respectively (26, 28). They were responsible for instituting treatment protocols and preventive measures.

Malaria operations halted during World War II, but then resumed in 1947 as part of the Philippine Health Rehabilitation Programme, with support from the US Public Health Services. In the 1950s, a national structure for malaria control was established within the DOH (26). From 1953 to 1959, malaria control operations were highly centralized; the Malaria Division provided administrative and technical oversight for all field programme activities undertaken by 30 field units (28, 29). The human resources allocated for national malaria control and, later, eradication efforts amounted to 2 000 employees annually (29). The division, with its specialized structure and function, was responsible for implementing malaria control activities and addressing the increasing number of cases. Annual malaria morbidity was estimated to be 300 per 100 000 population in 1950.

Records indicate that, from 1946 onwards, all provincial hospitals had the capacity for microscopic examination, and that malaria cases were treated with either quinine or chloroquine, as per treatment guidelines. Malaria control measures used in the Philippines during this period included the use of screens and mosquito nets for household protection, and of Paris green, an arsenic-based larvicide. Other environmental management measures such as agro-engineering (i.e. drainage) were used to decrease the number of breeding sites (26, 28, 29).

DDT was introduced by the US Public Health Service on a small scale in 1948 as a temporary vector control measure, with two cycles of spraying annually for three years (26). Since the use of DDT for malaria control was relatively new in the country, WHO sponsored a two-year study (1952–1954) in Mindoro province and found it to be effective in controlling malaria transmission (30). The study's findings formed the basis of the six-year national malaria control plan and contributed to the development of the Global Malaria Eradication Programme (GMEP) launched in 1955. DDT spraying was adopted as the primary vector control measure by the national malaria control programme, which was also launched in 1955 with support from the International Cooperation Administration (26).

Malaria eradication phase (1956–1982)

With the substantial decline in malaria morbidity seen by 1955, the programme shifted from a strategy of malaria control to one of eradication in 1956, consistent with the efforts of the WHO-led GMEP (28). During this time, a number of provinces in the Philippines were declared malaria-free; however, there are no existing records on the declarations or the process behind this certification. Most of these provinces have remained malaria-free since the GMEP era, with only a few small outbreaks in some areas, all of which were successfully controlled. The Joint Philippine-American Malaria Eradication Programme was implemented from 1956 to 1960 (26).

Population movement increased during this period, largely due to resettlement programmes. These programmes were intended to relieve congestion in heavily populated areas in Luzon and Visayas, and were part of the government's land reform programme. Activity in the timber industry also attracted migrant workers from non-malarious provinces to logging camps located in endemic areas (26). These movements likely increased transmission and helped spread malaria, prompting WHO to sponsor a five-year project in 1958 to increase IRS and surveillance.

However, challenges for coordination and implementation arose when the Reorganization Act in 1958 decentralized health services to regional, provincial and municipal levels (26). At the national level, the Malaria Division under the DOH served in a technical and advisory role and was responsible for the formulation of plans, policies, and regulations of the programme for eradication, without direct authority over field staff. The Administrative Services, also at the national level, provided financial, logistical and human resource management support to the division and the regional health offices. Eight regional health offices were created, which had executive responsibility for directing and supervising the programme's operations under the technical oversight of the Regional Malariologist (29). To improve coordination across the different levels of the health system, the Malaria Eradication Committee was created in 1962 (28). With support from USAID and WHO, the International Malaria Eradication Training Centre (METC) was established, and offered courses in administrative and technical aspects of malaria control activities to local and international participants (26, 28).

As gaps in coordination were continuously seen in the decentralized system, a Malaria Eradication Law was passed in 1966 (Republic Act 4832), which called for the creation of the Malaria Eradication Service (MES) with all functions of the malaria control programme consolidated under this central unit (26). The MES operated as a vertical programme with epidemiology, research and training, field operations, and administration divisions. Field operations were facilitated by six area field offices, which were responsible for the coordination and supervision of activities of 36 malaria field units. These

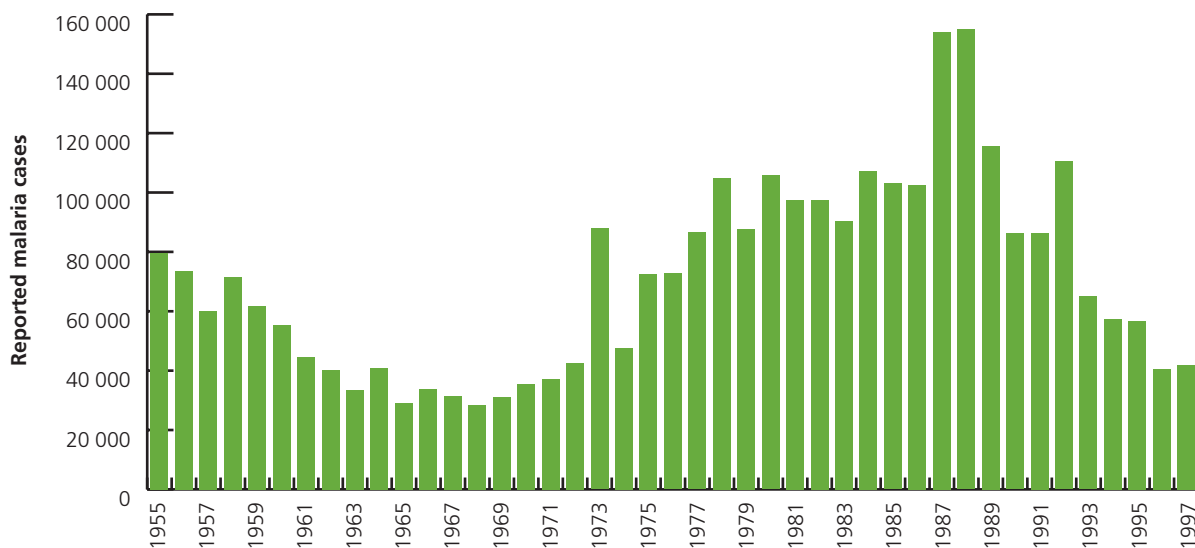
units conducted malaria control activities, including IRS, screening of fever cases, case investigation, and administration of treatment (28, 29). WHO and USAID supported the creation and implementation of the malaria eradication programme activities. Between 1960 and 1970, annual morbidity declined by 50%, from 160 per 100 000 population to 75 per 100 000 population (31).

By 1973, however, progress in malaria control had been slowed due to a combination of political unrest, population movement, and large reductions in financial support from USAID and WHO (26, 28). Political unrest accompanied the expansion of the New People's Army, the military arm of the Communist Party of the Philippines, which had its camps in the remote and mountainous areas of the country (32). Martial law, implemented in 1972, led to the deployment of military personnel all over the country, many to highly endemic areas. Amid these challenges, malaria trainings continued at the METC, facilitated by the national staff of the MES.

In the early 1980s, the malaria programme experienced yet another reorganization. Executive Order no. 851, implemented in 1982 (22, 26, 28) called for the integration of promotive, preventive, curative and rehabilitative components of health service delivery. The aim was to close the widening gap between the public health and public hospital systems. The resulting reorganization at the Ministry of Health (renamed according to the parliamentary form of government at that time) integrated malaria field operations into the Integrated Provincial Health Office (IPHO). Programme resources such as vehicles, equipment, funds and personnel, previously under the central MES control, were now under the purview of the IPHOs (22).

While policy mandated case finding and management to be the responsibility of the RHUs, these activities continued to be carried out by the malaria field staff—RHUs did not have the technical, logistical, or financial capacity to do so. According to key informants from the national programme, this arrangement did not lead to any major changes in operations or malaria conditions in the country.

Figure 3. Reported malaria cases, 1955–1997 (6, 31, 33, 34, 35)



The annually reported malaria cases between 1955 and 1997 are shown in [Figure 3](#). From 1956 to 1982, reported cases increased from 73 560 to 97 531. During that time there was a low of 28 354 in 1968. Relevant factors during this period included the withdrawal of USAID support in 1973 and a period of increased population movement between endemic and non-endemic areas.

Prompt case identification and active surveillance were important programme strategies. DOH field staff, known as malaria canvassers, were tasked with case detection and went from house to house to take blood smears from everyone who had a fever, although it is not known how often this was done (28, 29). Chloroquine was the drug of choice for treatment of both *P. falciparum* and *P. vivax* cases.

DDT was used extensively, with application to all ‘sprayable’ surfaces in houses located in malaria endemic areas (28). DDT use was temporarily discontinued in 1958, for reasons that are not clear, but was resumed one year later. Dieldrin was also used in limited scope, but with the confirmation of resistance of *An. flavirostris* in the same year, DDT was used to continue IRS operations (38).

Malaria control phase (1983–1998)

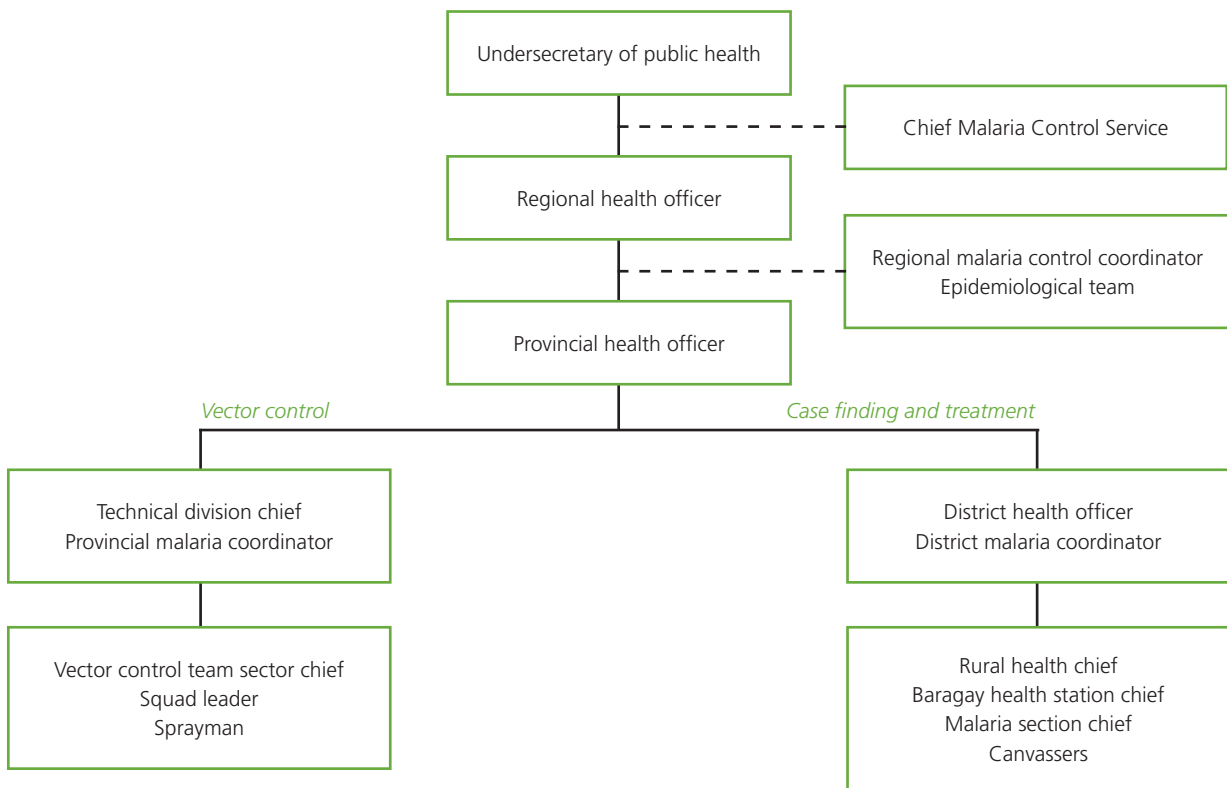
As external funding resources declined, and based on WHO recommendations, the programme modified its objective in 1983 from malaria eradication to control (26, 28). Malaria morbidity at this time was high—106 cases per 100 000 population (6)—and with limited programme funding, the probability of successfully eliminating malaria was believed to be low. At the same time, resurgences of malaria across many countries pointed to the failure of achieving global eradication targets.

National leadership changed in 1987, translating to further changes in the health system. The MOH again became the “Department of Health” and Executive Order 119 reinforced the decentralized structure, distributing its functions among the various units (22). The MES was renamed the Malaria Control Service (MCS) and placed under the Office for Public Health Services. Its mandate was policy formulation, standards developments, programme development, monitoring of disease control and service delivery programmes implemented by field offices, and technical advisory, specifically with regard to training and research (26).

The MCS consisted of 12 regional malaria coordinators, 70 provincial coordinators, and 1 530 municipal malaria coordinators (23). The programme was semi-vertical in organization, still operating within the context of Primary Health Care, but with the IPHOs responsible for vector control and the district health units responsible for diagnosis and treatment (see Figure 4 for the organizational structure for malaria control at the provincial level, 1987 to 1993).

During this period, the provincial and municipal health offices were not prepared to implement malaria control activities. There was limited funding for commodities, operations support, or capacity building for local health offices. The reporting system also needed improvement, as many cases were reported without laboratory confirmation (23, 28). As a result, there was a major increase in reported cases in 1987 and 1988 and in 1989 there were 115 542 reported cases (6).

Figure 4. Organization of malaria control, province level (23)



From 1993 onwards, malaria control activities operated in the context of health system devolution. The enactment of the Local Government Code of 1991 decreed the transfer of authority and responsibility for health service delivery from the DOH to LGUs (22). While the intention was to decentralize authority to local governments, thereby empowering them, there was no direction given to municipal health officers on how to manage the disease control programmes. As a result, provincial and municipal officials were not able to provide the necessary support to the local health sectors (23, 36). Because of this confusion, the NMCP of the DOH, while devolved, retained malaria field personnel as part of new offices, called Regional Health Offices. The DOH also maintained control over programme resources, as funding for malaria control came from the national level.

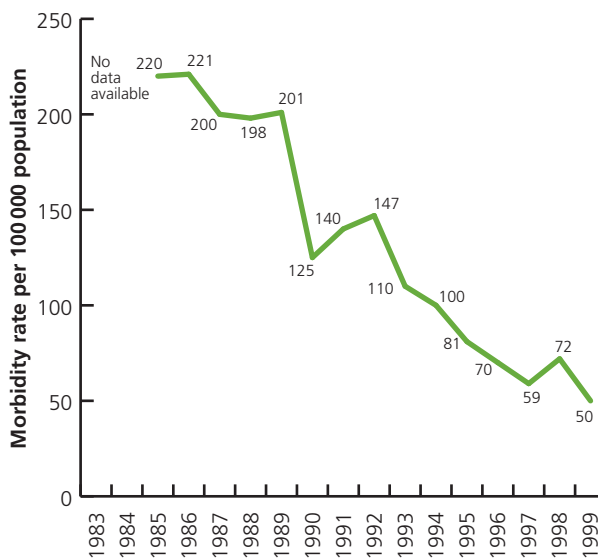
The national DOH continued to be responsible for provision of technical support at all levels, policy formulation and standard-setting. The Regional Health Offices, which were largely autonomous, provided logistical support and maintained authority over fund allocation for the programme, including human resources (23, 29). This organization contributed to the general perception that malaria control was the main responsibility of the DOH and not of the LGUs.

From 1989 to 1993, the programme received substantial logistical and financial support from the Philippine Health Development Project (PHDP), particularly for vector control and case finding (28, 37). Funded by World Bank, the PHDP was a comprehensive effort to assist the DOH in the improvement of disease control, field health service delivery and institutional capacity building. The objective of the malaria component of this project was to reverse the resurgence of malaria that occurred in the 1980s, targeting the challenges that arose during the integration of the programme into the decentralized health system (37). Of overall expenditures of US\$ 68.2 million for the PHDP, 6% was spent on the malaria control component (37), particularly on hiring of canvassers for case-finding, mobilization of IRS teams, procurement

of insecticides and production of information, education, and communications (IEC) materials. However, the project was hampered by delayed supply procurement, increasing costs of insecticides, gaps in institutional capacity, and the lack of counterpart funds from the LGUs to hire spray teams. Changes in DOH management—a total of six different DOH secretaries with different priorities created further obstacles. Overall, it was found that vector control was poorly managed and case finding did not increase as a result of the PHDP (37).

Figure 5 summarizes the trends in malaria morbidity from 1983 to 1999. During the period of malaria control (1983 to 1989), cases were at levels higher than during the previous period of eradication. However, from 1989 to 1998, there was a 64% reduction in malaria morbidity. There was a decline in malaria incidence from 14.2 per 1 000 population at risk (1989) to 5.7 (1993) (6, 38). The influx of people coming from malaria endemic countries, including Cambodia, Lao PDR, and Vietnam, into the Philippine Refugee Processing Center in Morong, Bataan (operational from 1980 to 1990) contributed 1 921 cases from 1984 to 1988 (39, 40).

Figure 5. Annual Malaria Morbidity, 1983 to 1999 (6)



In 1992, the Philippines was among the 96 countries that endorsed the new global strategy for malaria control. The strategy was a global movement to halve the burden of malaria through early diagnosis and prompt treatment, use of selective and sustainable preventive measures including vector control, prevention and containment of epidemics, and strengthening of local capacity for basic and applied research for the regular assessment of a country's malaria situation (41).

Extensive research was done to pilot strategies before adoption by the programme. Various vector control measures were applied, depending on the malaria stratification category of the area (Table 1). For IRS, research was conducted to find new insecticides after a country-wide ban on DDT. Supplementary vector control measures such as stream clearing and stream seeding with larvivorous fish were also implemented (28, 38).

Table 1. Vector control methods according to stratification of areas, 1996 (42)

Stratification category	Definition	Vector control method employed
Malarious A	<ul style="list-style-type: none"> • equal to or greater than 2% SPR, high transmission • mountainous, forested, less developed agriculture • mobile population, seasonal movement due to socio-economic activities, poor housing conditions 	ITN
Malarious B	<ul style="list-style-type: none"> • greater than 2% SPR, high transmission • forest fringes, foothills, agriculturally developed, plains, coastal • more or less stable population, good housing conditions 	IRS
Epidemic prone areas	<ul style="list-style-type: none"> • less than 2% SPR, low transmission • any topography • more or less stable population 	two-cycles in six-month intervals

Diagnosis by microscopy was conducted by trained medical technologists, mainly located at hospitals (43). Presumptive diagnosis was still practiced, but only in locations where microscopy was not available. National policy discouraged presumptive treatment and encouraged administration of appropriate antimalarial drugs for confirmed cases. As it was no longer seen as cost-effective, ACD was discontinued (43).

P. falciparum infections were treated with chloroquine. Sulfadoxine-pyrimethamine (SP) was the second-line drug, and quinine was reserved for severe or complicated cases or those unresponsive to chloroquine and SP. Single-dose primaquine was also recommended for all *P. falciparum* cases, with a dosage of 0.9 base/kilogram body weight (15 mg base/tablet). Glucose-6-phosphate dehydrogenase (G6PD) deficiency screening has been conducted in health facilities for newborns since the mid-2000s, but the coverage of screening is still limited. In addition, G6PD prevalence surveys were undertaken in 1964 and 2003 among males, with a range of 5.7–6.6% prevalence found. *P. vivax* cases were treated with chloroquine and a 14-day regimen of primaquine (43).

In 1996, during the period of devolution, the country adopted strategies associated with the WHO Global Malaria Control Strategy (41) for diagnosis and treatment, vector control, stratification and epidemic management (43, 44, 45). Guidelines and procedures were established for surveillance and outbreak response, and hospitals, RHUs and microscopy centres were identified in malaria endemic municipalities to be used as sentinel sites and sources of information for outbreak forecasting. The public health nurse in RHUs, the municipal malaria coordinator in hospitals, and the medical technologist/malaria microscopist in malaria microscopy centres, were responsible for the consolidation and analysis of malaria data. In the event of an outbreak or epidemic, the following actions were prescribed: mass malaria testing; immediate case confirmation and follow-up; ITN treatment; focal spraying; stream clearing; and intensive IEC (45).

In order to provide additional cover, ITNs were also introduced in 1996, to be used in conjunction with ongoing IRS. There is no data on the coverage rate for ITNs during this period (44).

In November 1997, after a year of intensive local and national consultation, a malaria elimination strategy was launched with the goal of a malaria-free Philippines by 2020. To inform the new strategy, stratification of malaria transmission was carried out, as well as an evaluation of the malaria status in several provinces where no indigenous cases had been reported since the 1970s. In light of overall case declines and the absence of recorded malaria over several consecutive years in provinces not yet declared malaria-free, the national programme undertook evaluations of all provinces from 1997 to 1998 to identify those that were malaria-free. The absence of indigenous malaria cases for five consecutive years was used as an indicator of successful malaria elimination in province. By 2001, 13 provinces were considered malaria-free.

Malaria control in the period of health sector reform (1999–2007)

The Health Sector Reform Agenda (HSRA), initiated in 1999, sought to address gaps that existed in the fragmented health care delivery system (22). The agenda informed policy for the creation of disease-free zones, including the mandate to pursue malaria elimination. In addition, the HSRA granted fiscal autonomy to government hospitals, provided government funding for priority health programmes which included malaria control, promoted the development of local health systems, strengthened the capacity of health regulatory agencies, and expanded coverage of the National Health Insurance Program (22). At the same time, the National Objectives for Health set the goals and objectives for the health sector for 1999–2004 (46). The goal for malaria was the reduction of cases to a point that it would cease to be a public health threat and a socio-economic burden, or a state of controlled low-endemic malaria.

These reforms were issued along with yet another reorganization of the national DOH. Executive Order

102 placed the NMCP under the Center for Infectious Diseases, which was part of the National Center for Disease Prevention and Control (28). NMCP responsibilities did not change significantly and comprised policy development, provision of technical assistance through training and research, and development and enforcement of policies and standards for malaria control. The Regional Health Offices became Centers for Health Development, or CHDs. Instead of maintaining control over resources, funding and technical aspects of the programme, the CHDs were tasked with facilitating collaboration with LGUs and communities to ensure access to services as well as their efficient delivery. RHUs were responsible for the delivery of malaria diagnostic and treatment services along with other standard health programmes (28).

The NMCP benefited from multiple sources of external support (47, 48, 49). DFAT provided funding for the Agusan del Sur Malaria Control Project from 1995 to 2000. The Roll Back Malaria (WHO-RBM) Project of the WHO Philippines Country Office, which was also funded by DFAT, covered three municipalities in the Davao Region in Mindanao in 2000, and was later expanded to 14 additional Mindanao provinces (2004 to 2007). During the expansion and consolidation phase, Rizal province and the Visayas region were added. The WHO-RBM Project played an important role in shaping and developing the new malaria control and elimination programme in the Philippines, working in close collaboration with national and local programme entities and partners to provide strategic technical inputs and capacity building support in key areas, and introducing and piloting new strategies. Examples of new approaches that were introduced and subsequently scaled up, included electronic case-based reporting through the Philippines Malaria Information System (PhilMIS); piloting the use of malaria rapid diagnostic tests (RDTs); setting up proficiency training and quality assurance systems (QAS) for malaria microscopy; setting up routine malaria drug efficacy testing; establishing cross-border operation activities; and supporting community-based malaria control activities.

In 2002, the Philippines was awarded a US\$ 11 million grant from GFATM to support control efforts in the 25 most endemic provinces (50). The additional resources augmented the yearly allocation of PhP 3.4 million (US\$ 67 393) from the national budget in 2002 (51).

In the following years, the Philippines secured three more GFATM grants for malaria control: Round 5, which covered the five most endemic provinces (2006); Round 6, which covered 25 provinces (2007); and the Rolling Continuation Channel (RCC) grant, which covered 25 provinces and ten additional project sites in endemic municipalities not originally included in previous grants (2009 to 2013) (50, 52). These three grants were consolidated into one in 2010, with anticipated completion by the end of 2014.

During this period, the NMCP began to use cases per 1 000 population to measure the national morbidity rate, instead of cases per 100 000 population (see Figure 6). While the morbidity rate generally decreased from 1999 to 2001, outbreaks occurred across 11 provinces during 2000–2001, and malaria re-emerged in three provinces in early 2002. Between 2000 and 2005 there was a 15% increase in malaria morbidity (7). However, the morbidity rate again began to decline in 2006 and has continued this trend up to the present (7).

Figure 6. Annual Malaria Morbidity (cases per 1 000 population), 2000–2011 (7)



Mobile populations, both from within and outside of the country, contributed to malaria transmission during this time. Workers from across the country, including from endemic Mindanao province, arrived at a new logging camp that was established in 2005 in Luna, Apayao. The subsequent closure of the logging concession in 2008 may have been related to a drop in cases. In addition, anecdotal reports traced the 2007 malaria outbreak in San Pablo City and Alaminos municipality in Laguna province to loggers arriving from the neighboring province of Quezon. An outbreak of malaria also occurred in Barangay Cawag in Subic, Zambales from 2007 to 2010 when migrant domestic workers were employed as construction workers in shipyards (53).

The increase in external funding for malaria control led to the expansion of diagnosis and treatment services, and the scaling up of vector control coverage and of malaria awareness campaigns (50, 52). The national strategy during this time period included: early diagnosis and effective treatment; capacity building for RHU, hospital and barangay health workers; ITN distribution and uptake; continued IRS for containment and other supplementary vector control measures; and outbreak response training (43, 44, 45). Procurement of ITNs was supported by GFATM, WHO-RBM, and later by the DOH. LLINs replaced ITNs by 2005, with a goal of 80% coverage of households in endemic areas. Focal IRS was used as an outbreak response measure and by 2007 was expanded to areas with adequate LLIN coverage with persistent transmission. In every endemic municipality of the GFATM-supported provinces, medical technologists underwent basic malaria microscopy training (50, 52).

Beyond supporting the scale-up of interventions, the GFATM grant also expanded the reach of the malaria control programme by creating greater local ownership. Through the grant process, local-level stakeholders discussed the importance of taking control of their programmes and became more engaged and proactive than before. As a result, targets for malaria morbidity and mortality reduction set in 2003 were successfully achieved by 2007.

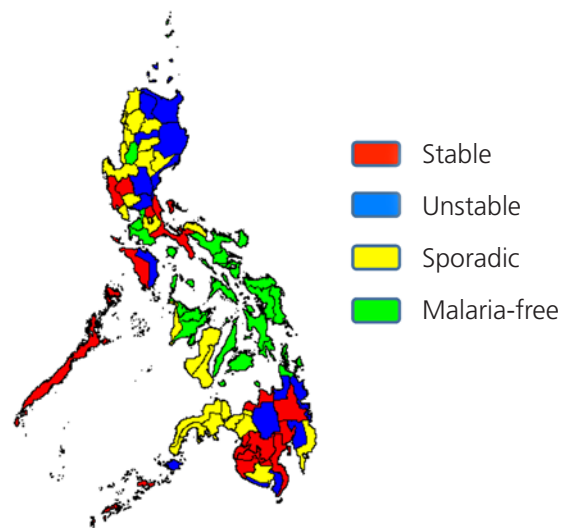
Moving from control to elimination (2008 onwards)

In recent years, the NMCP has been affected by major health sector reforms, changes to the annual malaria budget, and adoption of a subnational malaria elimination initiative. Five provinces (Palawan, Tawi-Tawi, Occidental Mindoro, Zambales and Sulu) and two cities (Subic and Puerto Princesa City) currently account for the bulk of malaria cases (7, 54).

In 2008, due to several factors, the programme re-oriented towards malaria elimination (9). First, there was a national campaign to establish disease-free zones for leprosy, rabies, schistosomiasis, filariasis and malaria. This initiative was part of the delayed health sector reforms, or decentralization through the Health Services Reform Act (55). The new disease free zones initiative focused attention on malaria elimination and drew in more resources—the malaria control programme budget increased from PhP 63 million (US\$ 1.4 million) in 2008 to PhP 169 million (US\$ 3.5 million) in 2009 (51). The allocation for malaria continued to increase up to 186 PhP million in 2013 (US\$ 4.2 million), and is estimated to be 270 PhP million (US\$ 6.2 million) for 2014 (9, 54). In addition, in 2007, the NMCP reinstated the subnational evaluation process.

From 2008 to 2012, 20 provinces registered a morbidity rate of less than one case per 1 000 population (7, 54). During the same period, ten provinces reported zero cases. In 2010, the DOH adopted a new stratification system, assigning provinces a malaria status of stable, unstable, epidemic risk or sporadic risk, or malaria-free (56). The goal of implementing this new system was to better track local transmission. To assign these risk categories to each province, the DOH reviews monthly malaria data from the barangay level to identify patterns of transmission. In 2010, 29 provinces were considered stable risk, 10 unstable, 18 epidemic or sporadic risk and 23 were malaria-free (57). By 2013, 27 provinces were considered malaria-free (Figure 7 and Table 2) (58).

Figure 7. Malaria stratification in the Philippines, as of 2013



The Philippines was considered vulnerable to malaria transmission during this time, not only as a result of internal migration, which continued, but also because of the estimated 2.2 million Filipinos that work abroad. OFWs returning from malaria endemic countries pose a potential transmission risk, albeit minimal (59, 60)—unpublished records show a total of 20 malaria cases among OFWs in 2012, and 93 cases from 2009 and 2010 (7).

The Malaria Medium-term Development Plan 2011–2016 outlines the strategies for different stratification categories (Table 3) (9). It was developed based on an assessment of the malaria control programme from 2002 to 2009.

The Philippines has been one of the first countries to regulate the processes for conferring malaria-free status at a subnational level. This approach has been adopted by the DOH and the NMCP in response to the country's geographical features, namely the fact that the Philippines is composed of many islands and has differing levels of malaria potential across provinces. In general, the island structure of the country limits transmission and vulnerability. As such, starting in 2011, the DOH formalized procedures for assessment and declaration of provincial malaria-free status (61). Policies and approaches for elimination were also developed (62).

Table 2. Stratification Scheme of Malaria Endemic Areas in the Philippines, as of 2013 (58)

Stratum	Definition	No. of provinces	No. of cities
1. Stable risk	With at least 1 barangay that has a continuous presence of at least one indigenous malaria case in a month for 6 months or more at any time during the past three years	15	5
1.1 High	≥1 000 avg. malaria cases from 2007–2009	2	1
1.2 Moderate	100 to <1 000 avg. malaria cases from 2007–2009	8	3
1.3 Low	<100 avg. malaria cases from 2007–2009	5	1
2. Unstable risk	With at least 1 barangay that has a continuous presence of at least one indigenous malaria case in a month for less than 6 months at any time during the past three years	15	4
3. Epidemic risk or sporadic risk	With at least 1 barangay that has a presence of at least one indigenous malaria case at any time in the past 5 years	23	3
4. Malaria free	Absence of indigenous malaria case for 5 past years even in the presence of malaria vector	27	0
Total		80	12

The process of subnational elimination in the Philippines is possible because of the country’s strong national elimination strategies and policies and the stratification system that concentrates efforts on filling gaps in coverage and identifying efficient interventions to allow elimination of malaria in low endemic provinces. There is also continuous malaria monitoring and surveillance in the country. Another key factor is the sustained political will for subnational elimination, both from the community and from the national government. This includes a commitment to, and an understanding of, the requirements for malaria elimination in low endemic provinces.

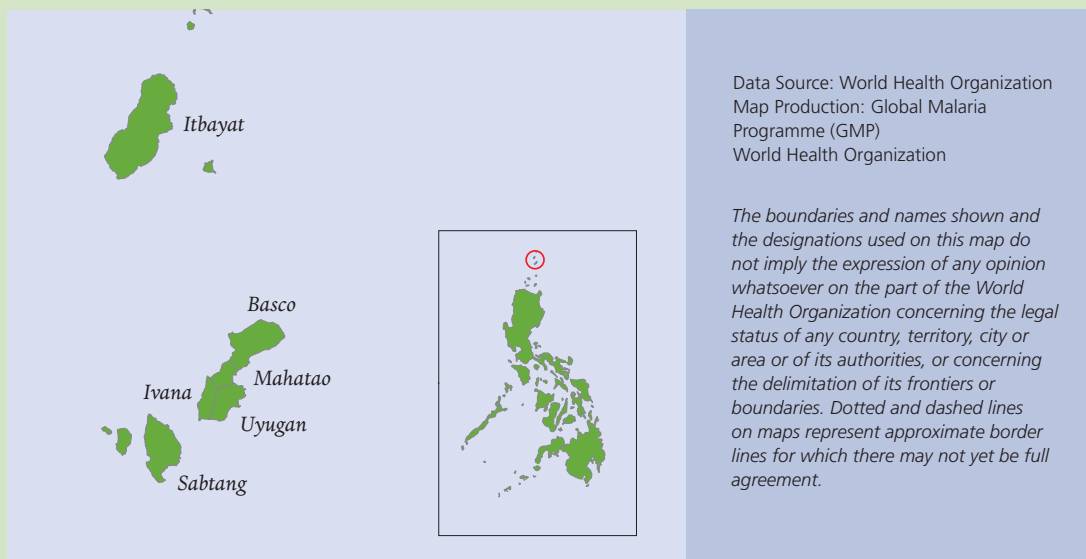
A malaria-free province is defined as “a province where there is no continuing local mosquito-borne transmission and the risk of acquiring the disease is limited to introduced cases only” (61). An evaluation team conducts the assessment of malaria-free status. The report of the evaluation is submitted to the national malaria Technical Working Group (TWG) in Manila, which may or may not confer malaria-free status. The TWG is composed of representatives from academic institutes, the Research Institute for Tropical Medicine (RITM), local government offices, the WHO Philippines Country Office, GFATM Principal Recipient, and the Asian Collaborative Training Network for Malaria (ACTMalaria) (61). References and criteria used in the evaluation process are detailed in [Annex 3](#). The subnational certification evaluation processes for Batanes and Cavite Provinces are documented in [Box 1](#).

Table 3. Malaria Prevention and Control Strategies and Interventions, by stratum (9)

Stratification categories	Stratification of areas			
	Stable transmission	Unstable transmission	Sporadic transmission	Malaria-Prone
Strategy	Scale-up	Pre-Elimination	Elimination	Maintenance
A. Clinical Surveillance				
1. Active case detection (ACD)	-	Screening and treatment, at least monthly	Reactive case detection, case investigation	Case investigation
2. Passive case detection (PCD)	√	√	√	√
3. Mass blood survey (MBS)	-	-	Once a year	-
B. Diagnosis and treatment				
1. Diagnosis	Microscopy, RDT	Microscopy, RDT	Microscopy	Microscopy
2. Treatment	√	√	√	√
C. Prevention and vector control				
1. Insecticide-treated net (ITN)	100% of families (1 net to 2–3 persons)	100% of families (1 net to 2–3 persons)	100% of families (1 net to 2–3 persons)	100% families (1 net to 2–3 persons) in case of epidemic
2. Indoor residual spraying (IRS)	100% of houses (no malaria reduction despite high ITN coverage for 1 year)	100% of houses (only for epidemic, displaced populations, or if ITN is not acceptable)	100% of houses (for epidemics, displaced populations)	100% houses (in case of epidemic)
3. Environmental management	where appropriate	where appropriate	where appropriate	where appropriate
4. Biological control	where appropriate	where appropriate	where appropriate	where appropriate
5. Personal protective measures during night time activities	√	√	√	√
6. M&E	Entomological assessment (bioassay and susceptibility tests)	Entomological assessment (bioassay and susceptibility tests)	Entomological surveillance (spot check for presence of active breeding streams and local vectors) at least semi-annually	Entomological surveillance (spot check for presence of active breeding streams and local vectors) at least annually
C. Health promotion				
1. Health education	√	√	√	√
2. Community organizing	√	√	√	√
3. Advocacy	√	√	√	√
4. Multi-sectoral collaboration	√	√	√	√
D. Capacity building	√	√	√	√
E. Local health system strengthening	√	√	√	√
F. Evaluation	√	√	√	√

Box 1. Evaluation of the malaria situation and antimalarial operations in Batanes and Cavite Provinces

A. Batanes: Understanding the subnational malaria elimination certification process (63, 64, 65)



The Province of Batanes, (219 km²) is a tourist destination with a population of 16 000 people. It is comprised of 10 islands, between the islands of Luzon and Taiwan. The terrain is hilly and mountainous with sporadic flat areas on the coasts, with a subtropical climate. *P. vivax* and *P. falciparum* have been recorded in Batanes. Indigenous malaria cases were concentrated mainly in the island of Itbayat, where an outbreak occurred in 1948.

From 1991 to 2000, a total of 128 malaria cases were reported, predominantly in one barangay of Itbayat. Since 2001, four malaria cases have been recorded: two imported from Cagayan (one mixed infection of *P. vivax* and *P. falciparum*, and one of *P. vivax*), a nearby endemic province; one fatal case of *P. falciparum* in 2003 from San Rafael barangay in Itbayat, of unknown origin; and one *P. vivax* case not epidemiologically classified, detected in Basko in 2006. Since then, no malaria cases—imported or autochthonous—have been recorded.

Current anti-malaria activities in Batanes include:

Epidemiological surveillance. Febrile patients are RDT-tested—as of 2012 only RDTs were used in the province—through PCD only. Patients are only tested for malaria when a dengue test is negative, which may cause serious delays in diagnosis and treatment. ACD may be useful to better understand case definition. From 2009 to 2011, 344 patients were tested for malaria.

An epidemiological investigation is conducted for each case; however, some malaria cases have not been successfully classified due to missing epidemiological data in the forms.

Vector control and entomological surveillance. The primary vector in the province is *An. flavirostris*, although its density is found to be low, and *An. ludlowae* is present in Basco. Vector control operations are limited since no malaria cases have been found since 2006. Some vector control

operations, including LLIN distribution to every household and limited IRS and stream clearing, have been scaled up since 2010, when a dengue epidemic occurred.

Measures to prevent reintroduction of local malaria transmission. Malaria vulnerability and receptivity in Batanes are considerably low. There is no major population movement and no land borders with malaria endemic areas. However, there is migration from endemic areas of the Philippines, mainly from Cagayan, into Batanes

for work (e.g. construction, fishing), school or tourism. Routine surveillance is carried out, but no response measures have been developed.

Malariogenic potential is low in Batanes and, combined with the lack of malaria cases since 2006, indicates that current malaria transmission in the province is unlikely. Vigilance must be maintained, however, and malaria surveillance should be strengthened, and a plan of action for prevention of reintroduction should be developed.

B. Cavite: Preventing reintroduction after being declared malaria-free (66, 67, 68, 69)



Data Source: World Health Organization
Map Production: Global Malaria Programme (GMP)
World Health Organization

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

The province of Cavite (1 427 km²) is located on the southern shores of Manila Bay in the Calabarzon region of Luzon. It is surrounded by Laguna to the east, Metropolitan Manila to the northeast, Batangas to the south and the South China Sea to the west. It is mostly comprised of coastal plains. Cavite has two seasons—a relatively dry season from November to April and a wet season from May to October. The province is highly

urbanized and industrialized with export processing zones; it is also a tourist destination. Cavite has an estimated population of 3.3 million (2012), making it the most populous and the second most densely-populated province in the country.

Cavite province was declared malaria-free in 2007 after a 2006 evaluation of the malaria situation and activities. The last indigenous cases were reported

in 2000 (3 cases, species unknown) in Sapang barangay. From 1999 to 2004, 1–2 imported cases were recorded annually from known endemic areas in other provinces. From 1999 to 2005, between one and 183 slides were examined in the province per year (median 139.5).

An. flavirostris is the primary vector and *An. maculatus* the secondary vector. From 1999 to 2002, limited IRS and ITN distribution occurred and then, from 2003 onwards, the only intervention was stream clearing. Limited breeding sites and a low density of vectors were found in the last endemic barangays. In some areas, environmental change, including pollution, had greatly reduced or eliminated malaria vectors.

During the period 2007–2010, a total of 10 imported cases from abroad (Nigeria and Madagascar), and from malaria endemic areas in the Philippines (Palawan), were reported. There was one case of probable transfusion malaria detected in 2008 in a 48-year-old woman residing in an area of the province that was not considered receptive. She had received blood from nine donors, two of whom were from endemic Quezon province. Among these imported cases, neither introduced nor indigenous cases were detected.

Present anti-malaria activities include:

Epidemiological surveillance. In 2007 to 2010, ACD (household visits) was conducted in two remaining foci (municipalities of Maragondon and Ternate), with 20 to 313 slides collected from febrile persons per year. Malaria cases were investigated with a short, free-format case investigation report. Generally, the information collected was sufficient to prove that the cases could not be indigenous. Screening of blood donors was

performed on some occasions. During the case investigation in 2008, however, donors were not investigated and, instead, 300 people were screened near their residences. Testing the blood donors would have identified the source of infection. PCD through examination of persons with fever is limited mainly to rural areas. All cases are confirmed microscopically. A database on malaria cases is maintained at a provincial level.

Vector surveillance and control. There is no provincial entomologist, so the province is partially covered by the regional entomologist. Vector control is limited to promotion of the consistent use of ITNs and/or house screening.

Measures to prevent reintroduction of local malaria transmission. Malaria receptivity and vulnerability in Cavite province appear to be low. However, some risk factors may prove challenging. These include: labour movements from endemic provinces; the presence of indigenous population groups who have a nomadic lifestyle and limited access to health services; and the presence of a Marine military training base with arrivals from all over the country every six months.

No indigenous cases of malaria have been found since Cavite was declared malaria-free, despite the diagnosis of several imported cases and the implementation of ACD in receptive areas. To ensure that Cavite's malaria-free status is maintained, a provincial plan to prevent the reintroduction of malaria should be developed, and should be focused on vigilance and on maintaining surveillance.

A comparison of subnational elimination approaches for Batanes and Cavite can be found in [Annex 4](#).

In 2010, 23 provinces were declared malaria-free, and by 2012 they were joined by four more, bringing the total number of malaria-free provinces to 27 of the country's 80. These provinces are listed in [Box 2](#) (54, 70).

In 2009, guidelines on the diagnosis and treatment for malaria mandated the use of artemether-lumefantrine combination as a first-line drug for uncomplicated *P. falciparum* cases (71). Primaquine single-dose is given on the fourth day of treatment. Quinine is given for cases unresponsive to first-line treatment or in cases of severe malaria. The treatment for *P. vivax* infection remains three days of chloroquine and 14 days of primaquine (daily dose of 0.25 mg/kg). The NMCP introduced a Manual of Procedures (MOP) in 2010, stipulating malaria microscopy as the main diagnostic tool, and use of RDTs if microscopy services are not available (56). The guidelines identified the vector control methods to be applied for each category of stratification. LLINs remain the main vector control strategy in all areas. IRS is used as a supplemental control measure to be applied during

epidemics; among displaced populations; in areas where use of LLINs is not culturally acceptable; or in stable transmission areas where malaria transmission does not improve over a one-year period despite 100% LLIN coverage (56).

Box 2. Malaria-free provinces of the Philippines, 2013

Albay, Aklan, Batanes, Batangas, Benguet, Biliran, Bohol, Camarines Sur, Camiguin, Capiz, Catanduanes, Cavite, Cebu, Eastern Samar, Guimaras, Iloilo, Marinduque, Masbate, Northern Leyte, Northern Samar, Romblon and Dinagat Islands, Siquijor, Sorsogon, Western Samar, Southern Leyte, and Surigao Del Norte.

FACTORS CONTRIBUTING TO CHANGE IN THE MALARIA SITUATION

How did the Philippines maintain malaria control from 1950 to 1999?

Over time, malaria incidence and mortality rates in the Philippines have been influenced by programme strategies and by availability of resources, the organizational structure of the health sector, programme policies, and climatic and environmental factors (23, 72). The history of malaria in the Philippines must also be viewed in the context of the organization and development of the health sector, with socio-economic and political forces impacting programme policies and directions.

STRATEGY, POLICY, AND LEGISLATION

Policy support through the Eradication Law (1966) enabled extensive coverage of IRS during the eradication period and substantially contributed to sustained reductions in malaria incidence (28). During this period, the centralized structure and allocation of funds by the national government, mandated by law, facilitated the smooth operations and flow of command from the national DOH down to the local level, where malaria control activities were implemented (23, 28). In contrast, DOH reorganization in the 1960s, coupled with population migration and insecticide resistance, resulted in the disruption of malaria case declines achieved in the previous decade. Coordination of field implementation of malaria control between the national and regional health offices proved to be a challenge in this new decentralized structure (23, 28).

Challenges with decentralization also emerged with the passage of the Local Government Code of 1991. While health service delivery was devolved to the LGUs, the NMCP continued to function under a semi-vertical structure—an arrangement that hampered operations and

failed to foster a sense of ownership of the programme by LGUs. Both the LGUs and the DOH believed that malaria control was the responsibility of the national government (22). The HSRA, instituted in 1999, attempted to address this fragmentation of health services delivery. Moreover, the HSRA provided the policy directive for the creation of disease-free zones, including the mandate to pursue malaria elimination (22).

VECTOR CONTROL

IRS has been a cornerstone of malaria control strategy throughout the programme's history. Wide coverage of IRS with DDT—an estimated 1.2 million houses and six million people protected, or 22.8% coverage of the total population in 1960—likely contributed to the large decline in cases in the 1950s to early 1960s (73). DDT spraying was done twice a year for three consecutive years, after which it was only used in areas with persistent foci of transmission. IRS was later confined to settlement fringes, but upon WHO evaluation and a rise in number of cases in areas where spraying was discontinued, it was resumed in 50% of risk areas by 1959 (23).

In 1991, spraying operations were impacted by weakened coordination between administrative units as a result of decentralization. BHWs were assigned to implement IRS and target areas were prioritized according to morbidity rate. Yet, less than 20% of targeted areas were covered with IRS activities (23, 29).

National government financial support increased, starting in 1990, when PhP 24 million (US\$ 556 996) was allocated for an estimated 1 000 tons of DDT, making two cycles of spraying per year possible. This helped the programme achieve 76% coverage of targeted areas (6, 28).

IRS was also complemented by intensified community-level environmental management strategies, such as stream clearing. Structural changes and additional support from national government resulted in the control of epidemics and stabilization of transmission.

IRS continues to be a priority strategy, with alternative insecticides such as fenitrothion, bendiocarb, deltamethrin, cyfluthrin and lambda-cyhalothrin used since the ban of DDT. The strategy for IRS was further refined, starting in 1988, with two cycles recommended in areas where the morbidity rate was more than 10 per 1 000 population and one cycle in areas with a morbidity rate between 5–9 per 1 000 population. Focal spraying was recommended in areas with a morbidity rate of less than 5 (23, 44). Spraying was scheduled to take place before seasonal peaks of malaria transmission, but frequently this did not occur due to delays in funding for spraymen and lack of training, which resulted in poor quality of implementation (28).

ITNs were first distributed in 1996 (44). Compared to IRS, they provided a more cost-efficient means of individual protection. It is not known how many were distributed, but it is clear that it was not on a wide scale due to limited programme resources. The guidelines on net distribution developed in 1996 apportioned ITNs to the Malarious A and Malarious B areas (Table 1). Initial observations, though, indicate that ITNs were potentially suitable as an alternative to residual spraying (44). During this time, the programme was already looking for another vector control strategy to replace the better established, but costly, IRS. Supplementary vector control activities such as stream seeding and stream clearing were also implemented, but had limited impact due to inconsistent use.

ENTOMOLOGICAL SURVEILLANCE

An. flavirostris was established as the most prevalent species as early as 1957. Many entomological studies were conducted from 1915 through the early 1980s on the biology and bionomics of *A. flavirostris*, particularly in relation to its control (73, 75).

From the late 1980s till the early 1990s, the programme also conducted studies on the efficacy and comparative effectiveness of alternative insecticides for use in spraying, and on the use of nets impregnated with deltamethrin and permethrin (5, 32). Results of these studies provided important information in characterizing the distribution pattern of the primary and secondary vectors in the country, as well as guidance in the selection of appropriate insecticides and use of ITNs.

PARASITOLOGICAL SURVEILLANCE

Malaria microscopy was the main method of parasitological confirmation. According to DOH staff, during the period of integration into the primary health care system, ACD and treatment were the responsibility of malaria canvassers (DOH field workers). Hospital medical technologists performed microscopic examination, but laboratory confirmation, until recently, was not available in remote areas, which were often the most endemic. Many RHUs did not have trained microscopists, and of those that did, microscopists were employed only on a casual basis based on the availability of funds (28).

In the late 1980s to early 1990s, malaria staff regularly tested 10% of the endemic populations each year—a practice dating back to the eradication period for ongoing surveillance. Many malaria tests were conducted, placing a burden on microscopists (29). Guidelines issued in 1996 on diagnosis and treatment of malaria discouraged this practice and recommended a more strategic approach to PCD with the establishment of malaria diagnostic posts (43).

LABORATORY SUPPORT

A central verification laboratory based at the DOH and validators at the regional health offices monitored the quality of microscopy during the eradication period. The validator positions were discontinued during the control phase, however, because of a lack of resources and trained personnel to conduct the work. Logistical support, including provision of laboratory supplies, was provided by the DOH (28, 29).

CASE MANAGEMENT AND REPORTING

The drug of choice for microscopically confirmed *P. falciparum* malaria cases during the eradication period was chloroquine, which was initially given presumptively, with the addition of primaquine as a gametocytocidal treatment (28). *P. vivax* cases were given chloroquine and a 14-day course of primaquine. The practice of presumptive treatment and easy access to antimalarial drugs may have contributed to the decreased effectiveness of these drugs (76).

With the shift from eradication to control, chloroquine remained the first line of treatment, with SP as second-line and quinine as third-line treatments. Drugs were dispensed by health staff at the barangay health station, RHUs and hospitals (29). The lag time between performing a blood smear, microscopic examination and delivery of results often resulted in presumptive treatment (28).

In 1996, during devolution, the Philippines adopted strategies associated with the GMCP (41) that met standards for diagnosis and treatment, vector control, stratification and epidemic management (43, 44, 45). Cases reported by the RHUs, hospitals, barangay health stations and malaria microscopy centres were then forwarded to the regional health offices for consolidation, and subsequently submitted to the national DOH. An external review of the programme conducted in 1993 noted that the information system was functioning well, although it was structured more toward planning and resource allocation rather than towards generating epidemiologic information. Data analysis was also limited since basic demographic data of cases was not recorded (26).

OUTBREAK MONITORING AND RESPONSE

The NMCP, in coordination with the National Epidemiological Center and LGUs, was charged with outbreak response. Since 1996, responsibility for responding to outbreaks and epidemics has been with the hospitals and microscopy centres in malaria endemic municipalities, which are considered sentinel sites (45). Response measures include conducting mass malaria testing, immediate case confirmation and follow up, vector control measures, and IEC.

HEALTH EDUCATION AND COMMUNITY MOBILIZATION

Community education was emphasized during the 1990s. Print materials such as flipcharts were developed as aids, and malaria programme staff were mobilized to train BHWs in community education (28). Early community mobilization efforts were documented in Camarines Norte in the late 1980s. In this province, a Malaria Surveillance and Vector Control Council (MASUVECCO) was organized to screen febrile patients, conduct mass treatment, undertake stream clearing and health education, and distribute bednets. The mobilization of barangay officials, BHWs and community members was found to be successful through increased vigilance of malaria transmission and reduction of breeding sites (28). Malaria incidence reportedly declined in the barangays where MASUVECCO was piloted, and the programme was later adopted in all malarious areas in the region, as well as in northern Mindanao.

EXTERNAL SUPPORT AND COLLABORATION

USAID and WHO provided funding to the NMCP in the early years of the eradication period until 1973, when the former agency withdrew funding and the latter reduced its support (26, 28). The PHDP, implemented from 1989 to 1993 with funding from the World Bank, made additional resources available for case finding and spraying. However, weaknesses in the government procurement system and fiscal processes resulted in underutilization of funds and failure to maximize this external support (28, 37). Smaller bilateral projects provided additional funds, but only in isolated instances of assistance (31).

CROSS BORDER COLLABORATION

Malaria control activities, such as blood smears and treatment, net distribution and health education, were conducted simultaneously along the border barangays of the Central Luzon provinces of Aurora, Isabela, Quirino, Nueva Vizcaya and Nueva Ecija, where many malaria cases were found. The border operations involved detailed planning and coordination and adequate logistic support across provinces (28). This resulted in a decline in cases, prompting other provinces, including

the Mindanao provinces of Misamis Occidental and Zamboanga del Sur, to follow suit.

PROGRAMME MANAGEMENT

Programme management of the DOH was influenced by policies and strategies that were implemented between 1954 and 1980. The primary health care approach in 1982 intended to maximize financial and human resources and bridge the gap between public health and hospital services (22). However, the decentralization and inclusion of malaria control in the IPHOs did nothing to equip the local health staff at the municipal level to conduct malaria control activities, leading some RHUs to resist taking on responsibility for programme management. Malaria control personnel responsible for operations remained at the regional and provincial level and were not sent to the municipalities, even if the programme had been devolved, which resulted in low morale amongst staff (29).

The establishment of the METC in the late 1960s by the DOH, with support from WHO and USAID, facilitated the capacity building of local and international malaria technical staff. It honed the expertise of the NMCP staff in clinical and programme management, and in leadership for programme planning and operations management (26, 28).

The passage of the Local Government Code in 1991 improved local participation, the flow of communications, and continuity of activities at the local level. However, the programme was less stable since it was dependent upon the support and priorities of local politicians, who were elected in a three-year cycles (22, 26, 28).

A review of the programme was conducted in 1993, from which findings and recommendations were drawn that formed the basis of the NMCP strategic plan of 1994–1998 (26). The programme designed interventions using on a rigid and static stratification criteria, based solely on malaria morbidity and not on patient age or the geographic and cultural context of the provinces. As such, the major differences across localities in the Philippines were not accounted for. Automatic application of control strategies without room for flexibility to

meet local needs became routine. However, improved stratification guidelines for barangays were issued in 1996 that incorporated prevalence among children 10 years old and under, topography, and socio-economic and cultural conditions (41).

OPERATIONAL RESEARCH

A few studies on knowledge, attitude and practice (KAP) were conducted in the 1980s and 1990s and these provided evidence that general knowledge on the cause of malaria was poor—people attributed infection to the eating of certain fruits or drinking water from the streams, or even to the influence of spirits. Mosquitoes were also implicated, but awareness that mosquito bites transmitted malaria was low (26, 28). The results of the studies helped improve net distribution strategies and the development of appropriate IEC campaigns.

How has the Philippines reduced transmission since 2000?

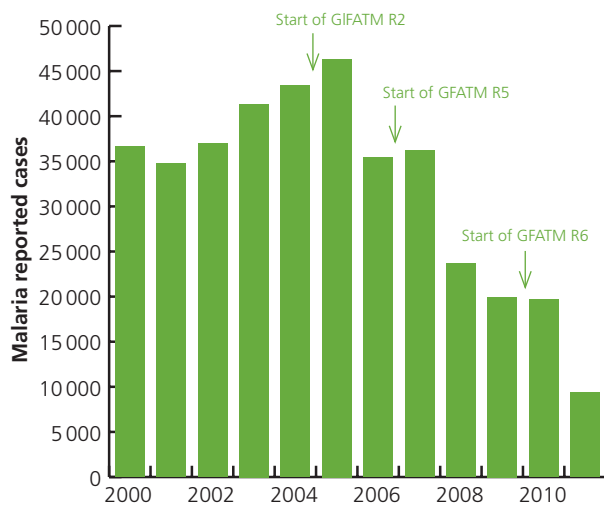
The Philippine NMCP continued to implement interventions consistent with the WHO Global Strategy for Malaria Control from the latter part of the 1990s (41). However, in the early years of the 2000s, there were limited local resources and no funding assistance from foreign donors (7).

Malaria morbidity was on an upward trend from 1999 to 2005, caused in part by population movement and a lack of capacity to detect and respond to outbreaks (6, 7). A decline in financial and logistical resources required prioritization of areas based on malaria morbidity rate, meaning that some areas at-risk for malaria did not receive attention.

During this period, malaria continued to affect the poor and marginalized, as documented in the 2002 proposal to GFATM. Between 1997 and 2001, 90% of cases nationwide were found in only 25 of the then 65 endemic provinces (77), and the majority of these endemic provinces had some of the lowest income levels in the country. As a result, the 25 Category A provinces received funding from the first GFATM grant in 2003 (77, 78).

Beginning in 2006 and 2007, cases began to decline (Figure 8).

Figure 8. Malaria Cases and GFATM support, 2000–2011 (7, 79)



STRATEGY, POLICY, AND LEGISLATION

A unique feature of the Philippines malaria control programme is the subnational elimination certification process. This is a rational elimination policy for several reasons. The Philippines is comprised of many islands and autonomous provincial governments. Many provinces are considered to have low vulnerability for malaria, and some have low receptivity. For example, Batanes province is composed of small, remote islands without any land borders with other provinces, thus vulnerability is considered low. However, there is still receptivity to malaria. In Cavite, which has already been declared malaria-free, the potential risk of malaria importation from neighbouring territories may have been greater in previous years, but the three border provinces are no longer considered endemic. The decline in vulnerability is an example of the benefit to neighbouring provinces when one area eliminates malaria transmission, reducing vulnerability of the country as a whole. However, highly industrialized provinces such as Cavite, could be at risk of labour migration from other endemic provinces, which may increase vulnerability.

The development of new disease-free initiatives (for leprosy, rabies, schistosomiasis, filariasis and malaria) facilitated a major increase in national government funding for malaria control activities (55). The NMCP budget jumped from PHP 3.4 million (US\$ 67 393) in 2002 to PHP 63 million (US\$ 1.4 million) in 2008 (51). Government contributions to the NMCP continued to increase in the years thereafter.

VECTOR CONTROL

The proportion of the endemic population protected by both ITNs and IRS was only 8.6% in 2002 (80). ITNs were scaled up as a major strategy from 2003, aiming to provide every household with at least one ITN. However, because this level of coverage did not appear to impact transmission (81), the target was revised in 2005 to one net per two people in a household, with at least 80% of the population at risk (PAR) covered. LLINs were introduced in 2008.

The social marketing scheme initiated by the programme in the 1990s, whereby ITN costs were covered by communities and LGUs, was later adopted by the GFATM-recipient provinces and through the Round 2 GFATM grant activities. By 2007, estimated coverage of ITNs reached 84% in the 25 most endemic provinces (81). In 2011, ITN and LLIN coverage in the expanded 40 GFATM-recipient provinces was 73% of total target population (82).

IRS was used for containment of malaria epidemics in the early 2000s, and was scaled up in 2008 to complement ITN distribution. Most IRS was done in the provinces receiving support from GFATM because of their higher levels of endemicity (77, 81). Since the adoption of the new stratification scheme, IRS has been applied in focal areas of higher and stable transmission barangays (9). An estimated 237 085 houses were sprayed in 2011, protecting an estimated 1.8 million people, or an estimated 1.8% of the total population of the Philippines (82).

ENTOMOLOGICAL SURVEILLANCE

Since 2001, bioassay and susceptibility tests have been conducted on a regular basis in sentinel sites across five provinces by the RITM. Results have shown that *An. flavirostris* and *An. maculatus* are susceptible to delta-methrin, lambda-cyhalothrin, etofenprox, permethrin and DDT (83). Monitoring of susceptibility provides information to the programme on the effectiveness of the insecticides being used for IRS and ITNs, thus guiding vector control activities and procurement of commodities.

PARASITOLOGICAL SURVEILLANCE

Microscopy remains the gold standard for the diagnosis of malaria in the Philippines. RDTs were introduced in 2003 and are used as a supplementary diagnostic method in areas where microscopy services are not available or are impractical to set up (28, 84). NMCP guidelines specify the following conditions for RDT use: areas with no microscopy centre, or those that are more than two hours travel to the nearest microscopy centres, such as inaccessible coastal or island areas; epidemic areas where microscopy is not available; and selected hospitals without a trained microscopist for emergency situations. In 2008, the programme shifted from mono-antigen RDTs to a combination RDT, to detect both *P. falciparum* and *P. vivax* infections (79).

Surveillance relies upon PCD. 25–50% of all cases are investigated, with a focus on index cases of epidemic or pre-epidemic settings and pregnant women and children under five years of age.

Microscopy trainings were conducted in 2003 for medical technologists/microscopists from RHUs and hospitals in all endemic municipalities covered by GFATM funding. Separately, six Barangay microscopy centres were established in the provinces of Davao del Norte and Compostela Valley in Mindanao through the support of WHO-RBM. Volunteers and BHWs were also trained on the use of RDTs and were deployed in remote villages on a pilot basis (85).

LABORATORY SUPPORT

The QAS for microscopy was re-established in 2005 with support from WHO. It requires the submission of slides by microscopists from all diagnostic facilities to qualified provincial or regional validators (86). The guidelines stipulate that all provinces maintain a pool of validators, with regular proficiency assessments every two years, supervised by a national core group of trainers and validators. These trainers and validators are certified by an independent body and go through a regional accreditation and external quality assurance (EQA) programme to ensure competency (86). The DOH also established giemsa production centers in key regional offices to ensure that giemsa stain would be available and affordable to all diagnostic facilities (81).

CASE MANAGEMENT AND REPORTING

During the 2000s, early diagnosis and effective treatment continued to be a major strategy of the programme, through clinical assessment, microscopy or RDTs. Diagnostic policy was then updated, calling for treatment and reporting only of laboratory-confirmed cases (87). Updated treatment guidelines were released in 2002, using the results of therapeutic efficacy surveillance studies. Combined SP with chloroquine for *P. falciparum* infection was the interim first-line treatment and artemether-lumefantrine was the second-line. Primaquine remained in use as a gametocytocidal drug to reduce malaria transmission. Treatment for *P. vivax* infection remained the same, consisting of chloroquine and primaquine (87).

The first-line treatment of confirmed, uncomplicated and severe *P. falciparum* cases was changed to artemether-lumefantrine in 2009 after studies showed an efficacy rate of 97–100% (88). Quinine in combination with tetracycline, doxycycline or clindamycin is recommended for cases unresponsive to artemether-lumefantrine (88). The treatment for *P. vivax* infections remains the same, to date. Therapeutic efficacy surveillance continues in six provinces that serve as sentinel sites to monitor response to antimalarials.

Antimalarial drugs are distributed free of charge in public and private health facilities, and are provided by the DOH and GFATM in endemic provinces. Partnership with private service providers is being strengthened through referral networks.

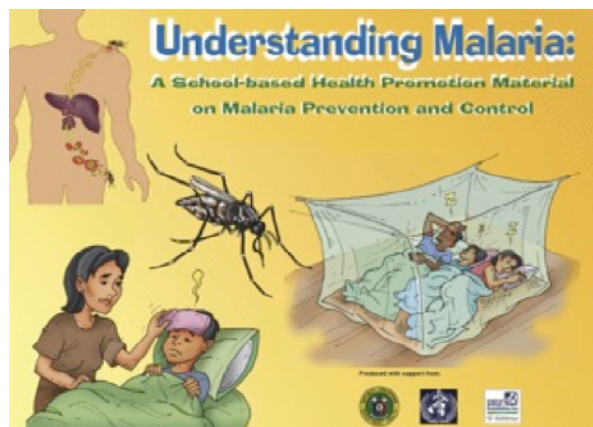
Municipal Health Officers and all RHU staff of endemic provinces have been trained on basic malaria management, funded by the DOH, GFATM and WHO-RBM. Treatment guides and other job aids were provided for health facilities in the GFATM-supported provinces from 2008 to 2011 (82).

In 2005, PhilMIS, developed by the WHO-RBM project, was expanded in GFATM-supported provinces, and is now the source of epidemiologic and programme coverage data for these areas (9). The Philippines Integrated Disease Surveillance and Response (PIDSRS) is another information system used to track notifiable diseases, including malaria, and is used in the rest of the endemic provinces not supported by GFATM (9, 89).

HEALTH EDUCATION

The DOH-, WHO- and GFATM-funded activities supported the development of various print materials such as posters, comics and flyers, which were created by Provincial Health Offices (PHOs) to encourage locally appropriate messaging, language and media. Key messages included seeking blood smear examination of fever cases, treatment compliance, and consistent and correct use of ITNs (9, 90). Flipcharts were also developed for use by health service providers during health education sessions, and both GFATM and WHO-RBM created teaching aids (Figure 9). The programme adopted the use of school-based malaria modules from the DFAT-sponsored Agusan del Sur NMCP project, with support from GFATM for the training of schoolteachers on the use of these materials (90). The Urbani School Kit, developed by the WHO-RBM project, is an integrated package containing materials that support health education and health promotion activities in elementary schools (91).

Figure 9. Malaria Flipchart used for school-based malaria education (91)



INTERSECTORAL COORDINATION

The lack of national level personnel, brought about by streamlining and reorganization from 2000 onwards, led the NMCP to partner more closely with RITM, San Lazaro Hospital, and the University of the Philippines. Collaborating centres for malaria and vector control situated in RITM locations in Palawan and Baguio City were established. With support from external sources—JICA and US NAMRU-2—these centres were further strengthened, functioning as reference centres and providing microscopy training, research services, and monitoring of insecticide and drug resistance.

Since 2000, there has been an increase in organization and coordination with numerous technical support groups, both at national and regional levels. These include the National Infectious Diseases Advisory Council, the Malaria Task Force and the WHO-RBM TWG in Region 11 in Mindanao (92). With support from GFATM, a national malaria TWG was established in 2003 to serve as an advisory body for the programme at all levels (93).

EXTERNAL SUPPORT AND COLLABORATION

Over the past ten years, external support from foreign donors has provided much-needed resources to expand access to services and coverage of interventions. The projects also facilitated discussion and clarification of the roles and responsibilities of the NMCP in the process of devolution. LGUs were mobilized to provide

counterparts for local activities and support for human resources. There was also greater ownership of the programme by the local health offices, both at the provincial and municipal levels.

The US NAMRU-2 provided support for research and training in 2000 to the DOH and RITM.

Support from GFATM enabled the establishment of diagnostic and treatment facilities in all RHUs of endemic municipalities and in strategically located villages, including training for health staff on malaria case management. ITN coverage was expanded in 2004, switching to LLINs in 2006 (93).

The WHO-RBM project, which started in Mindanao, expanded in 2002 to 14 additional Mindanao provinces, Rizal province on Luzon island, and the Visayas region (92). In 2007, the WHO-RBM project received a new grant of US\$ 4 million from the Australian government to continue work for the period 2008–2012.

CROSS BORDER COLLABORATION

Inter-provincial and inter-regional border operations have been conducted since 2007, initially with the support of DFAT, through the WHO-RBM project, and later with GFATM grants. These operations attempt to synchronize financial, logistical and human resources across different LGUs and deliver an integrated package of health services to border areas, which are often remote and inaccessible. Led by RHUs in the border areas with support from the PHO and CHD, project teams collect blood smears and sputum, distribute or re-treat ITNs, follow-up on patients, conduct dental exams, chlorinate drinking water, and provide micronutrient supplements, deworming drugs, prenatal care, and general consultation (94).

PROGRAMME MANAGEMENT

The MOP outlines the different management systems that must function effectively to support the delivery of quality malaria services: programme planning, human resource development, and procurement and logistics

management (8). In addition, the results of the new stratification criteria are to be used in programme planning to identify appropriate activities and strategies for each area. The NMCP provides guidance to the Regional Malaria Coordinators (RMCs) during the semi-annual Programme Implementation Review and Planning workshop. The RMCs then provide technical assistance to the provinces and municipalities through respective Provincial Investment Plans for Health (PIPH). Key informants, however, noted that with this multi-level process, there is a need to time planning activities across the different levels so that the 'bottom to top' approach is followed. This will help to ensure that the national level plan addresses the specific needs of both the regions and provinces, and that local plans be aligned with national directions.

OUTBREAK RESPONSE

In 2011, health staff in the 40 expanded GFATM-recipient provinces were trained on epidemic preparedness and response (95). Zonal stockpiles of insecticides, ITNs and antimalarial drugs were established in regions that were selected because of their proximity to nearby endemic provinces, to ensure prompt and adequate supplies in the event of outbreaks in provinces that were already less endemic (8).

The procedures for outbreak preparedness and response are outlined in the MOP finalized in 2009, which identifies trained surveillance staff in hospitals, clinics, and RHUs as being responsible for notifying the local chief executives and the next level health office, such as the PHO, CHD, and the DOH-National Epidemiology Center, within 24 hours of confirmation of a malaria epidemic (8). Immediate actions include early diagnosis and treatment through deployment of Mobile Diagnostic and Treatment Units (MDTU) to strategic locations in the affected areas, and distribution of drugs and insecticides from stockpiles. IRS is the vector control method of choice and should be applied during the early and accelerated stages of an epidemic prior to its peak (8).

What populations are most at risk, and what interventions are targeted at them?

Currently, an estimated 14 million Filipinos are at risk of contracting malaria, the majority of which live in the 53 endemic provinces (54). People living or working in rural areas, particularly forested areas, are most at risk. These at-risk groups include charcoal makers, loggers, and subsistence farmers, as well as development project workers, displaced populations, migrant workers, mobile indigenous peoples, military personnel and other armed groups. The mobile nature of the at-risk groups challenges the utility of vector control measures, such as IRS and LLIN distribution, since these populations may not sleep indoors or may be outside during peak biting periods. The groups also have a lower level of literacy and higher level of poverty, decreasing access to health services and information (9).

Children under the age of five years are disproportionately affected by malaria in the Philippines (104, 105). Reports from GFATM-supported provinces show that the percentage of cases occurring within this age is increasing, from 19.93% in 2011 to 39% in 2012. Pregnant women are also vulnerable to severe malaria infection. Rising prevalence among these risk groups suggest that there are still gaps in the distribution and use of ITNs, and in diagnosis and treatment (95).

Lastly, there are several groups seen by the DOH as vulnerable to malaria infection, or who may serve as potential sources for reintroduction of malaria in low endemic areas. These groups include OFWs and local and foreign tourists (96).

How much did malaria control and elimination cost?

The yearly cost of moving from levels of high endemicity to low transmission or malaria elimination was evaluated in four provinces of the Philippines. These provinces were chosen to represent a range of malaria eco-epidemiological environments and programmes in varying phases of malaria elimination. Benguet and Cavite are

currently malaria-free while Apayao and Laguna are moving towards elimination (see Figure 10 for a summary of epidemiology and key malaria programme control efforts by province). An overview of expenditures on malaria control in these four provinces are presented to show cost per capita at risk of malaria per year over time (see Figure 11).

APAYAO PROVINCE

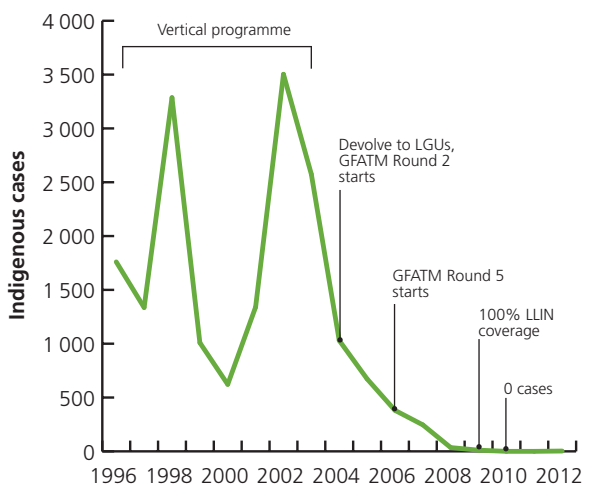
Apayao is a land-locked province in the Cordillera Administrative Region in northern Luzon. Mountainous terrain, heavy forest cover, limited infrastructure, and the presence of highly mobile indigenous groups and migrant workers pose significant challenges for the malaria control programme. The entire province is endemic, *An. flavirostris* is the primary vector, and most cases are caused by *P. falciparum*, followed by *P. vivax*; some *P. malariae* cases also occur. Throughout the 1990s, annual caseload was in the thousands, and the natural transmission cycle led to dramatic peaks every four years (Figure 10). The groups at particularly high risk for malaria during this period were those who lived or worked in remote, forested areas with limited access to health-care facilities.

In 2003, Apayao was among the 25 high-burden provinces to receive Round 2 GFATM malaria support, and a Round 5 grant was launched in 2006, by which time the four-year transmission cycle was considered broken (Figure 10). The case study sample includes years 2007 to 2009, capturing spending in the years after the decline in cases and the lead-up to Apayao's realignment toward malaria elimination.

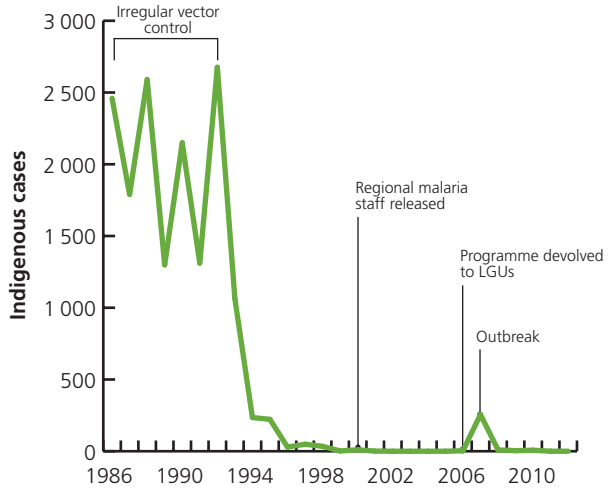
Total expenditure on malaria in 2007 was US\$ 747 368 (US\$ 7.21 per person at risk per year, or PPY) (see Annex 5 for details on costing), with prevention and vector control accounting for half of the total expenses, followed by management and M&E (20.8%), diagnosis and treatment (18.3%), IEC (5.9%), and surveillance (4.2%) (Figure 11). In 2008 and 2009, expenditures amounted to US\$ 570 603 (US\$ 5.35 PPY) and US\$ 360 114 (US\$ 3.28 PPY), respectively. From 2007 to 2009, total annual expenditures declined by 52%, yet the proportion

Figure 10. Malaria epidemiology and key malaria control programme efforts in Apayao, Laguna, Cavite, and Benguet (106)

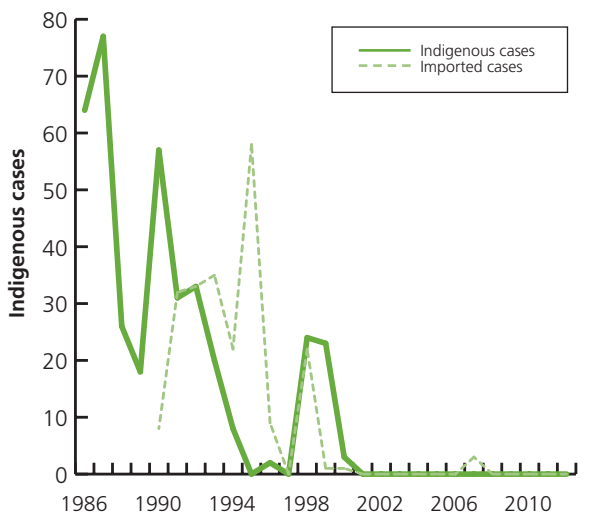
A. Apayao Province, 1996–2012



B. Laguna Province, 1986–2012



C. Cavite Province, 1986–2012



D. Benguet Province, 1991–2011

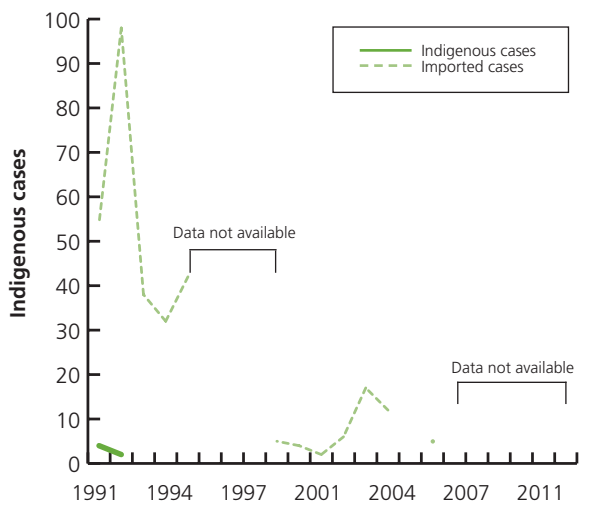
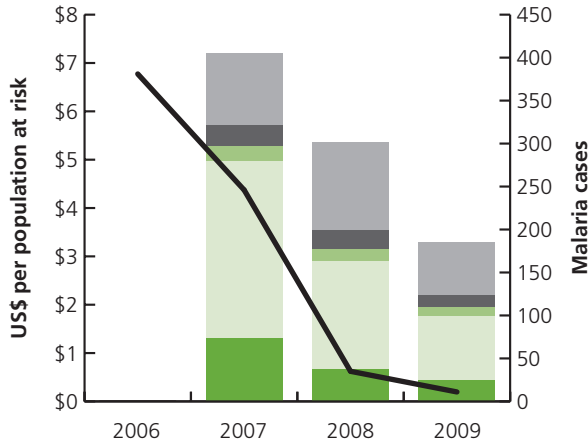
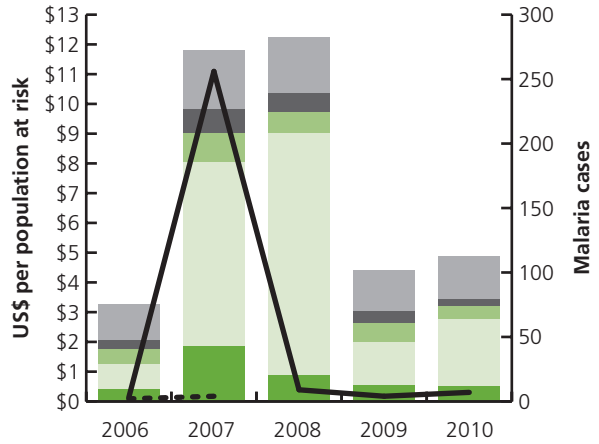


Figure 11. Malaria epidemiology and expenditures by type of malaria programme intervention in Apayao, Laguna, Cavite, and Benguet (106)

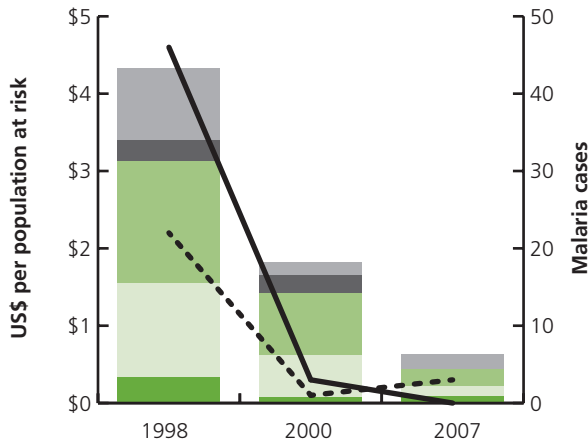
A. Apayao Province, 2007–2009



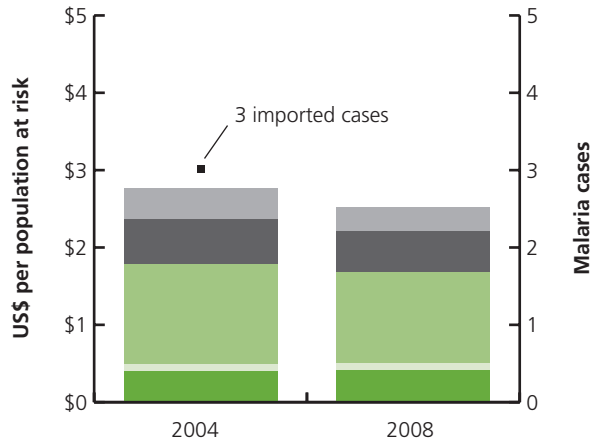
B. Laguna Province, 2006–2010



C. Cavite Province, 1986–2012



D. Benguet Province, 2004, 2008



- Management/M&E
- IEC
- Surveillance
- Prevention and vector control
- Diagnosis and treatment
- Indigenous cases
- Imported cases

of spending on prevention and vector control remained high, even as the programme shifted its focus from IRS and ITN retreatment to LLIN distribution. Substantial overhead costs captured under management and M&E, increased in 2008 and 2009 as LGUs took on more responsibility under the GFATM grant.

LAGUNA PROVINCE

Laguna is part of the Calabarzon (IV-A) region in southern Luzon, southeast of Metro Manila. Surrounded by mountains and bordered by Laguna de Bay, the largest lake in the country, its rich soil and ample water resources provide ideal conditions for natural forest growth and agriculture, but also create hospitable breeding grounds for *An. flavirostris*.

Malaria was endemic throughout Laguna during the 1980s and early 1990s, with cases numbering in the thousands and epidemic peaks occurring every other year (Figure 10). Infections were evenly split between *P. falciparum* and *P. vivax*. Under the vertically-run control programme, regional field workers maintained surveillance activities and conducted IRS when cases rose. Cases remained in the thousands through 1993, when economic development and urbanization began to rapidly increase. Industrial parks replaced forested areas and waterways became polluted, reducing the number of mosquito breeding habitats and contributing to a drop in malaria cases from a peak of 2 676 in 1992 to 222 in 1995. Cases reached zero in the early 2000s, and at the same time, regional staff retained to run the programme were released or reassigned as part of the devolution process.

In 2006, three indigenous cases, the first cases reported in five years, were detected in the relatively undeveloped border area between two municipalities, where slash and burn farming and logging are common (Figure 10). In 2007, an outbreak of 256 indigenous cases occurred in the same location. This re-emergence of cases coincided with the devolution of the malaria programme to LGUs. Just prior to the outbreak, management and implementation duties were transferred to inexperienced RHUs, which were generally unprepared to promptly respond to an outbreak. As a result, former regional field staff were

mobilized to lead case management and prevention activities, and to train the local staff. By 2008, the RHUs had assumed all malaria programme duties, achieving 100% coverage of IRS in the population at risk. 100% coverage of LLINs was reached in 2010. Cases again declined to zero in late 2010 and have remained at zero through 2012. The regional health office (CHD IV-A), through its extension office, continues to provide technical guidance and logistical support as needed by the local implementers.

In 2006, total expenditure in Laguna was US\$ 27 844 (US\$ 3.26 PPY), with the bulk (37.2%) spent on management and M&E, followed by prevention and vector control, then surveillance and diagnosis and treatment (Figure 11). Expenditures rose to US\$ 103 537 (US\$ 11.82 PPY) in 2007 and peaked in 2008 at US\$ 110 093 (US\$ 12.24 PPY) as outbreak containment activities were implemented. Spending on consumables increased dramatically during these years (40.6% in 2007 and 53.5% in 2008) when large purchases of drugs, laboratory supplies, and vector control materials were made in response to the outbreak, then declined to 14.3% in 2009. After containing the outbreak, total expenditures declined to US\$ 40 699 (US\$ 4.41 PPY) in 2009 and US\$ 43 562 (US\$ 4.90 PPY) in 2010. The balance of spending returned to levels similar to those seen in 2006, except for a slight increase in vector control expenditures. LGUs provided the vast majority of programme funding each year, except during the peak of outbreak response in 2007 and 2008 when national support increased to 38.8% and 55.4%, respectively, to pay for regional field staff, drugs, and vector control supplies.

CAVITE PROVINCE

Cavite province is located in southern Luzon. A detailed description of the location and epidemiology of malaria in the province can be found in the [History of malaria and malaria control in the Philippines](#) chapter, [Box 1](#). In 1987, the province reported 77 indigenous cases, followed by a steady downward trend until 2000, when the province had three indigenous cases. By 2001 there were no indigenous cases reported (Figure 10).

In 1998, the malaria programme in Cavite had achieved a state of controlled low-endemic malaria. That year, malaria expenditures totalled US\$ 42 484 (US\$ 4.33 PPY) (Figure 11). 36.2% of expenditures were used in surveillance activities, 28.1% for vector control, 21.4% for management and M&E, 7.8% for diagnosis and treatment, and 6.6% for IEC. Across the sampled years, total expenditure on malaria activities was highest in 1998.

In 2000, the malaria programme transitioned from maintaining controlled low-endemic malaria to elimination. Total malaria expenditures decreased to US\$ 23 757 (US\$ 1.81 PPY). Surveillance accounted for the largest percentage of costs (43.7%) followed by prevention and vector control activities (30.4%). Surveillance activities included passive and active case detection, which was carried out by the Provincial Health Team Office (PHTO) through 2012, as well as MBS targeting areas suspected to have high transmission, such as quarry sites, construction sites, and military camps. The percentage of expenditures spent on IEC increased to 13.1%. However, management and M&E, and diagnosis and treatment proportion of expenditures declined to 8.7% and 4.1%, respectively.

In 2007, Cavite was certified malaria-free and the programme is now focused on prevention of reintroduction. Total malaria expenditures declined sharply to US\$ 6 986 (US\$ 0.63 PPY). The proportion of expenditures on IEC activities increased to nearly half (48.6%), along with management and M&E (to 31.3%). The percentage of expenditure on surveillance declined by over half, to 20.1%. Diagnosis and treatment, and prevention and vector control activities were altogether negligible.

BENGUET PROVINCE

Benguet, located in the southern Cordillera mountain range, was declared malaria-free in 2005. The last indigenous malaria cases occurred in 1992, which were both *P. vivax* cases. In 1992, the malaria morbidity rate was 0.4 per 1 000 population, and three of 12 municipalities were considered endemic (Itogon, Tuba and Sablan). In the same year, the province was classified as a Category C province (i.e. the average number of cases during the past 5 years < 100 cases in isolated foci) (97). *An. flavirostris* and *An. maculatus* were found as of 2004.

Benguet has thriving agricultural, farming and mining sectors, and as a consequence, has a historically high volume of migrant and seasonal workers from the bordering malaria-endemic provinces of Apayao, Kalinga, Mountain Province, La Union, Pangasinan and Nueva Vizcaya (98). Migrants from these areas account for nearly all of the imported malaria cases in Benguet. Imported cases varied over the period 1991 to 2011, peaking in 1992 with 98 cases (Figure 10). The last imported cases were found in the province in 2006 (epidemiological records from 1996 to 1998 and from 2006 to 2012 are not available).

Expenditures on malaria control were collected for 2004 and 2008. In 2004, the year before malaria-free certification, expenditures totalled US\$ 16 185 (US\$ 2.77 PPY) (Figure 11). Surveillance accounted for 46.6% of total expenditure, followed by IEC (21.4%), management and M&E (14.4%), diagnosis and treatment (14.2%) and prevention and vector control (3.4%) (Figure 11). In 2008, after malaria-free certification and transition to prevention of reintroduction, expenditures totalled US\$ 15 931 (US\$ 2.52 PPY). Surveillance still accounted for the largest expenditure (46.7%), followed by IEC (21.2%), diagnosis and treatment (16.5%), management and M&E (12.1%) and prevention and vector control (3.5%).

Surveillance activities accounted for the largest proportion of total malaria expenditures—46.6% in 2004 and 46.7% in 2008—and are considered an important activity to reach the goal of zero local transmission. LGU and provincial personnel conduct case investigation and ensure timely reporting, while BHWs ensure passive surveillance and conduct visits to remote barangays. IEC was the second highest category of expenditures in both years: 21.4% in 2004 and 21.2% in 2008. Health workers combine malaria messages with other disease prevention initiatives (e.g. dengue) to maintain awareness of malaria risk, particularly in municipalities that border endemic provinces.

CROSS-PROVINCE COMPARISON OF EXPENDITURES

With the exception of the outbreak in Laguna province, overall expenditure PPY decreased in each phase from low-endemic malaria to elimination to prevention of re-introduction. Expenditures during low-endemic malaria ranged from US\$ 1.81 to US\$ 7.21 PPY. Elimination phase expenditures ranged from US\$ 2.77 to US\$ 12.24 PPY, with the latter figure associated with the management of an outbreak. Provinces that are currently malaria-free and that did not have a deliberate goal to eliminate spent the least overall across all phases. In these eliminated provinces, expenditures associated with POR ranged from US\$ 0.63 to US\$ 2.77 PPY.

Laguna province offers an example of a malaria-free province that encountered an outbreak, and the relative level of resources required to manage an outbreak when outbreak response mechanisms are not yet in place. In 2006, due to the inexperience of local staff, handling of the cases required a great deal of coordination, training, and management by regional DOH personnel, in addition to targeted activities within the affected purok (i.e. sub-barangay units). ITN retreatment and distribution, IRS, mass screening, and prompt treatment of cases were used to contain the outbreak in 2007 and 2008. Even after cases declined in 2009 and 2010, expenditures remained higher than average as LLIN distribution and active surveillance were maintained in order to prevent another outbreak.

What is the programmatic baseline from which the Philippines will eliminate malaria?

The steady and large reduction in national malaria incidence observed from 2007 to 2011 has led the NMCP to pursue malaria elimination, with a goal of eliminating by 2025. Because of the geographic and topographic characteristics of the country, the NMCP aims to progressively shrink the malaria map one island or province at a time in its subnational malaria elimination strategy.

STRATEGY, POLICY, AND LEGISLATION

The NMCP's Medium-term Development Plan 2011–2016 enumerates the different strategies and activities for malaria elimination. An additional guiding document, the NMCP MOP, approved in 2010, provides guidance for programme planning and implementation (58). The MOP and the medium-term plan are being updated according to the elimination strategy. Also being updated are the NMCP treatment guidelines and stratification procedures, along with the use of serology for the evaluation of malaria-free areas.

The following administrative orders have been approved and issued to date: guidelines on MBS and the conduct of border operations, strategies for special population groups, evaluation of low endemic provinces for the malaria-free declaration, and QAS for malaria microscopy (86, 94, 96, 99, 100). A policy directive to establish malaria elimination hubs has also been approved, for which provinces that are malaria-free and with sporadic transmission will have a supply of goods, staff and skills to respond to imported malaria or an outbreak (101). When needed, these hubs will provide disease and entomological surveillance alongside a stockpile of antimalarial drugs, insecticides and other supplies.

The malaria transmission patterns within endemic provinces are assessed every three years using the new stratification criteria (see the [Country background](#) chapter) and the NMCP develops the strategies needed to control and eliminate malaria (Table 4).

The provincial malaria coordinators and other key programme staff at the PHO, RHU and PHTOs have been oriented on the stratification process in order to facilitate the development of their elimination plans. Between 2010 and 2016, the NMCP plans to strengthen PHO and LGU planning. Resource mobilization and strengthening of monitoring will also be pursued (58).

Table 4. Corresponding intervention required by stratification stratum (9)

Strata	Phase	Strategy
Stable Transmission	Control	Scale up intervention (achieve universal coverage of the malaria interventions)
Unstable Transmission	Pre-Elimination	Maintain universal coverage and ensure high utilization
Sporadic Transmission	Elimination	Halt the local transmission (prevent onward transmission from an indigenous case)
Malaria-Prone Area	Maintenance	Prevent re-introduction

VECTOR CONTROL

LLIN distribution and IRS will continue to be major vector control measures but application will depend on the stratification category of the targeted area. LLINs will be distributed to 100% of families in all endemic areas, targeting at least one net for every 2-3 persons. Families in malaria-free areas will be given LLINs during epidemics. IRS will be a supplemental vector control measure in areas with stable transmission that have not achieved a reduction of malaria incidence despite 100% ITN coverage over a one-year period (9, 58).

HEALTH EDUCATION/IEC

The current focus is to conduct education and awareness to increase demand and support for anti-malaria services (9, 58). Baseline and post-intervention KAP surveys will be conducted, which will serve as the basis for provincial health promotion and communication plans to be developed at the CHD and LGU level.

INTERSECTORAL COLLABORATION

Initial discussions with the Philippine Surgeon General's Office have been conducted to identify potential areas for collaboration to increase access to diagnosis and treatment and malaria prevention for military personnel. The Departments of Labour and Employment and Foreign

Affairs will also be approached regarding screening of OFWs (58). Policy on special populations will be disseminated, providing guidelines on managing malaria among indigenous people, developmental project workers, overseas contract/migrant workers, local/foreign tourists, military and paramilitary, displaced populations, forest workers, pregnant women and children under five years old (58, 96). Representatives from partner agencies such as the Department of Education and the Armed Forces of the Philippines will be identified and trained on malaria diagnosis and treatment.

EXTERNAL SUPPORT AND COLLABORATION

The current GFATM grant funding will end in 2014. For the remaining period of implementation, the GFATM-supported projects will continue to invest in capacity building, with a particular focus on enhancing the proficiency of medical technologists and barangay microscopists, as well as on clinical management of acute and severe malaria (102). Antimalarial drugs, RDTs and laboratory supplies will be procured, along with support for therapeutic efficacy surveillance studies and drug quality assurance monitoring. Support to vector control includes the provision of nearly one million LLINs and support of IRS operations (102).

The conclusion of GFATM funding in 2014 will lead to major challenges for ongoing financing of programme implementation. A new source of malaria funding may be available from the Sin Tax Reform Law (House Bill 5727) signed into law in December 2012 that restructures the excise tax on alcohol and tobacco (103). The additional revenues will fund the expansion of PhilHealth enrolment to the second poorest 20% of the population, the upgrading and modernization of hospitals and other health facilities, and the expansion of preventive and promotive programmes (103). The NMCP budget increased by 74% between 2013 and 2014, up to 323 million PhP per year. The NMCP is coordinating with the Principal Recipient of the GFATM consolidated grant, WHO and others to ensure that there will not be any overlaps in investment areas.

CROSS BORDER COLLABORATIONS

Prevention activities will be conducted along borders to reduce or stop the introduction of local transmission in areas with no more malaria cases. Approved in 2012, guidelines call for a malaria border operations team to be formed in the municipal health office, consisting of a vector control team and a diagnostic team. Together with the Provincial and Regional Malaria Coordinators, the border operations team will enumerate the different conditions under which border operations can be conducted. The PHO, in coordination with the Municipal Health Office, will lead activity implementation (104).

ORGANIZATION AND SUPPORT, PROGRAMME MANAGEMENT

Human resources present a challenge for the programme. In the past two decades, the rapid turnover of health workers, typically those who seek better employment abroad, has resulted in a constant need for recruitment and training of new staff. The current malaria staff at regional, provincial and municipal levels do not just focus on malaria control, but divide their efforts across multiple programmes. The DOH central and regional offices have limited human resources, and there is a shortage of entomologists in particular. There are currently no plans to add more positions, and vacant posts will no longer be filled in light of the Rationalization and Streamlining policy (22). Those who remain in service must be prepared and trained for the programmatic shifts from control to elimination as the malaria situation improves.

Another area that requires strengthening is procurement and logistics management. Timely procurement and delivery of commodities must be ensured, as does proper storage, handling, and inventory management. Tracking of malaria commodities and equipment given to LGUs is weak because inventories are not facility-based. This leads to a lack of awareness regarding stock levels and the need to replenish or to move commodities across facilities. There is also a significant delay in procurement, up to 1.5 years, due to the government procurement

process. This is compounded by the lack of a local manufacturer of LLINs, antimalarial drugs and other commodities (9).

OUTBREAK MONITORING AND RESPONSE

Malaria elimination hubs will be established to maintain a malaria epidemic-preparedness and response system in malaria-free and sporadic transmission areas (101). In 2013, RMCs, members of the national core of trainers, RITM and other partners set up Malaria Collaborating Centres, which are reference centres intended to strengthen quality assurance, and vector control through sharing of technical, logistical and human resources.

These measures will help equip health staff, particularly in malaria-free areas, where there is limited capability on entomological surveillance and clinical management (105).

SURVEILLANCE

Recognizing that surveillance is a critical component of the health care system in the elimination phase, three approaches will be adopted depending on the rate of transmission in the area: ACD, PCD and MBS. MBS will be done to detect all parasite carriers with asymptomatic infection in sporadic transmission and malaria-prone areas where only one or no indigenous cases have been present in the last five years (99).

There are two areas of the country that require special efforts for elimination. Two Negros provinces in the Visayas region have challenging topography and insurgency, yet both have low endemic malaria. In addition, the ARMM has security challenges due to ongoing internal conflict, which has negatively impacted malaria control efforts and has resulted in persistently high transmission. Special programme reviews will be conducted for these areas in order to identify specific needs.

In addition, the malaria microscopy QAS and the medium-term plan were evaluated in 2013, and the medium-term plan is currently undergoing revision (58).

LESSONS LEARNED AND OUTLOOK FOR THE FUTURE

From 2000 to 2011, the Philippines reduced its malaria cases by 74.4%. Twenty-seven out of a total of 80 provinces have eliminated malaria as of 2013 (54). Challenges still remain, however. The NMCP continues to strive for elimination and has a history of experience with malaria control that can serve as useful guidance for other countries facing similar challenges.

The major declines in malaria are believed to be the result of several key actions: development of new stratification criteria, early detection and prompt treatment, strengthening of vector control, strengthening of surveillance and epidemic management, scale-up of quality services, intensification of health promotion, and building local capacity to manage and sustain the programme.

Organizational structure of the malaria control programme

Malaria control in the Philippines has been significantly impacted by major changes in the organizational and functional structure of the NMCP. The transfer of authority and responsibility from the national DOH to LGUs led to uncoordinated malaria control activities and a decline in coverage. Peripheral health staff were not adequately prepared by the DOH to carry out and supervise malaria control interventions, having previously relied heavily on the leadership and technical and financial support of the DOH and, later, on the regional health offices. However, when a resurgence in cases required a swift response, local health staff rapidly took on these responsibilities (105).

From 2000 onward, streamlining of the DOH structure resulted in decreased staffing for malaria at all levels of government. This was intended to further facilitate the complete transition of authority, programme

management and implementation to LGUs. However, with this decrease came the loss of expertise of field personnel and key staff at the national level. Further capacity building and mentoring is needed to ensure that local health offices are adequately equipped. The rationalization programme is still underway in the different regions and its full impact on operations has yet to be seen.

Improvements in programme strategy and implementation

Despite the extensive challenges in controlling and eliminating malaria, improvement in the malaria situation was seen several times across the history of the programme, and there has been significant progress in bringing the number of cases down to a manageable level.

In the early years of the programme (1920 to 1954), as the health sector became more organized and local health officials better equipped, control measures were instituted based on experience from other countries and on research conducted by programme staff, resulting in a moderate level of control. Geographical reconnaissance completed during the eradication phase (1950 to 1982) facilitated the focused application of vector control measures and the mapping of affected communities and households. These proved to be essential in planning and implementation.

While there is no single strategy that can account for the significant decrease in malaria incidence throughout different periods in the history of the malaria control programme, the extensive coverage of active case detection and IRS with DDT during the eradication period are likely to have contributed to declines. Active case detection involved blood smear collection from fever cases through house-to-house visits. IRS was applied to

all sprayable surfaces in multiple cycles. In some provinces, such as Cavite, urbanization and development has reduced receptivity to malaria transmission.

From 1983 onwards, while ACD was no longer used, PCD was enhanced by the provision and use of RDTs, introduced in 2005. Microscopy remained the gold standard, however. Training in both methods for medical technologists, microscopists and community volunteers in all highly endemic areas expanded access to diagnostic services for at-risk communities. Successive surveillance studies ensured use of effective antimalarial drugs and updating of treatment guidelines.

Malaria stratification facilitated a more focused targeting of activities and allocation of resources. Even the macro-level stratification, which classified provinces based on their malaria morbidity rate, and later included climate and topography, parasite rate and socio-economic conditions, provided a basis for prioritizing areas, given the limited resources available during the control period (1983 to 1998, extending up to around 2002).

The adoption of ITNs (1996) and LLINs (2008) as major vector control methods in addition to IRS, provided improved protection against malaria. The use of IRS as a complementary strategy, while not yet proven to be more effective, shows promise in halting transmission (105). The NMCP monitors insecticide susceptibility to ensure that insecticides remain effective.

Currently, there is a large body of knowledge about local malaria parasites and vectors, and the pattern of malaria transmission across barangays and provinces. The NMCP has continued to focus on research, M&E, leading to the development of, and updates to, policy and technical guidelines. This increase in understanding of malaria transmission, together with improved technology and products for diagnosis, treatment and vector control, and with strengthened management capacity at all levels is believed to have boosted the scale and quality of programme operations.

Community mobilization and Local Government Unit ownership

Community engagement has been secured where local people show good knowledge and understanding of malaria, together with an understanding by the programme of the environment and local culture in that particular area. This understanding has facilitated acceptance of malaria control strategies and motivated communities to become involved in surveillance, the expansion of diagnostic and treatment services, vector control, and health promotion.

Devolution is considered successful where local governments have taken the initiative to own and manage the malaria programme in their respective areas. GFATM grant funding led to greater local ownership in the recipient provinces. Political will has been instrumental in ensuring that policy directives have been adequately resourced through budget allocation. In addition, strong leadership by PHOs can serve to mobilize the active participation of municipal health offices, which in turn mobilize communities, as illustrated by the Apayao PHO's ability to motivate and support the RHUs in their goal of malaria elimination.

Financing and sources

Throughout its history of malaria control, the Philippines has received substantial external funding to support the activities needed to keep transmission under control. National funding, influenced by frequently shifting government priorities, was often inadequate to meet the needs of a robust malaria control programme.

During the eradication period (1950 to 1982), substantial national government funding for the programme was legally mandated. Additional funding from USAID and WHO enabled expansion of IRS coverage and the maintenance of surveillance, diagnosis and treatment. Beginning in 2003, GFATM grants were successful in expanding the reach of the malaria control programme in several different ways. First, the grant process facilitated greater ownership by local governments. Second, access to diagnosis and treatment for malaria expanded,

particularly in remote areas. The health worker force also increased through volunteers, BHWs, and field health staff. In addition, the grants supported expansion of ITNs and IRS, and these activities led to declines in transmission in highly endemic provinces. As a result of these inputs, targets for malaria morbidity and mortality reduction set in 2003 were achieved by 2007.

In addition to the increase in external funding sources, national funding increased with the push to establish disease-free zones in 2008, resulting in substantial additional domestic budget allocation for the malaria control programme in 2009. This funding has been used to cover the needs of the lesser endemic provinces and to support health systems strengthening. Increased national government funding also enabled the DOH to leverage for counterpart funding from LGUs, particularly those not supported by GFATM.

Strong political commitment backed by actual budget allocation (and disbursement), both at the national and local government level, positively influenced morbidity trends. Several examples of local governments paying for malaria control can be seen, including the containment of outbreaks in Laguna and the hiring of medical technologists and microscopists by LGUs. These newly-hired staff have been trained through the GFATM and WHO-RBM projects. LGUs have also given their share of support to vector control activities and health education campaigns.

Subnational elimination goal

The Philippines has set out to eliminate malaria one province at a time. Given the geographic and topographic diversity, as well as the variable levels of risk across the country, this is a more feasible and appropriate strategy to interrupt transmission than a national elimination approach. The Philippines demonstrates that, in certain settings, provinces can achieve and maintain malaria-free status with the help of strong political commitment, adequate funding and the application of correct policies and interventions. However, there could be improvements made in the process of subnational elimination and in the prevention of malaria reintroduction in malaria-free provinces. This could include improvements

in surveillance, through more rapid case detection and more comprehensive case investigation. Enhanced vigilance is needed after malaria-free status is conferred on a province.

Future outlook: How will the Philippines eliminate malaria?

The Philippines has made major progress in reducing malaria burden through strengthening malaria diagnosis, treatment and control efforts. However, there are implementation gaps that the NMCP must address to attain elimination.

Some of the most at-risk population groups, such as tribal communities, are located in remote, mountainous, unstable areas or those prone to natural disasters. They are among the remaining active and residual foci in the isolated areas of the country, and the NMCP must develop targeted strategies to reach these populations.

Sustaining capacity, motivation, and resources through to successful elimination is another challenge. There is high turnover of staff in some hospitals and private clinics due to overseas employment opportunities. At the same time, sustaining interest and commitment of communities and LGUs to maintain malaria control efforts can be challenging, especially in areas that have zero or very few cases. Continued advocacy for malaria elimination will be needed to mobilize participation. Malaria control requires an adequate stock of supplies. CHDs have made adequate procurement of antimalarial drugs, LLINs, and IRS commodities a priority, particularly in regions that have both high and low risk provinces. Malaria elimination hubs will be set up in regions with malaria free or nearly-eliminated provinces in order to ensure these supplies are available for use in epidemic situations that require a rapid response.

The private sector must be brought into the elimination effort, to ensure quality of diagnosis, case management and case reporting. Many countries in the Asia Pacific and beyond struggle with this challenge, and innovative strategies for effective private sector engagement are needed.

Although the Philippines has increased domestic financing for malaria control and elimination, maintaining support for implementation in the absence of any external support is an important concern. As malaria incidence declines, and elimination across the country is met, it will become harder to make a case for continued funding, both domestic and external, of malaria work. The programme intends to maximize the support expected from the revenues of the Sin Tax Reform Law; however it is unclear if these additional funds will be enough to sustain the gains made toward elimination.

A comprehensive programme review was undertaken in 2013 and, together with the external evaluation of GFATM-supported projects, will be the basis for a revision of the strategic plan for malaria control and elimination 2015–2020 and a proposal for GFATM and other donors. The NMCP also prioritizes strong advocacy to build political commitment and funding for malaria control in the remaining foci of transmission. With advocacy, secured funding, and careful planning and implementation, the NMCP, working closely with its partners, is well positioned to pursue elimination in the Philippines.

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ANNEX 1: DATA SOURCES AND METHODS USED

This case study employed a mixed methods approach, including historical record review, key informant interviews, field observations and extraction of expenditure data from programme accounts. Multiple sources were used for data collection, including the Infectious Disease Office of the Department of Health, which houses the NMCP, and a subset of provinces sampled for various portions of the case study.

Five provinces on Luzon Island (Apayao, Benguet, Cavite, Laguna and Sorsogon) were purposefully chosen for the comprehensive and costing components of the case study. They were selected to represent a range of malaria eco-epidemiological environments and phases of malaria elimination: Sorsogon, Benguet and Cavite are currently malaria-free, while Apayao and Laguna are moving towards elimination. The province of Sorsogon was not included in the expenditure analysis due to the lack of available records, but epidemiological record collection and interviews were still conducted. Data collection included key informant interviews with a range of current and former personnel at the national, regional, provincial, municipal, and barangay levels. Transcriptions of key informant interviews were coded and analysed in Atlas.ti 6.2, a qualitative data analysis software programme. Codes were developed to classify information according to type of activity, epidemiological indicators, funding source, financial and human resources and outbreak response. Expenditure data were entered into

Microsoft Excel and costs were classified across three dimensions: 1) funding source, such as internal or external; 2) malaria activity, including diagnosis and treatment, prevention and vector control, surveillance, information and education campaigns, programme management, or M&E; and 3) expenditure type, including personnel, commodities, services, or capital equipment. All expenditures are deflated to the year 2010 and converted to US Dollars.

In order to capture the historical and current picture of the national malaria control and elimination activities, as well as to focus on the subnational elimination experience, data collection also occurred at the Davao Region (CHD XI) in Mindanao and the province of Palawan, which still has high malaria transmission. Field observations in two provinces, Batanes and Cavite, were conducted to document the subnational elimination certification process. Batanes was selected as an example of the evaluation process of a candidate for declaration of malaria-free status while Cavite served as an example of the assessment of programme interventions for prevention of reintroduction. Data on malaria epidemiology, programme performance and coverage, as well as achievements over recent years were collected through visits to health facilities, meetings and discussions with the regional, provincial and municipal health authorities and by reviewing related reports and other programme documentation.

ANNEX 2: DEMOGRAPHIC DATA AND HEALTH, SOCIAL AND ECONOMIC DEVELOPMENT

Table 1. Demographic data (1)

Variable	Year/Period	Value
Population	2011	94 852 030
Population sex ratio (male per female)	2011	1.01
Percentage aged 0–14	2011	35.07
Percentage aged 15–64	2011	61.23
Percentage aged 65 and above	2011	3.70
Population growth rate (annual %)	2011	1.69
Crude birth rate (live births per 1 000 population)	2010	25.09
Crude death rate (deaths per 1 000 population)	2010	5.79
Infant mortality rate (infant deaths per 1 000 live births)	2010	23.2
Life expectancy at birth, males/females (years)	2010	65.22/71.92

Table 2. Health indicators (2)

Indicator	Sex	Value	Year
Life expectancy at birth	Male	65.22	2010
	Female	71.92	2010
	Both sexes	68.48	2010
Adult mortality rate (per 1 000 adults 15–59 years)	Both sexes	182	2009
Under 5 mortality rate (per 1 000 live births, both sexes)	Both sexes	17	2010
Maternal mortality ratio (per 100 000 live births) Interagency Estimates	Both sexes	35 [29–49]	2010

Table 3. Health economics (2, 3)

Indicator	Year	Value
External resources for health as percentage of total expenditure on health	2010	1.3
General government expenditure on health as percentage of total expenditure on health	2010	35.3
General government expenditure on health as percentage of total government expenditure	2010	7.6
Total expenditure on health as percentage of GDP	2010	3.6
Out-of-pocket expenditure as percentage of private expenditure on health	2010	83.6
Per capita government expenditure on health at average exchange rate (US\$)	2010	31 (3)
Per capita total expenditure on health at average exchange rate (current US\$)	2010	77.330
Private expenditure on health as percentage of total expenditure on health	2010	55.3 (3)
Social security expenditure on health as percentage of general government expenditure on health	2010	0.1 (3)

Table 4. Distribution of years of life lost by cause (2008). Percentage reflects proportion of total years of life lost (4)

Indicator	Year	Country	Region
Communicable	2008	42%	19%
Noncommunicable	2008	45%	63%
Injuries	2008	13%	18%

References

1. The World Bank. The World Databank. Washington, DC, 2012.
2. World Health Organization. Global Health Observatory Data Repository. 2012.
3. The World Bank. World development indicators 2012. Washington, DC, 2012.
4. WHO Country Profiles: The Philippines: Health Profile. Geneva, 2012. Accessed July 23, 2012.

ANNEX 3: EVALUATION TEAM, SOURCES AND CRITERIA FOR SUBNATIONAL ELIMINATION

The subnational elimination certification evaluation team is comprised of the national malaria programme manager, a medical specialist on hospital and clinical malaria management, a medical technologist, national/regional entomologists, the regional malaria coordinator, the provincial malaria coordinator and the local staff (1).

The subnational, provincial level evaluation to establish malaria-free status is based on the following aspects:

- Review of province reports and validation of lack of indigenous cases in the past five years;
- Review of malaria activities implemented in the last five years before the last reported indigenous case up to the time of the evaluation;
- Findings during the visits of local health facilities (rural health units, public/private hospitals)—number of trained staff, malaria laboratory diagnosis and treatment availability and quality, completeness of documentation, etc.;
- Interviews with key informants;
- Mosquito collection and examination.

The evaluation criteria for the province are as follows:

- No indigenous case confirmed in the last five years;
- A malaria surveillance system set up and implemented, including a diagnostic laboratory with a medical technologist trained in malaria microscopy;
- Epidemiological investigation of cases being conducted and epidemic preparedness in place;
- The LGUs making available vector control logistic support for any outbreak occurrence, as well as anti-malarial drugs for imported cases;
- Continued intensive health education and advocacy on malaria prevention and control.

Reference

1. The Republic of the Philippines, Department of Health, National Malaria Control Programme

ANNEX 4: SUBNATIONAL ELIMINATION APPROACHES OF THE PROVINCES OF CAVITE AND BATANES

Table 1. Comparison of the strategic directions for prevention of reintroduction of malaria transmission in two provinces in the Philippines

Strategic approach	Province of Cavite		Province of Batanes	
	Activities	Challenges	Activities	Challenges
Malaria surveillance				
Prompt detection of imported and autochthonous cases	ACD related to epidemiological investigation of imported cases, screening of some donors; PCD; Testing febrile patients, travelers for malaria		PCD; Testing febrile patients for malaria	Testing for malaria fever patients only after they have been febrile for about a week; this may cause delayed diagnosis and treatment with clinical and epidemiological consequences; ACD would probably be useful as part of the epidemiological investigation of potential cases
Laboratory support	Microscopy and RDTs; Microscopic confirmation of all cases	Lack of trained laboratory staff in the remote areas	RDTs in the hospital laboratory of Basco for all cases	Transportation of samples/patients from other islands/settlements may take time; this could lead to delayed diagnosis and treatment; No microscopy. No local trained staff in malaria microscopy
Quality assurance of malaria laboratory diagnosis	EQA in place		No EQA	Case management would benefit from including the province in the national EQA scheme
Radical treatment of malaria patients and parasite carriers	Conducted in line with the National Guidelines; Covered by the government; Malaria drugs available at provincial level		Conducted in line with the National Guidelines Covered by the government	Shortage of malaria drugs in the provincial hospital
Registration and timely mandatory notification of cases; cases and foci recording	Conducted in line with the National Guidelines; Malaria case reporting is integrated with the PIDS R		Registration and weekly notification. Conducted in line with the National Guidelines; Malaria case reporting is integrated with the PIDS R	
Epidemiological investigation of cases and foci	Epidemiological investigation of cases conducted		Epidemiological investigation of cases conducted	Insufficiency of epidemiological data making classification of some cases difficult

Entomological surveillance		No regional professional resources to conduct it	Few entomological studies have been conducted in Batanes by the RITM	No regional professional resources to conduct it
Vector control	Mosquito nets and screening of houses are traditionally used		LLINs, Limited IRS, clearing of streams	
Regional Plan of action for prevention of malaria reintroduction		Not developed		Not developed

ANNEX 5: SUPPLEMENTARY COSTING INFORMATION

Sources of funding

The major sources of programme funding are the national government through the DOH and CHDs, the LGUs, and external funders such as GFATM, DFAT and JICA. The NMCP at the central DOH allocates a portion of its budget to CHDs to augment the regular funds used by the latter to support malaria control operations. The planning and budgeting process of the provincial health offices and municipal health offices plan are autonomous from that of the central and regional DOH, with the internal revenue allotment comprising the main source of funds for these plans. In addition, funds from other sources, such as income from user fees, Philhealth capitation and reimbursements and grants from external sources, are aggregated by the LGUs. Where there is an existing province-wide or citywide investment plan for health (PIPH/ CIPH), the annual budget is synchronized with its annual investment plan. The annual budgets are passed by the respective LGU legislative councils (1). The phases of elimination as used by the UCSF Global Health Group for this study are a mix of criteria from the World Health Organization (2), Cohen et al. (3), and the Philippines DOH (4):

- Controlled low-endemic malaria (CLM): interventions have reduced endemic malaria transmission to such low levels that it does not constitute a major public health burden (3), typically between <5 cases/1 000 PPY and 1 case/1 000 PPY (2).

- Elimination: interventions have interrupted endemic transmission and limited onward transmission from imported infections below a threshold at which risk of reestablishment is minimized (3), typically when indigenous cases are below 1/1 000 PPY (2).
- Prevention of reintroduction: zero indigenous cases are maintained; provinces are certified malaria-free if no indigenous cases arise for five consecutive years (4).

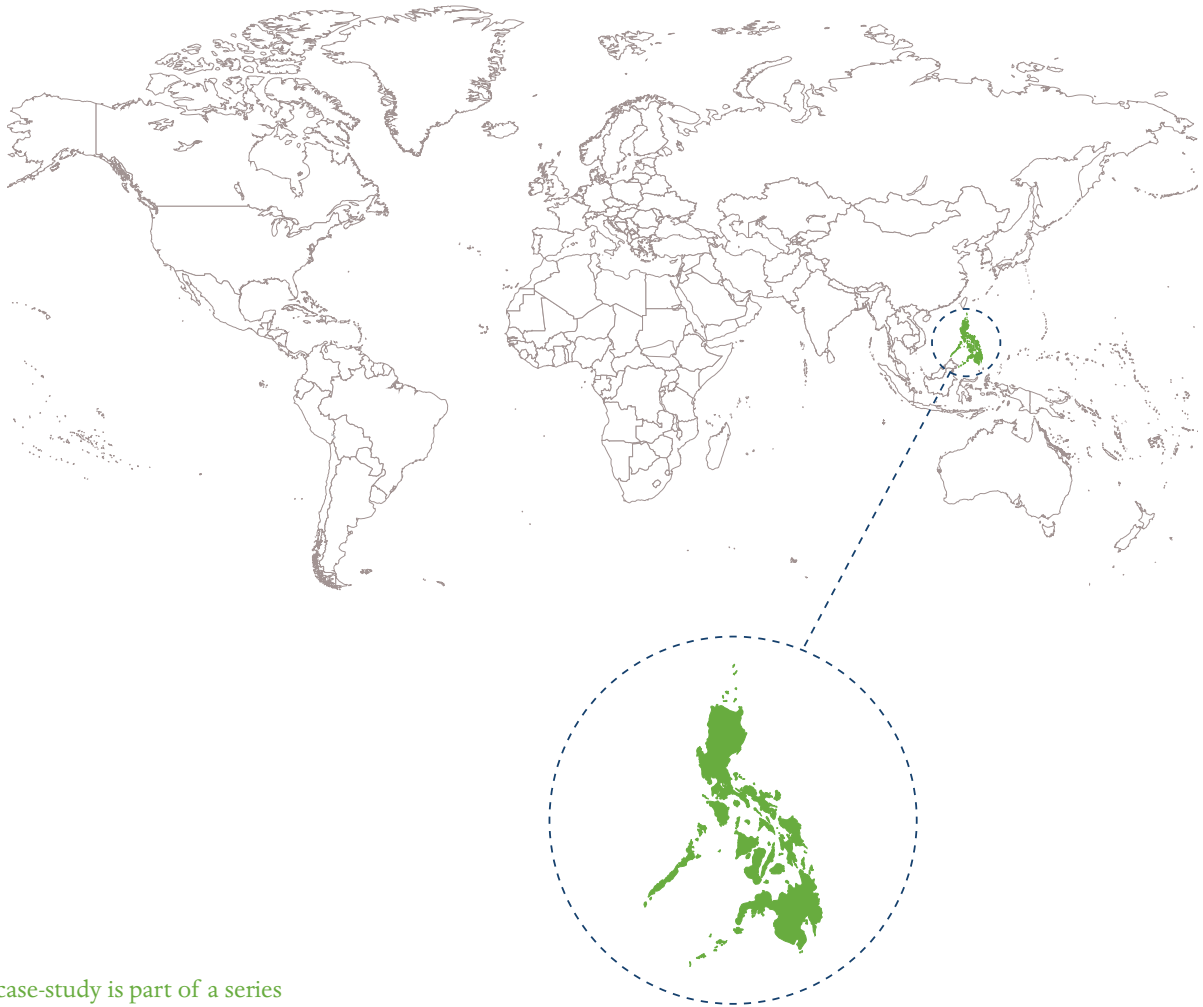
See [Table 1](#) on the following page for additional malaria expenditures and information for each study province.

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2. World Health Organization. *Malaria elimination—A field manual for low and moderate endemic countries*. Geneva: World Health Organization. 2007.
3. Cohen J, Moonen B, Snow R, Smith D. How absolute is zero? An evaluation of historical and current definitions of malaria elimination. *Malaria Journal* 9: 213. 2010.
4. Republic of the Philippines Department of Health. *2011–2016 Malaria Medium Term Development Plan*. Manila: National Malaria Control Program. 2011.

Table 1: Malaria expenditures, population at risk, cases, funding sources, and personnel time across study provinces

	Apayao		Laguna				Cavite				Benguet		
	2007	2008	2009	2006	2007	2008	2009	2010	1998	2000	2007	2004	2008
Programme phase (1)	CLM	CLM	E	E	E/OB	E/OB	E	E	CLM	CLM/E	POR	E	POR
Population at risk (2)	103 633	106 642	109 742	8 532	8 760	8 995	9 236	8 892	9 814	13 101	11 033	5 841	6 325
Indigenous malaria cases (3)	246	35	11	3	256	9	4	7	24	3	0	0	N/A
Imported malaria cases (3)	0	0	0	2	4	N/A	N/A	N/A	22	1	3	12	N/A
Total expenditures (4)	\$747 368	\$570 603	\$360 114	\$27 844	\$103 537	\$110 093	\$40 699	\$43 562	\$42 484	\$23 575	\$6 986	\$16 185	\$15 931
Expenditures per PAR (4)	\$7.21	\$5.35	\$3.28	\$3.26	\$11.82	\$12.24	\$4.41	\$4.90	\$4.33	\$1.81	\$0.63	\$2.77	\$2.52
Funding sources													
Local government	14.9%	16.5%	23.9%	78.8%	42.2%	33.2%	69.7%	49.6%	29.7%	34.4%	59.1%	49.5%	48.2%
Provincial government	3.9%	4.1%	5.5%	7.8%	18.9%	11.3%	13.3%	31.5%	<1%	<1%	15.4	18.3%	15.2%
National government	1.7%	1.8%	2.5%	13.1%	38.8%	55.4%	16.8%	18.9%	70.3%	65.5%	25.6%	26.4%	26.7%
Global Fund	79.5%	77.4%	68.0%	-	-	-	-	-	-	-	-	-	-
Other	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	-	-	-	5.8%	9.8%
Personnel													
% of total expenditures	20.3%	24.3%	31.8%	95.2%	59.1%	46.3%	85.2%	63.4%	88.7%	79.8%	100.0%	91.4%	90.2%
Count	123	121	16	28	61	36	34	33	13	11	12	29	30
FTE equivalent (5)	33.33	30.66	8.25	5.68	14.40	11.29	6.70	4.33	5.86	3.47	1.04	2.85	2.86
Staffing ratio (6)	3.69	3.95	1.94	4.93	4.24	3.19	5.07	7.62	2.22	3.17	11.59	10.18	10.49



This case-study is part of a series of malaria elimination case-studies conducted by the World Health Organization (WHO) Global Malaria Programme and the University of California, San Francisco (UCSF), Global Health Group. The case-studies series documents the experience gained in eliminating malaria in a range of geographical and transmission settings with the aim of drawing lessons for countries that are embarking upon elimination.

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