The Vanuatu Ministry of Health aims to progressively control and eliminate malaria in all 6 provinces of the country.

This National Malaria Strategic Plan for Vanuatu incorporates the findings of a comprehensive Malaria Program Review conducted in 2013 and extensive follow-up discussions with the national Vector Borne Disease Control Program, MOH and other partners, including non-Government and civil society stakeholders.

To achieve its malaria control and elimination targets, the VBDCP will work in close partnership with provincial health services and local communities to ensure that universal access to health promotion, prevention with long-lasting insecticidal bed nets, and quality-assured diagnosis and treatment is maintained.

Building on experience gained in pilot elimination activities in Tafea province, the Program will use indoor residual insecticide spraying to accelerate the reduction in malaria transmission in selected areas.

It will strengthen and maintain excellent surveillance and apply new knowledge as it becomes available in order to achieve malaria elimination and the prevention of reintroduction.

By 2020, Vanuatu expects to reach an annual parasite incidence below 1 per 1,000 nationally, and maintain zero confirmed deaths from malaria. Three provinces would have entered the elimination phase (including two provinces with zero – or close to zero – local malaria transmission).

NATIONAL MALARIA STRATEGIC PLAN, VANUATU, 2015-2020

7th (Final) Draft

NMSP Working Groups,
Ministry of Health, Vanuatu

Table of Contents

Foreword

Minister or DG (to be completed once MOH has endorsed the NMSP) …

Acronyms and Abbreviations

ABER	Annual blood examination rate
ACD	Active case detection
AICEM	Australian Initiative for the Control and Elimination of Malaria
ACSM	Advocacy, communication and social mobilisation
ACT	Artemisinin-based combination therapy
ACT-Malaria	Asian Collaborative Training Network for Malaria
AL	Artemether-lumefantrine
API	Annual parasite incidence
APMEN	Asia Pacific Malaria Elimination Network
BCC	Behaviour change communication
CCM	Global Fund Country Coordination Mechanism
CMO	Provincial Chief Medical Officer
CMS	Central Medical Stores
CoMBI	Community mobilisation for behavioural impact
CQ	Chloroquine
DDT	Dichlorodiphenyltrichloroethane
DHS	Demographic and Health Survey
DOT	Directly-observed treatment
FIND	Foundation for Innovative New Diagnostics
FSaT	Focal screening and treatment
G6PD	Glucose-6-phosphate dehydrogenase
GDP	Gross domestic product
GIS	Geographic / geo-referenced household information system
GNI	Gross National Income
GOV	Government of Vanuatu
HIS	Health information system
HPO	Health Promotion Officer
HRH	Human resources for health
IEC	Information, education and communication
IMR	Infant mortality rate
IQK	Insecticide Quantification Kit
IRS	Indoor residual insecticide spraying
ITN	Insecticide-treated bed net
IVM	Integrated vector management
KABP	Knowledge, attitudes, behaviour and practices
LAMP	Loop mediated isothermal amplification for malaria parasites
LLIN	Long lasting insecticidal net
LSM	Larval source management
M&E	Monitoring and evaluation
MAP	Malaria Action Plan
MaST	Mass screening and treatment
MDA	Mass drug administration
MDG	Millennium Development Goal

MICS	Multiple Indicator Cluster Survey
MIS	Malaria information system
MMFO	Malaria Management for Field Operations
MMLL	Monthly malaria line listing
MNCH	Maternal, neonatal and child health
MOH	Ministry of Health
MPR	Malaria program review
MSC	Malaria Steering Committee
NCD	Non-communicable disease
NGO	Non-government organisation
NMSP	National malaria strategic plan
PacMI	Pacific Malaria Initiative
PacMISC	Pacific Malaria Initiative Support Centre
PCD	Passive case detection
PCD+	Enhanced passive case detection
PCR	Polymerase chain reaction
PHC	Primary (and preventive) health care
POE	Point of entry
PPP	Purchasing power parity
PQ	Primaquine
PR	Principal Recipient
QA	Quality assurance
QC	Quality control
RDT	Rapid diagnostic test
SCA	Save the Children Australia
SOP	Standard operating procedure
SP	Sulphadoxine-pyrimethamine
SPC	Secretariat of the Pacific Community
TA	Technical Assistance
TAG	Technical Advisory Group
TES	Therapeutic efficacy study
TWG	Technical Working Group (under TAG)
U5MR	Under-five mortality rate
UQ	University of Queensland
USD	United States Dollar
VanPHIS	Vanuatu Public Health information System
VBDCP	Vector Borne Disease Control Program
VCNE	Vanuatu College of Nursing Education
VHW	Village Health Worker
VUV	Vanuatu Vatu
WHO	World Health Organization
WHOPES	WHO Pesticide Evaluation Scheme

Acknowledgements

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The drafting team consulted closely with members of the following Working Groups (from national VBDCP team unless specified otherwise):

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- Diagnosis and Treatment: Esau Naket, Griffith Harrison (Vila Central Hospital), Kalo Kalkoa, Wesley Donald, Winch Garae, Harry Iata, Nancy Miyake (Save the Children, Australia), Guy Emile
- Vector Control: Timothy Quai, Wesley Donald, Winch Garae, Harry Iata, Nancy Miyake (SCA)
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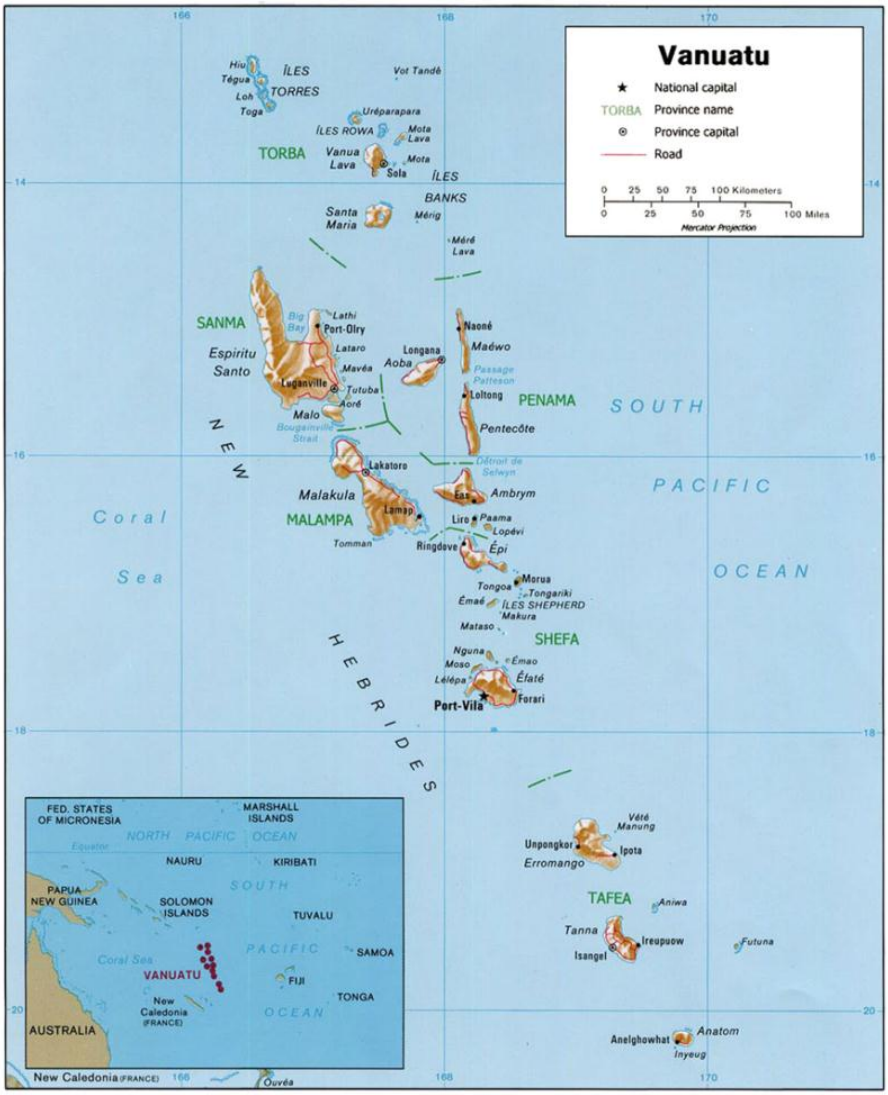
Many of the principles underpinning the new *Strategic Plan* were first discussed at a preliminary workshop in March 2013, facilitated by Marcel Tanner (Swiss Tropical Medicine Institute). Marcel also undertook independent peer review of the final draft of the strategy.

RC, CD and BP were engaged by the University of Queensland through PacMISC / AICEM. They were closely assisted by the Senior Program Management Support Officers in Port Vila (initially Pat Field, then Christine Leonard).

Map of Vanuatu showing provincial composition



Executive Summary

Malaria Situation and Existing Program

Malaria has historically been one of the leading causes of ill health in Vanuatu. The whole population of the country – about a quarter of a million people – is considered at risk of infection.

Since 2004, the Ministry of Health (MOH) and its partners have implemented an intensified program to progressively control malaria through: widespread access to diagnosis by microscopy or rapid diagnostic test (RDT); widespread access to highly effective treatment with artemisinin based combination therapy (ACT); high coverage with long lasting insecticidal bed nets (LLIN); widespread community engagement; and intensive, targeted technical assistance. All interventions are provided free of charge to the end-user. This has seen the annual parasite incidence (API) fall from 74 per 1,000 in 2003 to 13.2 per 1,000 in 2012, and the virtual disappearance of confirmed malaria-related deaths.

Pilot malaria elimination activities commenced in Tafea province in 2009 and have just begun in Torba, using indoor residual spraying (IRS) of houses and selective larval breeding site management (LSM) to accelerate reduction in transmission; this is superimposed on a background of 100% LLIN coverage, universal access to prompt diagnosis and treatment, and enhanced surveillance and rapid response to identified cases. Tafea achieved close to zero local malaria transmission in 2013 and is on track to achieve sub-national elimination by 2016.

Malaria services are centrally coordinated and managed, and draw significant development partner support. At a time when health financing in Vanuatu is under increasing pressure and donors provide just over one-third of the health budget, the Malaria Program absorbs about one-quarter of donor financing for health and its human resources represent about one-third of health sector employees.

Findings from a comprehensive Malaria Program Review conducted in June 2013 have been used as a basis for developing this revised *National Malaria Strategic Plan 2015-20* (NMSP).

Challenges remain in the delivery of anti-malaria interventions in more remote areas, where some communities continue to have poor access to health and other services. The revised NMSP takes note of the Government of Vanuatu health sector reforms announced in 2013, which place additional emphasis on delivering integrated health services directly to the community level (under predominantly Provincial Health Office management and supervision).

The National Malaria Strategic Plan 2015-20

The MOH aims to progressively control and eliminate malaria in all provinces of the country, with a view to national level certification of malaria-free status between 2025 and 2028.

The Goal of the new Strategy, which covers the period 2015 to 2020, is:

> ***By the end of 2020**, to reduce the annual parasite incidence rate to < 1 per 1,000 nationally and maintain zero confirmed deaths from malaria.*

Under the Strategy, Malaria Program activities are grouped into three thematic operational areas:

Thematic Area 1: VECTOR CONTROL

Strategic Objective: *To maintain universal coverage with LLINs for the whole population of Vanuatu and accelerate reduction in malaria transmission in selected areas using IRS*

Thematic Area 2: DIAGNOSIS AND TREATMENT

Strategic Objective: *To achieve 100% testing of suspected malaria cases by microscopy or RDT and provide prompt treatment and care for 100% of confirmed malaria cases according to the national 'Guidelines for Treatment of Malaria'*

Thematic Area 3: ACTIVE SURVEILLANCE AND RESPONSE IN SUPPORT OF ELIMINATION

Strategic Objective: *Once a province has entered the elimination phase, to investigate and manage all malaria cases and identify, investigate and manage foci of infection according to national 'Guidelines for Malaria Elimination'*

An additional objective addresses **PROGRAM MANAGEMENT** to maintain core national functions and support provincial service delivery. The relevant Objective is: To *strengthen Malaria Program leadership and management capacity at provincial and national level to plan, deliver and report on malaria interventions in a well-coordinated, efficient and timely manner*.

Rationale and Implementation Strategies

Building on recent achievements at the national level, the Vector Borne Disease Control Program will work in close partnership with provincial health services and local communities to ensure that universal access to health promotion, prevention with LLINs, and quality-assured diagnosis and treatment is maintained.

In order to reach and maintain universal coverage with LLINs, the Program will undertake systematic full replacement of LLINs (on the basis of one net per sleeping space) throughout the entire country on a three-yearly provincial and health zone cycle: this means about 500,000 nets will be delivered over the 6 years of the Strategy. This will be supported by behaviour change communication to ensure a high level of net utilisation, and operational research to confirm the useful life span of LLINs and the best way to use or dispose of expired nets.

Drawing on successes and lessons from the pilot elimination activities in Tafea province, the Program will apply one, two or three (occasionally more) annual rounds of IRS in selected areas to accelerate reduction in malaria transmission towards pre-elimination levels; this will be based initially on stratification at health zone level, but will focus increasingly at the village and community level to increase precision and efficiency. Operational research will guide the selective use of LSM to supplement the effects of IRS (in combination with other interventions).

Quality assured diagnosis by microscopy or RDT and prompt, effective treatment of *P falciparum* and *P vivax* according to the national *Guidelines* are essential components of case management. The new Strategy seeks to maintain universal access to diagnosis and treatment while, at the same time, seeking greater efficiency by rationalising the number of microscopy points and ensuring effective external QA for all diagnostic methods.

Due to uncertainties about the risk and management of severe haemolytic reactions, less than 5% of *P vivax* cases are currently prescribed primaquine. To facilitate the safe administration of primaquine for *vivax* malaria, G6PD screening will be established in at least one centre pending the availability of feasible, accurate, cost-effective point-of-care testing.

In areas that have reached low levels of transmission (API < 1 per 1,000), provincial health teams will maintain excellent malaria surveillance, active case finding and response in order to achieve malaria elimination and the prevention of reintroduction. Annual blood examination rates by microscopy or RDT will be maintained at 15% or above; cases will be investigated within 5 days according to

national *Guidelines*; and known or emerging foci of transmission will be investigated and re-classified at least annually and recorded on a geographic information system. These functions will be progressively integrated into the Vanuatu health system as part of overall disease surveillance, contributing to stronger public health management of other diseases – especially those that are epidemic prone or targeted for elimination.

To make more efficient use of both malaria-specific and other MOH and donor resources, the Program and provincial health services will undertake trials of innovative service delivery options at the community level, providing multiple health interventions during community visits based on cost sharing between public health programs (which may have different funding streams). This will involve close partnerships with Village Health Workers and community nurses, with a view to supporting integrated community outreach more efficiently and effectively.

In "Small Island" or isolated community settings, proactive case detection using mass screening and treatment (MaST) by RDT may be undertaken for the entire community. Positive cases would be identified and treated simultaneously under direct observation by a local or visiting health worker. For operational and cost efficiency, MaST would be undertaken at the same time as bed nets are distributed, houses sprayed and other community and public health outreach services provided.

Planning, Governance and Management

Stronger harmonisation between national and provincial health planning processes will be achieved through consultative planning processes and an annual review meeting. The Program and provincial partners will develop an integrated annual malaria operational plan and budget for the coming year (national and for each province), ready for inclusion in national health budget submissions.

The Program's existing governance bodies – the Malaria Steering Committee (MSC) and the Technical Advisory Group (TAG) – will be retained. The MSC (comprising Government, donor and technical partner representatives) will provide higher level inputs on the management and overall strategic directions of the Program, while the TAG will continue to provide technical oversight for the Program and individual thematic technical working groups, and technical recommendations for the MSC to consider.

As Vanuatu is considering applying for additional Global Fund assistance from 2015 under the *New Funding Model*, the new NMSP for 2015-20 will be used as a basis for that application.

Information Management, Monitoring and Review

Vector control and case management outcomes will be monitored through routine operational data and a monthly malaria line listing (MMLL). Subject to resources being available, this will be supplemented by a follow-up malaria indicator survey in 2016 (or a relevant module within the next Demographic and Health Survey).

Current information management capacity will be strengthened through the addition of one additional officer based at the national level, working closely with and supporting provincial information and surveillance officers. Provincial health teams and information managers will collate data from the MMLL, and will increasingly produce and interpret their own monthly data and monitor provincial trends for selected indicators.

As better data on malaria incidence by village or community become available, the Program will move towards stratification of transmission risk at those more local levels. This will provide more focused guidance for better targeting of interventions and potentially improved cost-effectiveness.

The Program will generate a comprehensive national annual malaria report. Semi-annual reports will be compiled at provincial, health zone and even facility level to guide and support the planning and implementation of malaria interventions in the community.

Independent reviews of the Program and Strategy will be conducted in early 2017 (taking advantage of available survey data from 2016), and in late 2019 or early 2020 to prepare for the next Strategy and eventual certification of malaria elimination.

Budget and Principal Financial Risks

The cost of implementing the Strategy is estimated at USD 24.35 million across the full 6 years and USD 11.66 for the first three years (2015-17). Vector control is allocated 29% of the whole-of-Strategy budget, case management 7%, elimination activities 4% and program management 60% (including human resources, short- and long-term technical assistance and M&E costs).

An anticipated 90% reduction in Global Fund support and recent contractions in the Australian aid program budget mean there is likely to be a funding gap of USD 6.56 million for the Strategy for the period 2015-17.

If the funding gap cannot be closed, a prioritisation exercise has already been undertaken (within the budget and strategy) to protect the gains made in Tafea province and maintain elements of the Program that are considered absolutely indispensable. Protection of achievements to date would also be addressed through a strong focus on ensuring the quality of interventions.

Impact and Outcomes

The logic model and theory of change for the Strategy are summarised in the following diagram (page xiii).

As a result of implementation of all of the proposed activities, the national API is expected to decrease progressively to below 5 per 1,000 by the end of 2016 and below 2.5 per 1,000 by the end of 2018. There should be no confirmed deaths from malaria.

By the end of 2020, the national API is expected to have fallen below 1 per 1,000. At least three provinces (Tafea, Torba and Shefa) are expected to have entered the elimination phase (provincial API < 1 per 1,000), and at least two of those provinces (Tafea and Torba) are expected to have achieved and be maintaining zero local transmission.

Logic model and theory of change, National Malaria Strategic Plan, Vanuatu, 2015-20

Vision: A malaria-free Vanuatu by 2025-28, contributing to the good health and well-being of the population

Goal: By the end of 2020, to reduce the annual parasite incidence rate to < 1 per 1,000 nationally and maintain zero confirmed deaths from malaria

ISSUES and CHALLENGES	STRATEGIC APPROACH	OUTPUTS (Activity areas)	OUTCOMES Short term (2016) → Intermediate (2018) → Longer term (2020)		
High rates of malaria transmission (except Tafea) API = 13.2 per 1,000 (range by province 4.7–38.2, excluding Tafea); TPR = 10% (range by province 5–21%). ***Vector control*** Close to 100% LLIN coverage but sub-optimal utilisation: 52% nationally (87% in Tafea). ***Case Management*** Good access to RDT and ACT; microscopy under-utilised. PQ under-prescribed for *P vivax* (G6PD screening unavailable). ***Elimination*** Close to 0 local transmission in Tafea following intensive intervention; now needs to be extended – progressively and cost-effectively – to other provinces. ***Health system*** Recent decentralisation of health system. Pockets of poor access to services in remote areas. Inefficiencies in delivery of some malaria services.	***Vector Control*** • Maintain high LLIN coverage and utilisation • Targeted IRS to accelerate transition from control to pre-elimination phase ***Case Management*** • Maintain microscopy services as appropriate • Extend RDT network • Maintain ABER > 15% • Maintain universal ACT • Introduce G6PD testing ***Surveillance & Response to support Elimination Areas*** • Manage malaria transmission foci as per *Guidelines* • Detect and respond to individual cases ***Program Management*** • Collaborative strategic planning with provinces • MAP well reflected in MOH and provincial business plans • Strengthened capacity of information management team	***Vector Control*** Implementation of LLIN distribution (3-year cycle). IRS in targeted health zones and provinces. ***Case Management*** Skills and commodities for diagnosis and treatment. G6PD testing established in at least one centre (or via RDT). ***S&R and Elimination*** Responsive case detection and investigation systems. Support to village health and elimination committees. ***Program Management*** Annual MAP developed, aligned with national and provincial business plans. Effective M&E Framework Policies and guidelines. Expenditure tracking reports. Supervisory outreach visits from national and provincial level. ***Activities developed and implemented in partnership between MOH (TAG & MSC), provincial health services and donors***	***Transmission*** API < 5 per 1,000 nationally; 0 local transmission in Tafea. ***Vector control*** >80% LLIN coverage and utilisation in all areas Targeted IRS completed in Torba, initiated in Malampa and Shefa. ***Case Management*** Universal access to RDT and ACT; microscopy network rationalised, EQA in place. G6PD testing in ≥25% of *P vivax* cases, with ≥25% PQ uptake. ***S&R and Elimination*** Cases and foci well managed in Tafea. ***Program Management*** GOV leads the Program (via MSC, supported by TAG) ≥ 2 provinces actively engaged in planning and collaborative approaches to service delivery. Annual malaria conference to develop annual report and MAP.	***Transmission*** API < 2.5 per 1,000 nationally. ***Vector control*** >80% LLIN coverage and utilisation maintained. Targeted IRS completed in Torba and Shefa, maintained in Malampa and initiated in Penama. ***Case Management*** Universal access to quality assured diagnosis and ACT. G6PD testing in ≥50% of *P vivax* cases, with ≥50% PQ uptake. ***S&R and Elimination*** Cases and foci well managed in Tafea, Torba and Shefa. ***Program Management*** GOV leads the Program (via MSC, supported by TAG) ≥ 3 provinces actively engaged in planning and collaborative approaches to service delivery. Annual malaria conference to develop annual report and MAP.	***Transmission*** API < 1 per 1,000 nationally; 0 local transmission in Tafea, Torba and probably Shefa. ***Vector control*** >80% LLIN coverage and utilisation maintained. Targeted IRS scaled back but ongoing as required. ***Case Management*** Universal access to quality assured diagnosis, G6PD screening and treatment. ***S&R and Elimination*** Cases and foci well managed in Tafea, Torba, Shefa and (according to progress) other areas. ***Program Management*** GOV leads the Program (via MSC, supported by TAG) All provinces actively engaged in planning and collaborative approaches to service delivery. Annual malaria conference to develop annual report and MAP.

1. Introduction

1.1 Background – malaria in Vanuatu

Malaria has historically been one of the leading causes of ill health in Vanuatu. In 1990, it infected an estimated 198 per 1,000 people and caused many deaths (MOH 2013); as recently as 2010, it was among the top 5 notifiable diseases nationally (WHO 2011). Malaria is present on all of the 68 inhabited islands of Vanuatu except for Aneityum (where it was eliminated in the late 1990s) and Futuna (which lies south-east of the Buxton Line, the natural limit to the range of *Anopheles* mosquito vectors) (Kaneko 2010).[1] The whole population of Vanuatu is considered at risk of malaria infection (WHO 2012a).

Guided by the *National Malaria Strategic Vision 2007–16*, the national Vector Borne Disease Control Program (VBDCP) has been implementing a range of strategies and interventions with the aim of: a) strengthening malaria control throughout the country; b) ensuring that zero deaths occur from malaria; and c) eliminating malaria from Tafea province by 2016 (VBDCP 2010). These strategies include: improved diagnosis by microscopic examination of blood slides or rapid diagnostic test (RDT); highly effective treatment using artemisinin based combination therapy (ACT); protecting people from contact with infected mosquitos by sleeping inside long lasting insecticidal bed nets (LLIN); widespread community engagement; and – selectively (in Tafea and, more recently, in Torba province) – indoor residual spraying (IRS) of houses with insecticide (VBDCP 2010, WHO 2012a).

As a result, the annual parasite incidence (API) has decreased from to 74 per 1,000 in 2003 to 13.2 per 1,000 in 2012; confirmed malaria deaths have fallen from about 7 per 100,000 to less than 1 per 100,000 over the same period (MOH 2013).[2] (Malaria epidemiology is discussed in more detail in Section 3.1).

This work has been undertaken in collaboration with the neighbouring Solomon Islands, with strong support from development partners: the Global Fund to fight AIDS, Tuberculosis and Malaria since 2004, and the Australian government's Pacific Malaria Initiative (PacMI) since 2008. Since the original Global Fund grant was approved, the Global Fund has provided about USD 4.9 million for malaria control in Vanuatu (SPC 2013). The World Health Organisation (WHO) and the Secretariat of the Pacific Community (SPC) have provided technical and administrative support, respectively.

1.2 Malaria in the context of the national health plan

Although the *Vanuatu Health Sector Strategy 2010-2016* does not specifically mention malaria, it places a strong emphasis on improving the health status of the population through equitable access to quality health services at all levels of the community (GOV 2010). Health sector reforms announced in 2013 place additional importance on the role of provincial health offices in strengthening health service delivery at the community level (GOV 2013). Given the continuing presence of malaria as a public health problem in Vanuatu, improving service delivery and health status at the community level will logically require malaria to continue to be addressed as a public health priority.

[1] Malaria elimination was achieved in Aneityum (population < 750) using a combination of weekly mass drug administration, universal bed net coverage, intensive community mobilisation and meticulous surveillance for introduced or relapsing cases.

[2] Earlier incidence data may actually under-estimate the true picture: only 10% of health facilities have microscopy, and RDTs were introduced in late 2008 (and only became widely available in 2010).

1.3 International context and commitments

The *Vanuatu Health Sector Strategy 2010-2016* includes a strong commitment to the Millennium Development Goals (MDG). Its MDG-specific targets include child and maternal health outcomes (MDGs 4 and 5) and improved access to safe water supply and sanitation (MDG 7); it does not identify any malaria- or other disease-specific targets (MDG 6) (GOV 2010).

However, Vanuatu is among 39 "elimination countries" participating in the international Malaria Elimination Group (Feachem 2009), and receives technical support through the Asia Pacific Malaria Elimination Network (APMEN). The *Australia–Vanuatu Partnership for Development* – endorsed by the Prime Ministers of both countries in 2009 – has an explicit, mutual commitment to "controlling and progressively eliminating malaria" (GOA-GOV 2009).

1.4 The planning period and reasons for selecting this period

While the *Vanuatu Health Sector Strategy* and *National Malaria Strategic Vision* both remain valid to 2016, the recently introduced health sector reforms are likely to see an eventual revision of the national health sector strategy. In addition, the VBDCP is likely to reach several of its milestones or objectives before 2016: achievement of zero (or close to zero) local transmission in Tafea province is anticipated around the end of 2014, and this coincides with the conclusion of the current Global Fund grant.

An application to the Global Fund under its *New Funding Model* requires a new (or updated) national malaria strategic plan (NMSP) that will remain valid throughout the period of Global Fund support. As Vanuatu is considering applying for additional Global Fund assistance from 2015, it is timely to develop a revised NMSP in advance of that application.

Technically, it is also timely for the VBDCP to review and revise its strategies with a slightly longer time frame in mind. As malaria transmission and incidence approach very low levels in some parts of the country, elimination strategies need to be integrated with provincial and community surveillance and response systems; the VBDCP is well placed to inform and guide the Ministry of Health (MOH) on new models of service delivery that will deliver integrated disease control and prevention services to the community in an efficient and effective way.

A preliminary workshop was held in Port Vila in March 2013 to discuss options for a revised NMSP and recommended that the new strategy covers the 6-year period from 2015 to 2020. This would align with the anticipated attainment of zero (or close to zero) transmission in several areas of Vanuatu by 2020.

1.5 Malaria Program Review and process of developing the strategic plan

Following the March workshop, a thematic desk review of key documents (VBDCP 2013) was undertaken in May 2013 followed by an external Malaria Program Review (MPR) in June 2013 (MOH 2013).

An international team visited Vanuatu in October-November 2013 to assist the MOH to revise the NMSP. They worked closely with WHO and five thematic working groups to examine different aspects of the Program (program structure and management; diagnosis and treatment; vector control; surveillance, response and elimination; and monitoring and evaluation [M&E]), review each of the specific recommendations of the MPR, and identify feasible and affordable options for implementation.

Strategic options were analysed and selected and the draft strategy presented to and reviewed with the VBDCP team and a small number of development partner representatives on 14 November. Further

refinements were incorporated into the strategy document and presented to MOH leaders and decision-makers, a broader range of key development partners and non-government organisation (NGO) representatives on 6 February 2014. A final presentation was made to the health sector Joint Partners Working Group on 19 February.

A detailed costing exercise was undertaken in between late February and early April 2014. The final costed strategic options (prioritised) and an indicative budget for a range of funding scenarios were presented to and reviewed with the VBDCP team on 2 and 4 April.

2. Country Profile

2.1 Socio-political system

Vanuatu is a lower-middle income country located in the south-west Pacific.[3] It is a constitutional democracy with a republican political system headed by a President (elected by sitting members of Parliament and presidents of Regional Councils) and a Prime Minister (who is the head of the ruling party or coalition within Parliament). Members are elected every four years to represent multi-seat constituencies.

Governments may change more frequently than four-yearly due to shifting alliances within the Parliament. The most recent election was in 2012, and the current Government was formed on 23 March 2013. The Government is active in driving the current health sector reforms.

2.2 Geography and demographics

2.2.1 Geography

Vanuatu is a Y-shaped archipelago consisting of approximately 82 islands of volcanic origin (65 of them inhabited). It lies between latitude 13° and 21°S (spanning 1,176 kilometres from north to south) and longitude 166° and 171°E. Total land area is about 12,274 square kilometres, within a maritime boundary of approximately 700,000 square kilometres. The highest point of elevation is 1,877 metres.

The country has been divided into six provinces since 1994. The names of the provinces derived from their constituent islands or island groups (refer Map, page viii). From north to south, they are:

- Torba (Torres and Banks Islands).
- Sanma (Santo, Malo)
- Penama (Pentecost, Ambae, Maewo)
- Malampa (Malakula, Ambrym, Paama)
- Shefa (Shepherds group, Efate)
- Tafea (Tanna, Aniwa, Futuna, Erromango, Aneityum)

2.2.2 Population and demographics

The population of Vanuatu is young and predominantly rural.

Based on projections from the 2009 census, the estimated population in 2013 is 251,784. The median age is 21 years, with 37.3% of the population aged 0-14 years and just 5.8% aged 60 or above. The population has a very slight male predominance (51.1%) (SPC 2011).

Almost 80% of the population lives on just 7 islands: Efate (where the capital Port Vila is located), Santo (the largest island, with the second-largest urban area, Luganville), Tanna, Malekula, Pentecost, Ambae and Ambrym (Van Met 2007). Approximately 76% of the overall population lives in rural areas – either in confluent coastal settlements that may span several kilometres, or in reasonably well-defined villages

[3] The World Bank's classification of national economies is based on Gross National Income (GNI) *per capita*. Lower middle income countries are currently classified as those with a *per capita* GNI for 2011 between USD 1,026 and USD 4,035. Vanuatu's classification potentially affects its ability to attract funding from some donor organisations – most notably, the Global Fund.

ranging in size from a few families to several hundred people. In Pentecost, Tongoa, Tanna and Santo, the interior is quite density populated.

The estimated annual population growth rate is 2.3–2.6%, with a projected national population for 2015 (the first year of this NMSP) between 260,000 and 277,500. The 24% of the population that lives in urban areas is growing more rapidly (3.5%) than the rural population (1.9%) (SPC 2011).

The population distribution by province in 2009 and the projected provincial populations for 2015 are shown in Table 1. The national population is expected to exceed 300,000 by 2020.

Table 1: Provinces of Vanuatu with Population and Growth Rate, 2009 and 2015

PROVINCE	No. of main islands	Population 2009	% of 2009 national population	Annual growth rate (%)	Estimated population 2015	% of 2015 national population
Torba	14	9,359	4.0%	1.9	10,091	3.9%
Sanma	11	45,860	19.4%	2.4	50,424	19.5%
Penama	3	30,819	13.1%	1.5	32,710	12.6%
Malampa	17	36,722	15.6%	1.2	38,517	14.9%
Shefa	15	78,723	33.4%	3.7	91,037	35.2%
Tafea	5	32,540	13.8%	1.1	33,996	13.1%

Source: Projected from Vanuatu Census 2009 http://www.vnso.gov.vu/index.php/data-catalog

2.3 Ecosystem, climate and environment

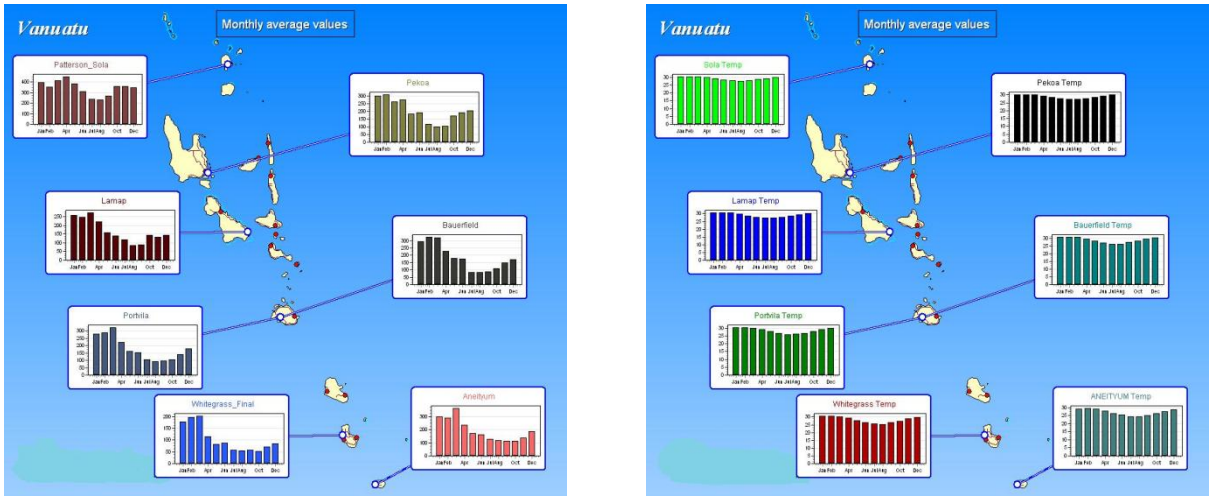
Most of Vanuatu's islands have a coastal fringe but are otherwise steep and lightly forested, with unstable soils and little permanent fresh water. An estimated 9% of land is suitable for agriculture (but only 6.9% is used for permanent crops) (SOPAC 2013).

There is a rainfall gradient from the north to the south of the country (Figure 1, left). Rainfall averages about 2,360 millimetres per year nation-wide, but ranges from around 2,000 mm in the southern islands (Tafea province) to 4,000 mm in the north (Torba province) (SOPAC 2013). The wet season is from November to April, and coincides with peak malaria transmission (see Section 3.1, *Epidemiology*).

The wet season is also associated with cyclone risk; the greatest frequency is in January and February. Vanuatu receives about between 20–30 cyclones per decade, of which three to 5 may cause severe damage and extensive disruption of services (SOPAC 2013).

There is also a slight north-south temperature gradient, but this is less pronounced than the rainfall gradient: Figure 1 (right) shows that Shefa and Tafea provinces have cooler and slightly longer winters than the more northerly island groups. In coastal areas, daily temperatures average 26°C in the hot season with an average maximum of 30°C and an average minimum of 24°C; night-time minimum temperatures in southern coastal areas may reach 13°C in the dry season (Van Met 2007).

Figure 1: Mean monthly rainfall (left) and temperature (right), selected sites, Vanuatu



Source: Vanuatu Meteorological Services http://www.meteo.gov.vu/VanuatuClimate/tabid/196/Default.aspx

In Vanuatu, both ground and surface water are used for domestic purposes. In urban areas the main water source is shallow aquifers whereas in rural areas various sources may be used: bores, wells, springs, streams and domestic or natural rainwater catchments (SOPAC 2013).

Poor drainage and waste management may create pools of water that provide favourable breeding sites for *Anopheles* malaria vectors (see Section 3.1.3, *Malaria vectors*).

2.4 Socioeconomic, health and development outcomes

The most recent available socioeconomic development data for Vanuatu are summarised in Table 2, and selected health output and outcome indicators are summarised in Table 3.

Vanuatu has made good progress in terms of improved life expectancy, which has risen from 56 years at the time of Independence from France and Great Britain in 1980 (Wang 2012) to 71.1 years in 2011 (SPC 2011, WHO 2013a) – higher than the average for Oceania as a whole (58.8 years) (Wang 2012).

Vanuatu is also on track to meet many of its health-related MDG targets. The under-five mortality rate (U5MR) has fallen from 39 per 1,000 live births in 1990 to 13 in 2011, while the infant mortality rate (IMR) has fallen from 31 to 11 per 1,000 over the same period (UNICEF 2013, WHO 2013a); neonatal causes account for a majority of infant deaths (7 per 1,000 live births). There is virtually no gender difference in either the IMR or U5MR.

The low rate of access to improved sanitation (Table 2) may contribute to the risk of childhood diarrhoeal disease and malnutrition. Under-nutrition (Table 3) increases the risk and severity of communicable diseases (including malaria and other parasitic diseases). There are disparities between provinces in each of these outcomes (UNICEF 2012a).

Despite the cost-effectiveness of vaccination as a public health intervention, maintaining immunisation coverage remains a challenge for Vanuatu (Table 3; see also Section 2.5). Measles vaccine coverage has been boosted to protective levels only through supplementary immunisation activities (UNICEF 2013).

Table 2: Summary of selected socioeconomic development indicators, Vanuatu

Economy and income		
Gross National Income *per capita* (2011)		USD 2,870
Gross National Income *per capita* (2011; purchasing power parity [PPP] in international dollars)[4]		I$ 4,500
Gross Domestic Product (2011; current USD)		USD 819.2 million
Demographics		
Total population (2011, projected)		251,784
Estimated population growth rate (2011)	National Range by province	2.6% (1.1–3.7%)
Median age of population (2011)		21 years
Life expectancy at birth (2011)	Total Males Females	71.1 years 69.6 years 72.7 years
Total fertility rate per woman (2010)		3.5
Proportion of population residing in urban / rural areas (2011)		24% / 76%
Social determinants of health		
Total adult literacy rate (%) 2007-2011		83%
Use of improved drinking water sources (2010)	Total Urban Rural	90% 98% 87%
Use of improved sanitation facilities (2010)	Total Urban Rural	57% 64% 54%

Sources: SPC (Pacific Island Populations 2011), WHO (World Health Statistics 2013), World Bank (World Development Indicators 2012, Health Financing Options Paper 2013)

The maternal mortality ratio is estimated to have halved from 220 per 100,000 live births in 1990 to 110 per 100,000 in 2010 (UNICEF 2013, WHO 2013a).[5] However, low rates of antenatal care and delivery attendance by a skilled provider (unchanged since 2007), low contraceptive prevalence rate among women (38% among all married women aged 15-49 years; 21% among those with low educational attainment) and high rates of teenage marriage may all compromise the rate of further progress in relation to MDG 5 (UNICEF 2013).

The observed declines in malaria (see Section 3.1) and the 96% tuberculosis treatment success rate (WHO 2013a) indicate good progress on MDG 6.

[4] PPP methods are designed to avoid distortions caused by variations in exchange rates and the costs of goods and services being lower in one country compared to another (where the actual "purchasing power" of the local currency may differ from other currencies). PPP uses a notional "international dollar" (I$) rather than the US dollar.

[5] Note: The maternal mortality ratio estimate in Table 3 lacks statistical precision due to small numbers and population.

Table 3: Summary of selected health indicators, Vanuatu

Neonatal, infant and child health	
Immunization coverage among one-year-olds (DPT3, 2011)	68%
Immunization coverage among one-year-olds (Polio3, 2011)	67%
Immunization coverage among one-year-olds (measles, 2011)	52%
Immunization coverage (newborns protected against tetanus, 2011)	75%
Neonatal mortality rate per 1,000 live births (2011)	7 per 1,000
Pre-term birth rate per 100 live births (2010)	13%
Infants exclusively breast fed for first 6 months of life (2005-12)	40%
Underweight children under 5 years of age (2005-12)	11.7%
Infant mortality rate per 1,000 live births (2011)	11 per 1,000
Under five mortality rate per 1,000 live births (2011)	13 per 1,000
Maternal health	
Antenatal care from a skilled provider (doctor, nurse and/or midwife), % with at least one visit (2007-12)	84%
Births attended by a skilled provider (doctor, nurse and/or midwife), % of total births (2007-12)	74%
Maternal mortality ratio per 100,000 (2010, adjusted)	110
Lifetime risk of maternal death (2010)	1 in 230
Relative burden of communicable and non-communicable disease	
Communicable, maternal, perinatal and nutritional conditions as % of total deaths, all ages (2008)	24%
Proportion of population at risk of malaria (2013)	~100%
Annual malaria parasite incidence (2012)	13.2 per 1,000
Malaria test positivity rate (microscopy and RDT)	10.0%
Confirmed deaths from malaria (2012)	0
Non-communicable diseases (NCDs) as % of total deaths, all ages (2008)	70%
Proportion of population aged 25 to 64 years with three or more NCD risk factors	22.3%
Proportion of population who are overweight (BMI ≥ 25 kg/m^2)	50.9%
Proportion of population with elevated fasting blood glucose (≥ 6.1 mmol/L) or currently on diabetes medication	21.2%

Sources: WHO (World Health Statistics 2013, NCD Country Profiles, STEPS survey), World Bank (World Development Indicators 2012), UNICEF (Vanuatu Statistics)

However, huge challenges are looming in relation to the growing epidemic of non-communicable diseases (NCD), which threaten to consume a large proportion of available health resources (World Bank 2012). Maternal and infant under-nutrition (Table 3) can initiate irreversible metabolic changes that carry a future risk of developing NCDs.

Periodic outbreaks of dengue fever continue to occur following importation from other Pacific Island countries. Despite the clear synergies with malaria surveillance and environmental monitoring, active

dengue case surveillance is reported to have ceased in March 2011 due to the concurrent demands of malaria control and elimination activities (MOH 2012).

2.5 Health System analysis

The Government of Vanuatu (GOV) has identified 5 groups of inter-linked strategic challenges in the health sector (MOH 2012):

- Weak health system (human resources, financial management, health information system [HIS], leadership and management);
- Resource allocation;
- Double burden of disease (NCDs superimposed on an existing burden of communicable diseases);
- Geographical location of facilities and communities;
- Vulnerability to natural disasters.

2.5.1 Service delivery system, access and equity

Government health services in Vanuatu are delivered through a four-tier system: the northern and southern regional referral hospitals (located in Port Vila and Luganville), Health Centres, Dispensaries and community-supported Aid Posts (WHO-MOH, 2012).

The type and number of government and community facilities in each province is shown in Table 4.

The provincial health office has overall responsibility for managing health facilities within their jurisdiction. Each province is divided into several health zones, and each zone has a principal Health Centre and several Dispensaries (WHO-MOH, 2012).

Table 4: Health facility access (2013) and utilisation (2012), by province, Vanuatu

PROVINCE	Hospitals	Health Centres	Dispensaries	Aid Posts	Total Facilities	Population (2013 est.)	Facilities per 1,000 population	Annual outpatient consultations per capita, 2012	No. of Villages	Villages per primary care facility
TORBA	1	2	6	23	32	9,903	3.23	1.53	34	1.1
SANMA	1	7	6	38	52	49,242	1.06	1.59	403	7.8
PENAMA	1	6	8	42	57	32,227	1.77	2.20	129	2.3
MALAMPA	1	7	14	45	67	38,060	1.76	1.17	N/A	—
SHEFA	1	3	7	42	53	87,789	0.60	0.61	N/A	—
TAFEA	1	5	6	41	53	33,626	1.58	1.21	245	4.6
TOTAL	**6**	**30**	**47**	**231**	**314**	**250,847**	**1.25**	**1.20**	**—**	**—**

Source: Vanuatu Health Service Delivery Profile (2012); updated using data from VHW Evaluation 2013 and VHW training program records held by Save the Children Australia. 2012 consultations were derived from the HIS.

Aid Posts are the most peripheral level of facility. They are owned, built and maintained by communities, staffed by volunteer Village Health Workers (VHW) and operate under the oversight of a local Aid Post Committee; costs are covered through a revolving fund or small direct payments from patients.

The VHW program is a key strategy of the MOH for improving access to primary health care in rural and remote communities. However, the placement of VHWs is currently determined by the willingness of a community to support the construction and maintenance of an Aid Post and not by a MOH master plan for primary and preventive health care (PHC).

VHW training is contracted by the MOH to a NGO, Save the Children Australia (SCA); the MOH supplies basic medicines and consumables. VHWs receive three months' training in PHC, focusing mainly on community health education, treatment of minor ailments and patient referral (Laverack 2013); their training includes the use of RDTs for diagnosis of malaria and dispensing of ACT for treatment, and the supervision of patients taking primaquine (PQ) for radical cure of *P vivax* once they have initiated treatment under the care of a trained health professional.

In the provinces, VHWs are supervised by provincial health promotion officers (HPO) and/or an area nurse from the nearest Dispensary or Health Centre; supervisory visits are scheduled for every 6 months but, in practice, are usually less frequent (Laverack 2013). While VHW protocols and standards continue to evolve, their articulation with the main health policies and system – and the ability of the VBDCP to leverage the presence of VHWs to integrate community level delivery of malaria services – is dependent on the functionality and quality of these supervisory relationships. SCA has developed tools for VHW supervisors, but these may need to be reviewed or adapted to include malaria-specific or other community health surveillance functions.

In practice, the quality of care provided through Aid Posts is highly variable. Some have dedicated, long-serving and experienced VHWs who are well supported by the community; others appear to operate with minimal or no training for the VHW, little or no supervision, and without a community committee.

Table 4 indicates a considerable variation in the population and number of villages served by each primary care facility. The ratio of primary care facilities (Aid Posts, Dispensaries and Health Centres) to the number of villages is close to one in Torba province, where the large number of small islands requires that model of service delivery. Sanma shows the opposite ratio, with each primary care facility serving around 1,000 people and up to 8 villages.

Data on actual geographical access to care based on the intended MOH standard (distance to a health facility no more than one hour's walk or 5 kilometres) are not available in Vanuatu. Aid posts are not necessarily strategically located as they depend on community interest to build, fund and maintain them. Access to health and other services is often inhibited by a lack of road access through mountainous terrain or the need for boat transport from islands or remote coastal communities in order to reach health facilities, and will be dependent on the availability of transportation. Only Tanna and, to a certain extent, Santo have a road network to inland areas; others, including isolated coastal communities, may need a boat to reach health facilities. People without access to mechanical land or sea transportation (which may be too expensive for those living outside the cash economy) may need to walk long distances for health care.

Utilisation of primary care facilities may be used as a proxy measure for access (Table 4). In 2012, the HIS reported a significant difference in annual *per capita* outpatient visits – including Aid Posts – between and within provinces (among the non-urban provinces, ranging from 1.17 in Malampa to 2.2 in Penama).

A malaria indicator survey of 4,741 people (all ages) in conducted in 2011 found that just 48.5% of the 933 respondents had the defined level of access to an Aid Post or higher level of health facility; among all respondents, 49% would seek treatment within 24 hours of the onset of fever or possible malaria symptoms and 94.6% would seek treatment within 48 hours.

In view of these constraints, the GOV recognises that there are likely to be significant pockets of under-utilisation of health services among more remote communities (AusAID 2009, GOV PMD 2010) – especially in Sanma and Malampa provinces (Table 4). This may result in undetected low vaccination rates among infants and children, low coverage rates for anti-malaria interventions like LLINs, poor access to malaria diagnosis and treatment, and difficulty conducting outreach interventions like IRS.

2.5.2 Health work force

Table 5 shows the distribution of trained health professionals and VHWs by province and population. Vanuatu has one of the lowest health worker to population densities in the Pacific; overall, there are 0.19 doctors and 1.58 nurses and midwives per 1,000 population. [6]

This is further exacerbated by urban-rural inequalities in health work force distribution. For example, in 2012, there was just one doctor per 47,250 people and one nurse per 218 people in rural areas (where 76% of the population live), while there was one doctor per 1,492 people and one nurse per 179 people in urban areas (Roberts 2012).

Table 5: Health Professionals and VHWs density per 1,000 population, by Province, Vanuatu, 2012

CADRE	Torba	Sanma	Penama	Malampa	Shefa	Tafea	TOTAL
Medical Practitioner	0.20	0.30	0.12	0.05	0.18	0.18	49
Registered Nurse	0.91	0.81	0.56	1.21	0.38	0.08	344
Midwife	0	0.16	0	0.21	0.10	0	51
Nurse Aide	0.10	0.06	0.03	0.92	0.07	0	162
VHW	2.32	0.75	1.24	1.05	0.47	1.22	222

Source: Vanuatu Health Service Delivery Profile (2012); Save the Children Australia (Aid Post Activity Data 2013)

Nurses are trained at the Vanuatu College of Nursing Education (VCNE). The 2013 MPR recommended that responsibility malaria-related training be transferred to VCNE (MOH 2013); however, that institution would appear not yet to have the capacity to provide such training to the diversity of health workers involved in malaria diagnosis and treatment (and potentially preventive activities under a more integrated service delivery model.

In addition, 25 ni-Vanuatu medical students are currently training in Cuba and the first graduates are due to return in 2015. While the Cuban curriculum and style of primary care aligns well with the intended

[6] The WHO regards a skilled health worker to population density of 2.3 doctors, nurses and midwives per 1,000 as the minimum needed to provide 80% coverage of basic essential services, e.g. skilled birth attendance and childhood immunization.

decentralisation reforms, assessment by WHO and Fiji School of Medicine suggests that considerable planning will be required to enable new graduates from Cuba to re-integrate into Pacific health systems (WHO SPC 2013). In particular, little malaria is seen in Cuba and it does not feature strongly in the undergraduate medical curriculum there.

The few private health facilities and practitioners in Vanuatu include 6 private medical clinics and four private pharmacies. The pharmacies require a prescription in order to dispense anti-malarial medications. Government regulations prevent the importation of mono-component artemisinin preparations.

There are also traditional healers, with an estimated density of 3 per 1,000 population. People may prefer to attend traditional healers because of accessibility and affordability, i.e. where there is difficulty in accessing mainstream health services (WHO and MOH 2012).

Most malaria activities (including those in the provinces) are currently managed centrally through the VBDCP team. The **malaria work force** comprises an estimated one-third of all MOH employees (Toole 2010) – currently 82 Program staff countrywide and 18 in Tafea province (13 funded through the GOV, the remainder through the Global Fund grant or the bilateral Australian aid program). The VBDCP has a very flat management structure, and there is no formal organogram that defines lines of delegation or intermediate reporting (MOH 2013).

2.5.2 Other health system building blocks in relation to the Malaria Program

The **planning** context within the MOH is summarised at Section 1.2, above. The VBDCP prepares an annual Malaria Action Plan (MAP) and budget, which provide detailed technical guidance to the national team and its donors on malaria-specific interventions. However, little detail from the MAP is reflected in the national MOH and provincial health business plans, restricting the usefulness of either type of plan as management tools (e.g. to inform synergies with other programs, to guide the collaboration of provincial counterparts in the implementation of malaria interventions, or to help provincial health managers to understand the true cost of public health and disease control activities taking place in their jurisdiction).

Malaria Program **governance** consists of a two-tier arrangement. The technical advisory group (TAG) comprises Program and technical partners and meets approximately monthly to consider technical and – increasingly – some management issues. The Malaria Steering Committee (MSC) includes a broader group of Program, MOH, donor and development partner members; it meets approximately two-monthly to endorse TAG decisions and directions, make management decisions, authorise budgets and financial reports, approve annual work plans and consultancy arrangements, and coordinate with other stakeholders. During a period of Global Fund Country Coordination Mechanism (CCM) inactivity, the MSC has functioned as an interim CCM; however, a reconstituted CCM is expected to resume its functions in April 2014.

Overall **health financing** in Vanuatu is under increasing pressure, with expenditure on health having exceeded the original Government appropriation every year since 2008. The principal drivers are an increasing MOH wages bill (despite gaps in the numbers of front line health workers), and an unmet obligation for retirement payments. Hospital services absorb 48% of total health expenditure – more than twice the expenditure on community health centres (World Bank 2013).

Financial support from development partners heavily underpins the health budget (Table 6). For 2012, total MOH expenditure was just over VUV 2.4 billion (USD 26.9 million) and, of this, the GOV provided just under two-thirds and development partners just over one-third.

Table 6: Summary of selected health financing indicators, Vanuatu

Health financing and expenditure	
Total health expenditure as % of GDP (2011)	4.11%
Private health expenditure as % of GDP (2011)	0.5%
Public (i.e. GOV + development partner) health expenditure as % of total health expenditure (2011)	87.8%
General government expenditure on health (including external resources) as % total government expenditure (2010)	18.2%
External resources for health as % total health expenditure (2012)	37%
Per capita total health expenditure, current USD (2011)	USD 133
Per capita total health expenditure, PPP (2011)	I$ 190
Per capita total expenditure on malaria, current USD (2011)	USD 12.2

Sources: WHO (Global Health Observatory, World Malaria Report 2012, World Health Statistics 2013, National Health Accounts Database), World Bank (World Development Indicators 2012, Health Financing Options Paper 2013)

The cost of achieving the observed reductions in malaria incidence has been significant relative to overall health expenditure. Malaria attracted just over one quarter of all development partner financing in 2012: VUV 222 million (USD 2.4 million) (World Bank 2013).

There is a need to maintain and extend the gains already achieved, and risks associated with not doing so relatively quickly (e.g. the emergence of drug resistance in the malaria parasite) (Feachem 2009). In the context of the Vanuatu economy, the benefits of malaria reduction and elimination are often expressed in terms of tourism and a healthy work force; however, there have been no documented cost-benefit studies to confirm this.

There is also strong MOH and development partner interest in controlling what is perceived as disproportionate expenditure on malaria – estimated at just over USD 12 *per capita* in 2011 (WHO 2012b) – and/or gaining maximum technical efficiency from those resources (World Bank 2010). The MOH needs to take care to use the malaria budget sensibly to strengthen the health system functions that it can, but it should not try to use malaria resources to substitute for areas of core MOH activity (MOH 2013). This requires a clear analysis of the functions that naturally lie with the Program at central level, those that are core MOH functions, and those that can be integrated with public health surveillance and response close to the community level (consistent with an elimination focus and strategy) (WHO 2007).

There are limitations to the timeliness and accuracy of the national **health information system**: disease surveillance and data on health services provided are incomplete; less than half (48.6%) of health

facilities submitted the required HIS reporting forms during 2010, and this fraction fell to just 34% in 2011 (World Bank 2013).

The HIS does not record sufficient variables to inform the planning and implementation of the malaria program, so a malaria information system (MIS) was developed in 2010. Reporting is now through a monthly malaria line listing (MMLL) which lists diagnostic and case management variables for every treated case and aggregate data for patient testing and stock control; data entry takes place at provincial level. Remaining tasks include to roll the MMLL out to hospitals and to strengthen completeness of reporting from the most peripheral facilities.

Procurement and logistics for malaria pharmaceuticals and commodities are generally funded through donor resources due to the limited GOV operational budget. SPC procures LLINs, laboratory supplies and RDTs through non-Government channels using the Global Fund grant; bed nets are distributed over a three year replacement cycle (with no continuous replenishment). Anti-malarial drugs are currently funded by AusAID through a direct funding agreement with the GOV and procured through WHO; they are then distributed by the Central Medical Stores (CMS) through the usual MOH pharmaceutical logistics system, which tracks stock using the *mSupply* software. These processes are described further in Section 3.2.6 under *Malaria program performance*.

Malaria drug stock-outs are reported to be uncommon,[7] although over-supply may occur when the forecasting system does not recognise the effect of a reducing incidence of malaria. However, a recent UNICEF study identified significant shortages of essential drugs and other commodities for managing obstetric conditions and a range of common ailments (UNICEF 2012b).

[7] Eighteen (8%) of 223 health facilities visited in 2012.

3. Malaria Situation Analysis

3.1 Epidemiology

3.1.1 Malaria transmission by province

Within the provinces, malaria transmission is not uniform but varies greatly from place to place, indicated by the more darkly-shaded health zones and islands in Figure 2 and from year to year (see also Annex 1 for more detail by province and health zone).

Historically, the malaria burden in Vanuatu has always been reported as higher in Vanuatu's northern provinces than in the south. This is generally ascribed to the rainfall gradient and, to a certain extent, the temperature gradient between the north to the south of the country (Figure 1, Section 2.3). API data by island from 1985 to 1990 also suggest that the incidence may have been higher at that time on the larger islands (e.g. Santo, Malekula, Efate and Tanna) than on the smaller islands (e.g. Banks, Torres, Paama and Aniwa); this was also shown in prevalence surveys between 1988 and 1992 (Kaneko 1998).

The southern-most province, Tafea, has consistently recorded an API as low as 10 per 1,000 over several years whereas an API fluctuating between 10 and 50 per 1,000 is commonly reported from the more northerly provinces such as Torba (Figure 2; also Annex 1).

Figure 2: Annual parasite incidence (left) and test positivity rate (right), by health zone, Vanuatu, 2012

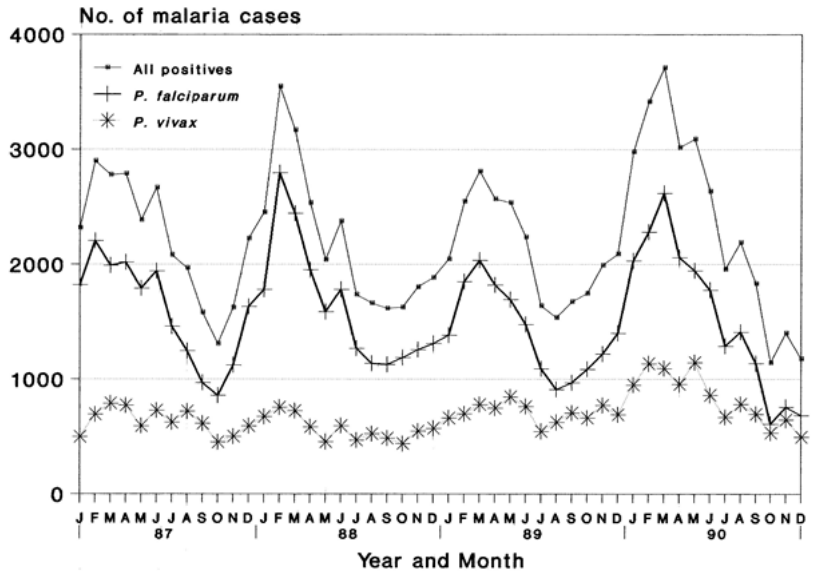
Transmission is usually highest close to the coastal zone where the primary vector (*An farauti*) is highly prevalent (MOH 2013). Inland foci of transmission may also occur, subject to the environment and ecosystem (natural or modified) providing suitable vector breeding sites.

As noted above (Section 1.1), the island of Futuna in Tafea province has always been malaria-free due to the absence of *Anopheles* vectors while the neighbouring island of Aneityum became malaria free in 1991 following an intensive, community-oriented malaria elimination campaign. The whole of Tafea province is earmarked for elimination by 2016 (described in more detail in Section 3.2.5, *Pilot elimination activities*).

3.1.2 Malaria parasites and seasonality of transmission

Both *P falciparum* and *P vivax* occur in Vanuatu. Historically, *P falciparum* transmission is seasonal, peaking clearly from February to April, whereas *P vivax* infections have occurred throughout the year with only slight fluctuations as shown in Figure 3 (Kaneko 1998). The relative proportion of *P falciparum* infections has been falling since the large scale introduction of insecticide-treated bed nets (ITN), and these patterns now appear to be becoming less pronounced (MOH 2013).

Figure 3: Seasonal fluctuation of malaria incidence in Vanuatu: number of microscopically confirmed malaria cases (passive case detection), January 1987 to December 1990, Vanuatu



Source: Kaneko *et al* (1998)

Recent parasitological surveys have shown that *P vivax* is now the dominant species. In a mass blood survey conducted by the MOH on Tanna Island in 2006, the parasite rate was found to be 3.8% (125/3,298) with a *P falciparum* prevalence of 1.7% and *P vivax* 2.1% (Cooper 2008). A subsequent prevalence survey of 4,716 children aged 2-12 in Tafea province in 2008 found a prevalence of 1% for *P. falciparum* and 2.2% of *P. vivax* by microscopy and PCR (Reid 2010). A malaria indicator survey (MIS) of

4,741 people (all ages) in 2011 recorded a malaria prevalence of 0.6% by microscopy and 2.0% by PCR (of which 24% were *P. falciparum*, 71% *P. vivax*, 5% mixed infections) (MOH 2013).

3.1.3 Malaria vectors

The only vector present in Vanuatu is *An farauti* (Laveran), which belongs to a complex of seven isomorphic species (Beebe 1995). Larvae can tolerate organic pollution and up to 70% salinity (Sinka 2011). Breeding sites include swamps, salt marshes, blocked river outlets, river and stream margins with emergent or surface vegetation, springs, seepage areas, and ponds located near the coast (Russell 2010) as well as transient ground pools that are maintained by rainfall (Cooper 2008). Flight range is generally less than 1 km (Sinka 2011).

Entomological investigations on Tanna have shown that the breeding sites are generally within two kilometres of the coast; the 2006 and 2008 studies also indicated that the highest prevalence of malaria in Tanna children was among those living near the coast (Cooper 2008, Reid 2010, Russell 2010). Pending further entomological studies, it is expected that the same distribution occurs on other islands.

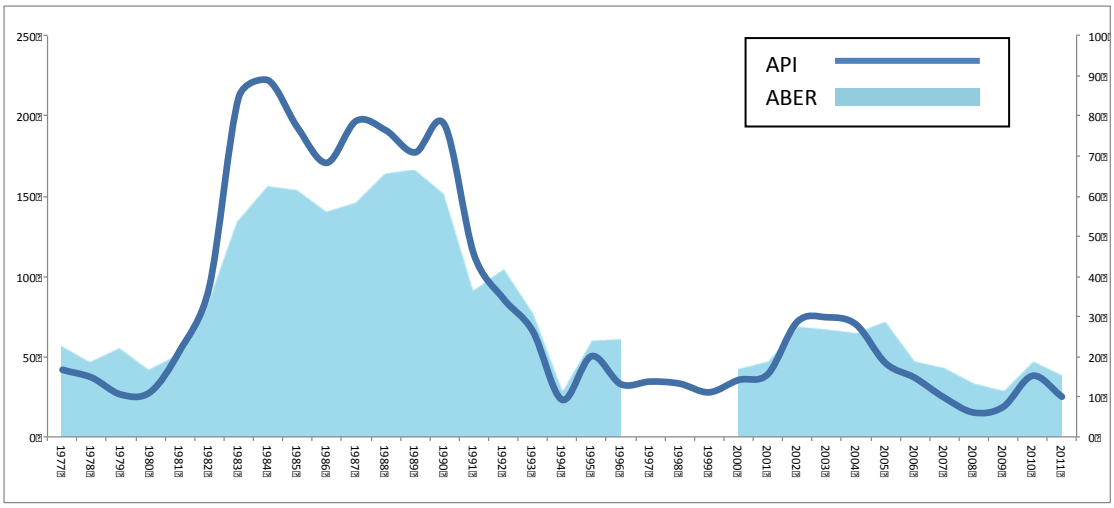
Adult females of *An farauti* readily feed on humans but will feed on other hosts if available. They will feed outdoors during the early evening and also enter houses to feed, but generally leave the house shortly after taking a blood meal (Sinka 2011). Adults feed throughout the night, both indoors and outdoors, with 70-80% of biting taking place while people are indoors (Cooper 2008). Resting places for males and females include any cool, moist, and shaded spot, including human dwellings (Sinka 2011). These observations have guided vector control activities during the elimination campaign on Tanna.

There are no data on vector resistance to commonly used insecticides, and no recent data from LLIN or post-IRS bio-assays. Although pyrethroids are used both in LLINs and for IRS, concurrent agricultural pesticide use is very low in Vanuatu and selection for pyrethroid resistance is also thought to be low.

3.1.4 Historical trends in malaria incidence

Figure 4 summarises the long term trends in API and annual blood examination rate (ABER) in Vanuatu since 1977.

Figure 4: Trends in API (line, Y1 axis) and ABER (shaded, Y2 axis), 1977 to 2011, Vanuatu



It should be noted that the criteria for reporting cases have varied over time, and may include both clinical (i.e. treated without diagnostic confirmation) and confirmed malaria cases.

It is instructive to view the trends in malaria incidence shown in Figure 4 in relation to the malaria interventions used at the time. IRS with DDT was conducted between 1973 and 1981 and this appears to have maintained the nation-wide slide positivity rate (SPR) below 20% and an API below 50 per 1,000. On cessation of DDT use, the incidence climbed quickly until ITNs were introduced in 1988 as part of the global ITN trials. This saw the SPR, the number of reported cases and the API all decline again from 1990 onwards.

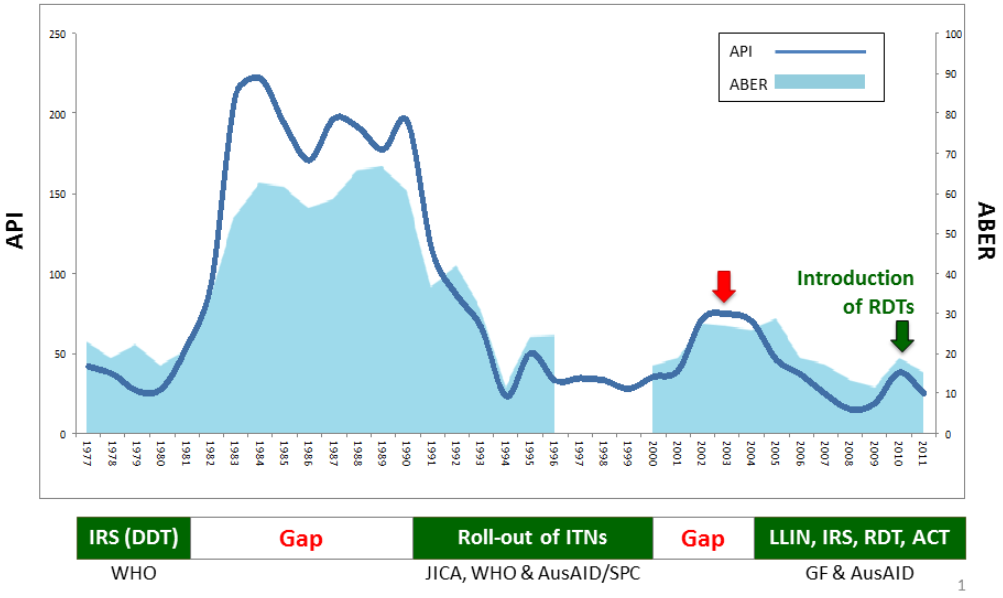
Between 1983 and 1991, three to four times the number of slides was examined each year than in 1981 and the detection rate by microscopy increased accordingly; this strengthened the ability of the Malaria Program to monitor the impact of interventions.

A gap in donor-funded assistance from 2000 to 2003 negatively impacted ITN coverage and saw a progressive resurgence of malaria incidence, SPR and the proportion of cases caused by *P falciparum* from 2001 to 2005-06. Confirmation of additional malaria financing through the Global Fund from 2003 onward allowed a resumption in distribution of subsidised ITNs – and later, free LLINs – reaching >80% coverage with LLINs from 2009 onwards.

These trends and influences are summarised in Figure 5, below, where it can be seen that the rebound in malaria incidence to almost 80 per 1,000 after 2001 (red arrow) coincides with a period of reduced commitment to malaria control.

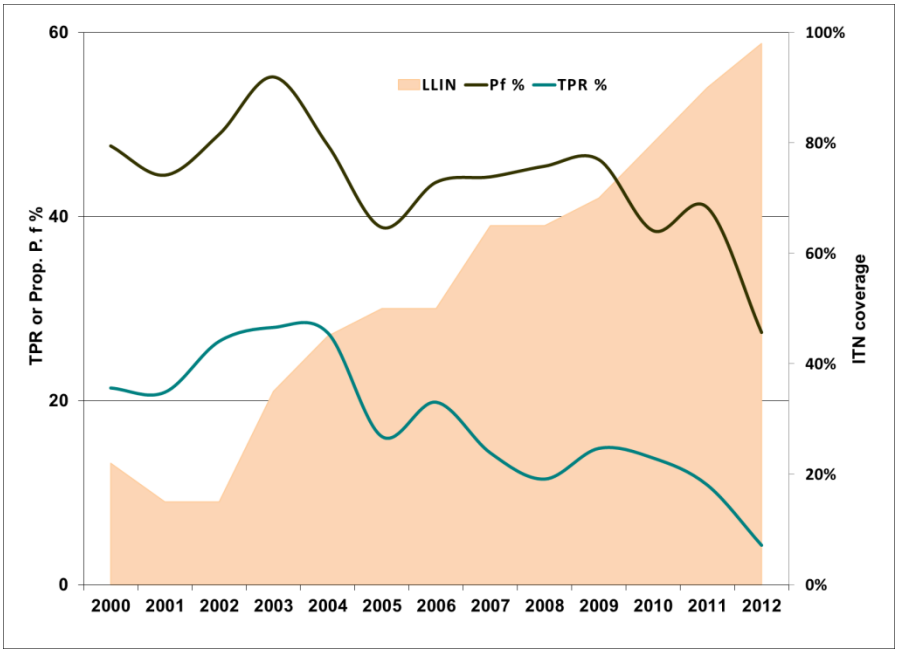
Additional interventions like IRS in selected highly endemic areas from 2009 and nationwide availability of free RDTs and ACT have further reduced malaria incidence. (The small secondary peak in reported incidence in 2010 [Figure 5; also visible in Figure 2] represents a case ascertainment bias coinciding with the widespread introduction of RDTs; this is shown in more detail in Figure 9).

Figure 5: Trends in malaria incidence relative to technical and financial commitment to malaria control, 1977 to 2011, Vanuatu



The recent impact of ITNs and ACT since 2003 – and especially more recently – on test positivity rate (TPR) is shown in Figure 6.

Figure 6: Trends in TPR and proportion of cases due to *P falciparum* (Pf %) in relation to LLIN distribution, Vanuatu, 2000 to 2012



3.1.5 Morbidity and mortality trends by province

Table 4 shows the annual trends in confirmed malaria cases (API and TPR) by province for 2010-12, noting also the number of slides and RDTs taken in the population (% detection rate as ABER).

API and TPR differ significantly by province, with the lowest rates in 2012 observed in Tafea (API 0.4 per 1,000, TPR 1%) and the highest in Torba (API 38.2 per 1,000, TPR 21%). Tafea has a well-established elimination program (see Section 3.2.5) and the ABER there of just 6% presumably reflects a fall in the incidence of febrile illness in the community (1.5% of Tafea children had a fever in the two weeks prior to the 2011 malaria indicator survey, compared with an average of 4.4% across all other provinces).

Table 4: Annual Parasite Incidence and Test Positivity Rate, reported confirmed malaria cases, by province and nationally, 2010 to 2012, Vanuatu

	MALAMPA			PENAMA			SANMA			SHEFA			TAFEA			TORBA			VANUATU		
Year	ABER	TPR	API	ABER	TPR	API	ABER	TPR	API	ABER	TPR	API	ABER	TPR	API	ABER	TPR	API	ABER	TPR	API
2010	17%	25%	44.1	6%	41%	22.6	26%	21%	53.9	19%	17%	31.5	8%	2%	1.9	24%	12%	29.4	17%	19%	32.6
2011	25%	22%	52.9	12%	29%	35.5	22%	15%	33.1	11%	10%	11.2	5%	1%	0.7	22%	21%	46.2	15%	17%	25.0
2012	16%	13%	20.3	11%	19%	21.2	23%	9%	21.3	10%	5%	4.7	6%	1%	0.4	18%	21%	38.2	13%	10%	13.2

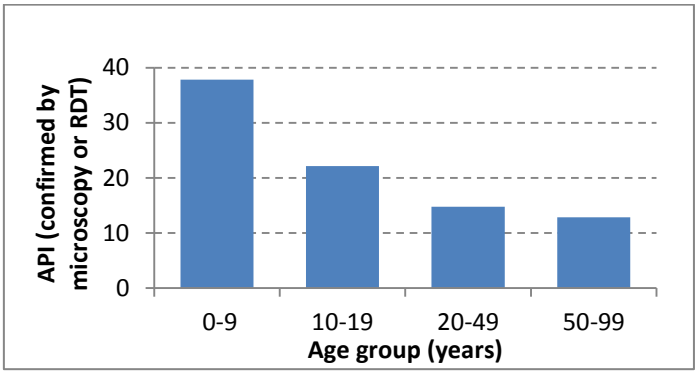
Very few malaria attributed deaths have officially been recorded within the national HIS during the last 10 years (from 2 in 2007 to zero in 2012). This might be due to better access to prompt and effective treatment, but may also reflect factors like the willingness of people to die at home rather than in hospitals or health care facilities, patients dying while in transit to a referral facility, or a lack of malaria diagnostic or *post mortem* capabilities at the referral centre.

The Program interacts with clinicians and HIS colleagues to fine tune the mortality data, and the HIS is embarking on a program for improving the recording of vital statistics and conducting death audits.

3.1.6 Malaria burden and species by age group

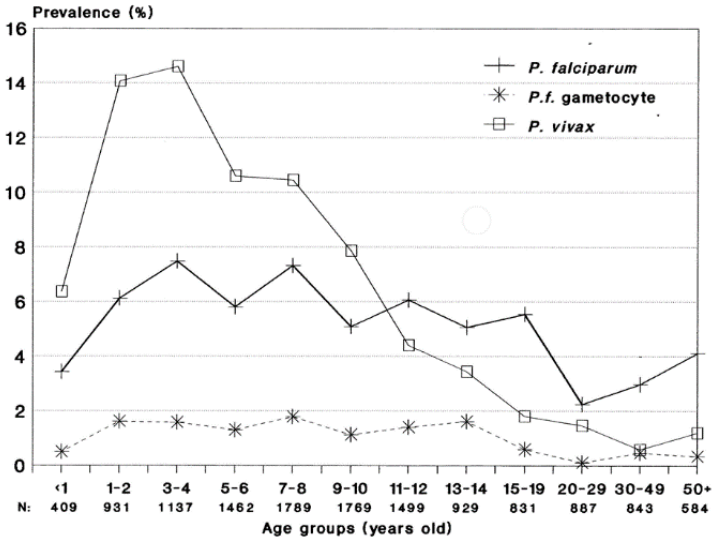
Children under 10 years of age comprise the most at-risk population, as shown in Figures 7 and 8.

Figure 7: Age-specific incidence of reported, confirmed malaria, Vanuatu, 2012



Source: MOH (2013)

Figure 8: Age-specific malaria prevalence in 16 islands of Vanuatu, 1988 to 1992



Source: Kaneko et al (1998)

The data on prevalence by age group from 1987 to 1991 show that *P vivax* infections are most prevalent in children under 5 whereas *P falciparum* infections occur more constantly across all age groups (Kaneko 1991). This suggests that children under 10 are the main reservoir of *P vivax*.[8]

3.2 Malaria Program Performance

3.2.1 Overview

Since 2009, significant external donor support (Figure 5) has seen a scaling-up of evidence-based interventions to initiate a malaria elimination strategy in Tafea province (and, more recently, Torba) and to enhance malaria control in the rest of Vanuatu.

While noting the disadvantages to the health system of a nation-wide, vertically implemented Malaria Program (see Section 2.5 and 3.2.7), these efforts have contributed significantly to a reduction in the national malaria burden (API 73 per 1,000 in 2003, 23.3 per 1,000 in 2007 and 13 per 1,000 in 2012; Figure 9), and have seen the province of Tafea reach almost zero indigenous cases in 2013 (Section 3.2.5).

Figure 9: API trends by year, 2000-12, Vanuatu

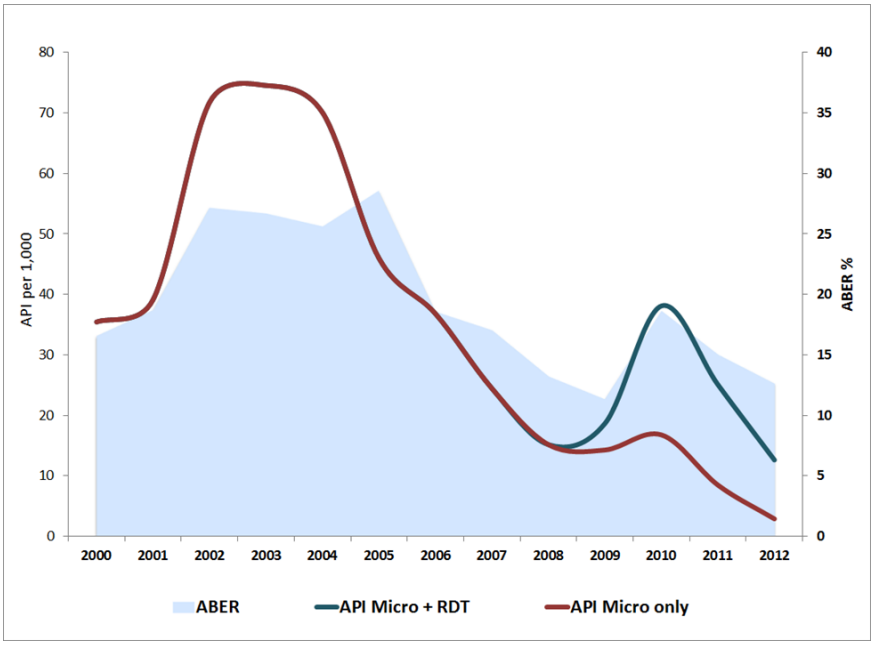


Table 5 (page 22) summarises Program performance against key indicators to the end of 2012 data to be added if possible), showing the achievement of most milestones and targets.[9]

[8] The *P falciparum* to *P vivax* ratio in Vanuatu has been consistently around 50% over many years, irrespective of the diagnostic method or prevailing malaria control interventions. This could be due to a lack of quality microscopy diagnosis, misclassification of clinically diagnosed cases, the use of different brands of RDT, etc. It is anticipated that, with improved capacity for species identification (microscopy, RDT and PCR), *P vivax* infections will become numerically more prominent as overall malaria incidence falls over time.

[9] The results shown in Table 5 need to be qualified by limitations or uncertainties in the data. In particular, in 2012, it was estimated that the MIS captured around 70% of malaria patients nation-wide (but is improving over time).

Table 5: Progress to 2012 relative to selected impact and outcome indicators, Vanuatu

Indicator	Source	Baseline (year)	2009	2010	2011	2012	Target (2014)
Confirmed malaria cases (by microscopy or RDT)	MIS	6768 (2000)	3316	7798	6126	3165	1692
Estimated proportion of treated patients being tested		Not known – probably very low				>90%	
Inpatient (severe) malaria cases (absolute cases)	HIS	NA	143	38	74		
Inpatient deaths due to malaria	MIS	2 (2009)	2	1	1	0	<2
Malaria test positivity rate (microscopy or RDT)	MIS	19% (2010)	15.9%	19.0%	16.7%	10.0%	10%
Percentage of cases due to *P. falciparum* or mixed	MIS	54% (2009)	53.7%	37.6%	37.3%	35.7%	40%
Confirmed cases of malaria per 1000 population at risk (API) by microscopy or RDT	MIS	74 (2003)	14.2	32.6	25.0	12.6	17
% of population covered by ITNs (@ 1 net per sleeping space)	Survey	16% (2009)	N/A	N/A	60%	—	95%
ITNs usage %	Survey	N/A			52%		
% of targeted population covered by IRS (denominator varies over years)	Opera-tional data	N/A		>90%	>90%	>95%	>95%

Note: Baseline varies according to year and data source (MIS or survey). A nation-wide malaria indicator survey was conducted in 2011

The 2013 MPR (MOH 2013) found that the following are the principal factors that have contributed to the rapid decline in malaria observed in Vanuatu:

- Provision of financial support through the Global Fund grant and PacMI (Australian aid), and technical support through WHO and PacMISC (the Pacific Malaria Initiative Support Centre, University of Queensland)
- Strengthening malaria-specific human resources by engaging additional staff in essential point of care, provincial and central locations
- A variable but generally high level of LLIN ownership (around 80% coverage nation-wide at a ratio of one net per sleeping space, or one net per 1.5 people)
- IRS operations (1 to 3 rounds according to initial API) in Tafea and parts of Torba provinces, covering >80% of households within a two kilometre coastal perimeter (i.e. corresponding to the main vector breeding sites in provinces targeted for elimination)

- Free access of patients to microscopy and RDTs followed by free ACT for both *P vivax* and *P falciparum* infections (increasingly administered via directly-observed treatment; DOT) when needed; this has seen a decrease in the number of patients treated without parasitological diagnosis
- Strengthening the malaria information system (MIS) using the monthly malaria line listing in an effort to record all malaria cases identified though the PHC system.
- Engaging leaders, communities students and teachers to help them to understand the nature of malaria and the Program objectives and activities
- Provision of targeted (long-term and short-term) technical assistance (TA) to the national Program and the provinces

3.2.2 Vector control

Vector control has been the mainstay of the Program since the arrival of increased donor support, and was noted by the MPR to be a key factor in the reduction in malaria incidence in Vanuatu (MOH 2013).

Since 2009, an average 70,000 pyrethroid-impregnated polyester LLINs have been distributed each year through a rotating three-year provincial cycle. The targeted coverage rate is one bed net per sleeping space per household (one net per 1.25 people; effectively, one net per 1.5 people after allowing for population movement). Bed net utilisation is good in Tafea (87.9%) and acceptable in most other areas (68.9%). This has been achieved in spite of significant disbursement delays that slowed distribution relative to the intended schedule; the effect of these delays may be partially mitigated by the three to 5 years' net durability reported by the manufacturer.

Vanuatu has now initiated a second cycle of full bed net replacement. However, there is not yet an agreed policy on disposal or recycling of old nets.

There is a risk that bed net utilisation might decrease with declining malaria incidence, or because of the perceived additional impact of IRS in targeted areas.

The Program has delivered three rounds of IRS with good coverage of targeted structures on Tanna, two rounds in higher risk areas of Shefa (including those communities with direct social contact with higher incidence outer island provinces), and one round in Erromango, Aniwa and the Torres Islands.

Larviciding with methoprene at 3-monthly intervals has been implemented in up to 95 identified breeding sites in Tanna since 2011. Some communities also undertake clearance of vegetation from water bodies, while other provinces promote the seeding of standing water bodies with larvivorous fish for larval source management (LSM). To date, there is no demonstrable evidence of LSM having an impact in Tanna above what has been achieved through LLIN and three rounds of IRS; similar reductions in transmission (magnitude and rate) have been observed on other islands of Tafea and in the Torres islands with LLINs and IRS but without any LSM.

Entomological surveillance capacity is limited; Vanuatu relies on continuing external TA for conducting even routine vector control monitoring. Vector behaviours, insecticide resistance and other basic entomological parameters following widespread introduction of LLIN and focal IRS remain unknown.

3.2.3 Diagnosis

Prior to 2009, the only diagnostic test for confirmation of malaria in Vanuatu was microscopy. As microscopy was only available in 33 (10%) health facilities, diagnosis was frequently on clinical grounds.

Since then, the Program has made significant efforts to maintain the network of microscopy services through the Global Fund grant. However, assessment of malaria microscopists' competency by the Australian Army Malaria Institute (AAMI) in 2008, 2010 and 2011 yielded quite poor results: only four of the 35 participants achieved the Level 1 or 2 standard, with the remainder at Level 3 or 4 proficiency. None of the four Level 1 or 2 microscopists is currently providing malaria microscopy services.

To improve the standard of microscopy services, a review was undertaken in 2011. Training in microscopy and quality assurance (QA) was conducted in 2012, and supervisory visits and a microscope maintenance program were initiated, but no quantitative results are available. The QA program requires microscopists submit all positive slides and a 10% sample of negative to their Provincial health laboratory for cross-checking; a program of panel testing (using 10 slides with known results) has just been initiated.

However, the proportion of malaria cases confirmed by microscopy has declined markedly since RDTs were rolled out to all health facilities in 2009, dramatically improving access to parasitological diagnosis: in 2011, > 90% of health facilities reported access to microscopy and/or RDT.

Figure 10 shows that the number of RDTs performed in health facilities increased from 11,900 in 2010 to 14,791 in 2012, but with a decreased utilisation of microscopy in favour of RDTs over the same period. The Figure also shows that, since 2010, both the number of tests performed and the proportion of tests that are positive have declined due to the decreasing transmission and burden of malaria.

Figure 9: Trends in number of diagnoses by microscopy and RDT (Y1 axis), and ABER and TPR (Y2 axis), 2008–12, Vanuatu

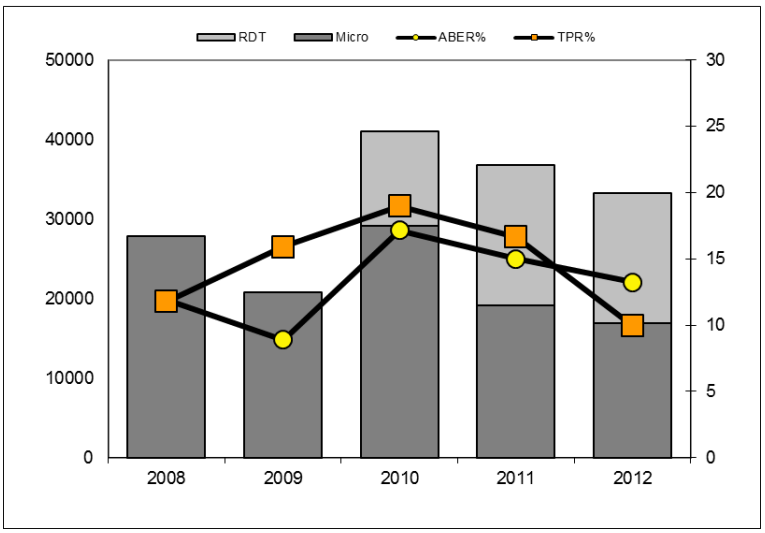


Table 6 summarises mean microscopy activity by province for 2012. Between 2010 and 2012, the number of slides taken annually in health facilities decreased from 29,180 to 16,981, with an average of less than two slides examined per day in 2012 in all but 5 sites.

Table 6: Microscopy activity per site, by province, Vanuatu 2012

Province	API 2012	Sites	No of slides examined, 2012	Mean no of slides examined per site per day
Shefa	4.7	6	5,295	3.5
Malampa	20.3	7	3,008	1.7
Penama	21.2	8	784	0.4
Sanma	21.3	4	5,877	5.9
Torba	38.2	3	1,174	1.6
Tafea	0.4	4	843	0.8
Total Vanuatu	**13.2**	**32**	**16,981**	**2.1**

Assumption: 250 working days per year. API based on both microscopy and RDT

There is no clear instruction in the *Guidelines for Treatment of Malaria in Vanuatu* (2009) on which patients should be tested for malaria. This leads some health workers to not test for malaria if they believe that there is a very low risk of malaria in their area (or even that it has been eliminated). This has probably also contributed to the progressively lower ABER noted in Tafea, for example (Section 3.1.5 and Table 4). While the case definition for 'suspected malaria' is fever or history of fever (as per the standard WHO definition), this may be interpreted quite variably (including between provinces); some lower incidence service delivery points are reported to be already implementing non-systematic screening of patients with a history of travel outside the area.

The proportion of suspected malaria cases receiving a diagnostic test is not measured directly. According to current indicators captured by the MIS, the proportion of reported malaria cases confirmed by either microscopy or RDT increased from 88% in 2010 to 97% in 2012. This may indicate a reporting bias (commonly seen in many countries) as it seems unlikely that as many as 97% of all cases treated for malaria would have received a diagnostic test.

3.2.4 Treatment

The introduction of new case management guidelines in 2009 was accompanied by extensive training for multiple cadres of health workers. The training program took advantage of the unique opportunity that arose from the newly introduced RDTs and ACT as the new first line treatment for both *P falciparum* and *P vivax*. Refresher training on malaria case management, malaria microscopy diagnosis and the use of the new RDTs was continued in 2011 and 2012.

Although health workers at Health Centre, Dispensary and Aid Post levels participated in the training, hospital staff and some Health Centre staff did not have the opportunity to take part. As a result, some doctors and nurse practitioners are unfamiliar with the up-dated treatment protocols (including for severe cases).

For health workers, there is limited 'on-the-job' supervision and support. Facility supervisory visits focus mainly on data and reporting without providing technical support or follow-up of training; because they are not conducted by nurses or clinicians, they do not include observation of treatment.

Some leeway to treat patients with negative tests according to clinical judgment is appropriate when there is diagnostic uncertainty, but this has led to large variation in actual clinical practices – particularly in poorly stocked Aid Posts where VHWs have had little (or in some cases no) training, and have few other treatments to offer a patient. Variable adherence to protocols is also reported from higher level health facilities, e.g. providing malaria treatment when a malaria-specific test is negative, or providing antibiotics without further investigation.

Therapeutic efficacy studies (TES) using WHO approved methodology were conducted on Epi in 2011 to assess the efficacy of artemether-lumefantrine (AL; *Coartem®*) against both *P falciparum* and *P vivax*. No cases of *falciparum* were identified. However, 80 *P vivax* cases were recruited and, among them, only one subject showed a reappearance of parasites within the 28 days follow-up period (justifying the continued use of AL as first line treatment for *P vivax* infection).

Treatment with primaquine for radical cure of *P vivax* infection is recommended in the treatment guidelines,[10] but is rarely practised and not well documented. The absence of a feasible screening test for glucose-6-phosphate dehydrogenase (G6PD) precludes the use of 14-day PQ therapy in most cases as patients will need to be referred to a Health Centre to initiate treatment under clinical supervision. The MIS indicates that, in the first 6 months of 2013, only 4% (35/847) of reported *P vivax* cases were prescribed PQ.

A multi-centre study is currently under way around Lunganville in Santo to assess the efficacy of different 14-day doses of PQ against the strains of *P vivax* found in Vanuatu, and to measure the efficacy of AL on *P falciparum* and *P vivax*. Unfortunately, not a single *P falciparum* case has been recruited over a 6 months period. G6PD screening has been made available, and G6PD-deficient individuals are excluded (meaning the study will not address the crucial issue of PQ safety when used without knowledge of the patient's G6PD status). However it will establish the effective dose and adverse effects of PQ in persons with normal G6PD activity, to guide future policy.

3.2.5 Pilot elimination activities

As noted above, the first pilot elimination activity in Vanuatu commenced in **Aneityum** in Tafea province in 1991. Against a baseline prevalence of 10% *P falciparum* and 15% *P vivax*, weekly mass drug administration (MDA) using sulphadoxine-pyrimethamine (SP) and PQ was provided for to the whole population (718 individuals) for 9 weeks; in addition, 100% coverage with ITNs (by population), introduction of larvivorous fish (*Gambusia* species) into a neighbourhood swamp, and screening of arrivals for malaria at ports of entry (POE) (Kaneko 2000, Kaneko 2010).

A resurgence of local transmission with a small *P vivax* outbreak occurred in 2002 after an outbreak on Tanna and Erromango 2001-03. This was managed with a new cycle of MDA using chloroquine (CQ) four times weekly followed by 14 days of PQ.

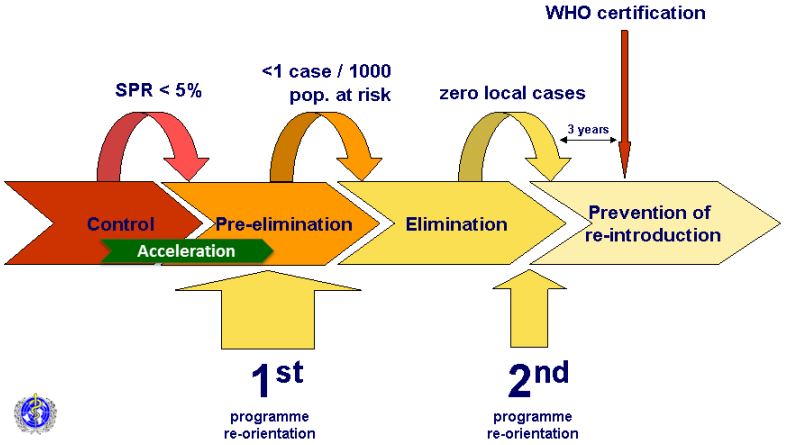
A small number of asymptomatic *P vivax* cases were detected in surveys during 2003-05. A serological survey in 2009 subsequently found 7 children under the age of 5 years who were seropositive for *P vivax*. One case of *P vivax* was detected through routine malaria surveillance in 2010 in an individual who had not travelled outside Aneityum. These observations suggest that low level transmission of *P vivax* may still be occurring.

[10] To minimise the risk of toxicity in the absence of G6PD screening, PQ is prescribed at a lower dose of 0.25mg/Kg/day.

In 2009, the whole of **Tafea** was selected as the first province-wide pilot elimination site in the country, with the objective of achieving zero local transmission of malaria by the end of 2014 (and sustained elimination by 2016). Tafea was selected based on the following criteria: a) the relatively low level of malaria endemicity and transmission (see Sections 2.3 and 3.1.5); b) the absence of malaria transmission in the island of Futuna; and c) the more recent, successful elimination of malaria transmission and reservoirs on Aneityum in the 1990s.

The interventions used in Tafea (summarised in Box 1) have been designed to accelerate the reduction in malaria transmission (API 23.3 per 1,000, TPR 21.7%) and move the province more quickly into an "elimination phase" strategy according to WHO criteria, shown schematically in Figure 11 (WHO 2007).

Figure 11: Acceleration strategy from control to pre-elimination phase, Tafea province, 2009-12



Box 1: Pilot Malaria Elimination Interventions, Tafea Province, 2009-13

Prevention: Vector Control and Personal Protection

Mass distribution of LLIN, topping-up and replacing nets

IRS x 3 rounds of all households within 2 km of the coast of Tanna, planned and managed using a sophisticated geo-referencing system

Blanket IRS coverage of Erromango and Aniwa x 1 round, followed by focal spraying targeting areas of local transmission

Case management: Diagnosis and Treatment

Diagnosis of every fever case using quality assured microscopy or RDT

Treating all *P falciparum* cases with AL, and all *P vivax* cases with AL plus 14 days of PQ (as per national *Guidelines*)

Administration of all malaria treatment by DOT

Vector control

Indicators of individual access to bed nets must be based on household surveys rather than estimated from distribution records. This will better inform procurement needs in future planning cycles.

Better evaluation of larval source management interventions is required before this intervention can be replicated in other areas

Surveillance and Response

Notifying positive cases to the Provincial Malaria Office within 48 hours

Investigating cases

Following-up all cases by microscopy: once a month for 3 months for *P falciparum* and once a month for 6 months for *P vivax*

Conducting selective mass screening and treatment (MaST) where epidemiological data indicate continuing local transmission

Community surveillance for detecting possible imported cases of malaria

Monitoring and evaluation

Passive case detection at health facilities – entering line listing data onto the MIS and reporting to the Provincial Malaria Office monthly

Recording case investigation details in the MIS

Recording LLIN distribution and IRS in the MIS

Community mobilisation and system strengthening

Enhancing community participation

Collaboration and coordination with other health programs

The impact to date of those interventions to date is shown in Table 7 and Figure 12. (Note that the vector control interventions shown in Figure 11 are superimposed on other public health interventions, i.e. universal access to parasitological diagnosis using microscopy or RDT and the availability of highly effective treatment using ACT).

Table 7: Progressive impact of interventions by year, based on the Tafea model (2008-12)

	Pop.	Tested	ABER	Cases	TPR %	API	IRS	ITN	PHASE	SURVEILLANCE			
2008	32540	3492	11	757	21.7	23.3	—	30%	CONTROL	MMLL		PCD	
2009	32540	1809	6	278	15.4	8.5	IRS 3	30%	ACCEL	MMLL		PCD	
2010	32906	2765	8	63	2.3	1.9	IRS 2	>85%	ACCEL	MMLL		PCD	
2011	33269	1680	5	17	1.0	0.5	IRS 1	>85%	PRE-ELIM	CASE		PCD	
2012	33635	1869	6	20	1.1	0.6	—	>85%	ELIM 1	CASE		PCD+	ACD
2013	34006			4			—	>85%	ELIM 2	CASE	FOCI	PCD+	ACD

PCD = passive case detection; PCD+ = enhanced passive case detection; ACD = active case detection

Figure 12: Confirmed malaria cases (Y2 axis) and TPR and API trends (Y1 axis) in relation to pilot elimination interventions, Tafea province, 2008-12

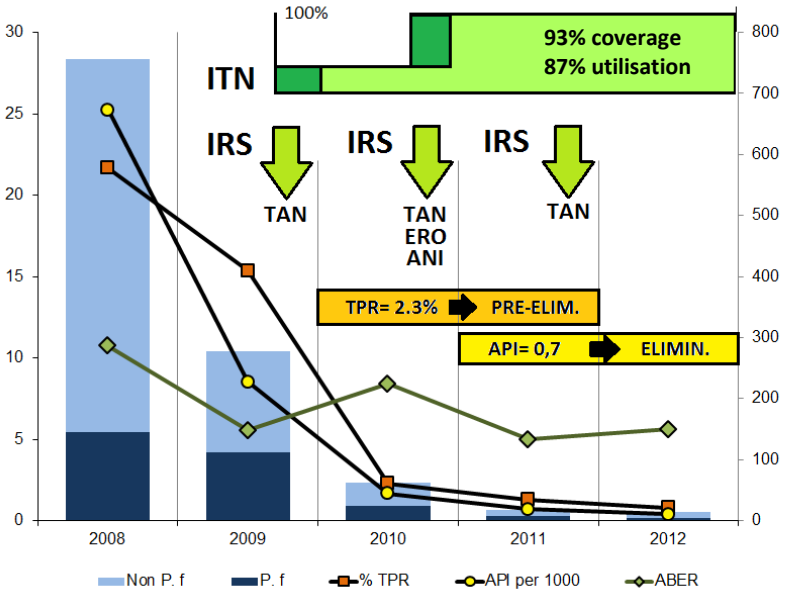


Table 7 and Figure 12 show that the number of reported cases in Tafea fell from 757 in 2008 to just four imported cases in 2013 (an additional indigenous case, reported during the strategic planning workshops in November 2013, is not included in the data). The province passed the WHO-recommended pre-elimination threshold (TPR < 5%; Figure 9) in 2010 after just one round of IRS. The elimination threshold (API < 1 per 1,000) was reached in 2011 after two rounds of IRS in all households situated within two kilometres of the sea (with a coverage of >90% of households sprayed), concurrently with the achievement of a high coverage of LLINs (93%, with 87% utilisation).

The provincial health service also maintained universal free access to diagnosis by RDT or microscopy and DOT with ACT through an expanded network of primary care facilities (including increasing the number of Aid Posts from 20 in 2010 to 31 by the end of 2012), by increasing community and school engagement, and establishing a team of 17 dedicated malaria staff (including 8 malaria elimination officers). LSM was undertaken on Tanna but not Erromango or Aniwa.

The API has continued to decline – to 0.4 per 1,000 in 2012 – and is expected to fall below 0.1 per 1,000 in 2013. There have been no reported deaths attributed to malaria since commencement of elimination-oriented activities.

These achievements can inform a progressive expansion of similar interventions to other islands, and form the basis of the proposed Strategy for 2015-20. The gradient towards higher transmission in the northern provinces represents a risk that the strategy may not be as fully effective as in Tafea (Section 3.1.1); however, early results from Torba suggest that the impact will be similar.

3.2.6 Supply chain management

The specifications for RDTs and ACT comply with WHO prequalification and evaluation guidelines; these commodities are procured through SPC- and WHO-prequalified suppliers.

Lot quality control testing is routinely performed for all arriving batches of RDTs.

Non-air-conditioned store rooms at facilities raise concerns about the validity of RDTs, ACT and other drugs in the field. There is currently no mechanism for collecting random samples of ACT or RDT from health facilities for quality testing.

All medical supplies are first stored and then distributed to provinces through the national CMS. The submission of orders may not be timely, communication between facilities, provincial pharmacies and the CMS may be inadequate, and provinces and facilities may not receive what has been ordered; on occasions, the CMS intervenes when the provincial pharmacy does not detect or respond to attempts to stockpile supplies at the facility level.

Forecasting systems for the quantification of medicine orders need to be adjusted to reflect the reduced number of cases to be treated – otherwise, oversupply and expiry of ACT will occur in many health facilities. Stock outs of RDTs are occasionally reported. Quantification of procurement is further complicated by the relatively short shelf life of both ACT and RDTs (often around two years).

3.2.7 Surveillance and information management

The Malaria Information System, which gathers and consolidates routine essential malaria surveillance and programmatic data through the MMLL, has been functioning in parallel with the HIS since 2009. At present, the surveillance and investigation of possible malaria deaths needs to be coordinated manually between the HIS and MIS.

The possibility of malaria resurgence after reaching very low transmission levels depends on several factors: human and mosquito movement due to frequent inter-island travel by air and sea through multiple entry points (importation risk) and the presence of vector mosquitoes and the degree of immunity in the human population (receptivity). Information on malaria outbreaks is currently very limited. Anecdotally, outbreaks or higher transmission levels have been reported from: Emae in 1985; Tanna in 1987 (following Cyclone Uma); Epi in 1988; Tongoa in 1990 (Kaneko 1998); Tanna, Erromango and Aniwa in 2000 and 2003 (Kaneko 2010); Gaua Island in Torba in 2010; and on Epi Island in Shefa and Malo Island and North East Santo in Sanma in 2012 (MOH 2013). However there is no written record of formal investigation and management of these events, or a clear definition of what constitutes an 'outbreak'.

3.2.8 Interaction with other health system elements

The *Strategic Vision* states a clear intention for the annual VBDCP work plan to be integrated progressively with provincial health plans, for operational planning and budgeting to be harmonised, and for health facilities to become the focal points for community level prevention (e.g. planning and management of LLIN distribution). This would free up the central VBDCP to focus on higher level activities to strengthen the implementation of the Program, e.g. operational research, QA, monitoring, surveillance and response.

In practice, the provincial malaria supervisors travel to Port Vila once or twice a year for review and planning meetings. However, the consolidated MAP is structured by programmatic area and activity – often reflecting project-based funding sources – rather than by geographic area, and implementation is centrally managed with little provincial input (MOH 2013).

Operationally, the Program has exercised some leeway to include other health programs (e.g. immunisation) in community outreach activities), and to include yaws and lymphatic filariasis surveillance activities in the malaria indicator survey. Those collaborations could be strengthened further through interventions like integrated vector management (IVM), surveillance and reporting, preventing or controlling other VBDs in Vanuatu.

The Program interacts constructively with CMS for procurement, supply chain management and logistics, and with the MOH Finance section for financial program management.

However, around 70% of malaria funding is provided from donor sources, almost 100% of commodities procurement is externally funded (and managed) and 68 of 82 positions are project-funded (although managed through GOV systems).

3.2.8 Recommendations of the 2013 MPR

The MPR made many specific recommendations in relation to individual thematic areas of the Program, plus a number of higher-order strategic directions (summarised in abbreviated form in Box 2).

Box 2: Strategic Recommendations of the Malaria Program Review, 2013

Program management

Malaria Program planning should be directed towards a comprehensive provincial planning, budgeting and expenditure reporting process and more substantive provincial input.

The VBDCP and the Malaria Steering Committee should resist taking on too many general health system strengthening tasks; it should focus primarily on its core functions – disease control and public health aspects of the Program.

Renewed donor support should gradually reduce the reliance on short term outside technical advisers, encouraging VBDCP instead to focus requests for such assistance on defined analytic tasks and to capitalise on internal resources and past capacity building activities.

Case management

In areas where quality-assured malaria microscopy is difficult to establish and sustain, RDT should be the diagnosis of choice (in both hospitals and Health Centres).

Quality assured microscopy should be maintained in hospitals for monitoring treatment response in in-patients, and in selected Health Centres.

Primaquine use and any adverse effects should be tracked and reported through the malaria line list until such time as G6PD testing and/or data on primaquine safety and efficacy from ongoing studies become available.

Vector control

Indicators of individual access to bed nets must be based on household surveys rather than estimated from distribution records. This will better inform procurement needs in future planning cycles.

Better evaluation of larval source management interventions is required before this intervention can be replicated in other areas.

Behaviour change communication and community mobilization

As malaria cases decline, it is critical to continue to engage both the community and health workers to maintain high levels of bed net utilisation.

Monitoring and evaluation

A strengthened M&E unit within the Program is needed to undertake regular epidemiological analysis, to guide elimination strategies and to set targets and timelines.

Surveillance in support of elimination

Frequent monitoring of indicators at provincial and health zone level is vital to improve risk stratification and targeting of interventions. For monthly or quarterly reviews, the Program should concentrate on a few critical indicators (e.g. incidence and test positivity rate by species) to guide interventions and relate activities and interventions to impact.

3.3 Introduction of zonal stratification and mapping

Traditionally, other than the north-south gradient in reported incidence (Section 2.3, Figure 1 and Table 4), there have been no officially defined strata of malaria transmission risk in Vanuatu.

The only other form of operational stratification was built on the finding that mosquito breeding and malaria risk in Tafea were higher within 2 km of the coast, and this guided the geographical coverage of IRS interventions. However, this 2 km zone does not correspond to any sub-provincial administrative level for program planning.

Monthly API and TPR data by health zone are now available for 2010, 2011 and 2012; these have been used to develop zonal transmission risk stratification maps (Annex 1) which, in turn, have been used to prioritise and target malaria interventions more efficiently in support of the elimination agenda (see Section 5.1 *Thematic Area 1: Vector control*). Stratification at even lower levels, e.g. administrative villages, will eventually allow even better identification of the important foci of transmission.

4. Strategic Plan Framework

4.1 Vision

The Vision of the National Malaria Strategic Plan for 2015-20 is: [11]

A malaria-free Vanuatu by 2025-28, contributing to the good health and well-being of the population

The Vision acknowledges the likely longer term time frame necessary to achieve sustainable zero malaria transmission throughout the country, i.e. about 10 years from commencement of the new NMSP.

4.2 Mission and values

4.2.1 Mission statement

The Mission of the NMSP, which clarifies its contribution to the Vision, is:

The Malaria Program aims to progressively control and eliminate malaria in all provinces of Vanuatu. The Program works in close partnership with provincial health services and local communities to ensure that universal access to health promotion, prevention with long-lasting insecticidal bed nets, and quality-assured diagnosis and treatment is maintained. It aims to use indoor residual spraying to accelerate reduction in malaria transmission in selected areas. It seeks to strengthen and maintain excellent surveillance and apply new knowledge as it becomes available in order to achieve malaria elimination and the prevention of reintroduction.

This Mission statement describes the direct contribution of Malaria Strategy to the achievement of the Vision. Activities supported by the Program are always informed by this Mission statement, and the Program is accountable for their implementation.

4.2.2 Values

The guiding values of the Strategic Plan are:

- Country ownership and leadership through the MOH, the VBDCP, provincial health services and their partners
- Free and universal access to malaria services, increasingly integrated with community PHC
- Evidence based, ethical and technically sound interventions
- Efficiency and value for money, for both Government and donors, both in relation to malaria targets and to the overall health system
- Partnership with: other health sector programs (e.g. maternal, neonatal and child health [MNCH] and environmental health); other non-health sector ministries and organisations; academic and research institutions; private sector entities; and civil society organisations
- Increasing community responsibility and leadership for malaria control and elimination (e.g. through community leaders, zonal elimination committees, and community health and surveillance committees)
- Transparency and accountability

[11] The Vision is aligned with the *Vanuatu Health Sector Strategy 2010-2016*. Should the *Health Sector Strategy* be updated during the new NMSP, the vision may need to be updated. This will be assessed at a proposed mid-term review in early 2017.

4.3 Overall strategic directions

The guiding direction for the Strategic Plan, agreed at the March 2013 workshop, is **progressive ("step-wise") transition from control to elimination, province by province.**

This will include:

- Progressive integration into the Vanuatu health system as part of overall disease surveillance and control/elimination activities; and
- Improved capacity for planning, priority setting and resource allocation at both provincial and national level.

HIS and malaria information system (MIS) data will be used to guide feasibility analysis and decision-making.

The MOH and VBDCP will set and pursue Vanuatu's own goals, which are currently aligned with the MDGs developments and are likely to remain consistent with the "post-2015 development agenda".

Noting the importance of continuing technical and financial assistance, the MOH and the Program will maintain and strengthen key partnerships, including: the Global Fund; WHO and the Global Malaria Programme; the Asia-Pacific Malaria Elimination Network; and bilateral donors (e.g. Australia, Japan).

4.4 Goal and Objectives

4.4.1 Goal

The Goal of the Strategy is:

> ***By the end of 2020**, to reduce the annual parasite incidence rate to < 1 per 1,000 nationally and maintain zero confirmed deaths from malaria.*

A number of intermediate Goals can be used as "progress markers" for the Strategy:

> ***By the end of 2016**, to achieve zero local transmission of malaria in one province (Tafea) and reduce the annual parasite incidence rate to < 5 per 1,000 nationally and maintain zero confirmed deaths from malaria;*
>
> ***By the end of 2018**, to reduce the annual parasite incidence rate to < 2.5 per 1,000 nationally and reduce the annual parasite incidence rate to < 1 per 1,000 in one additional province (Torba) and maintain zero confirmed deaths from malaria.*

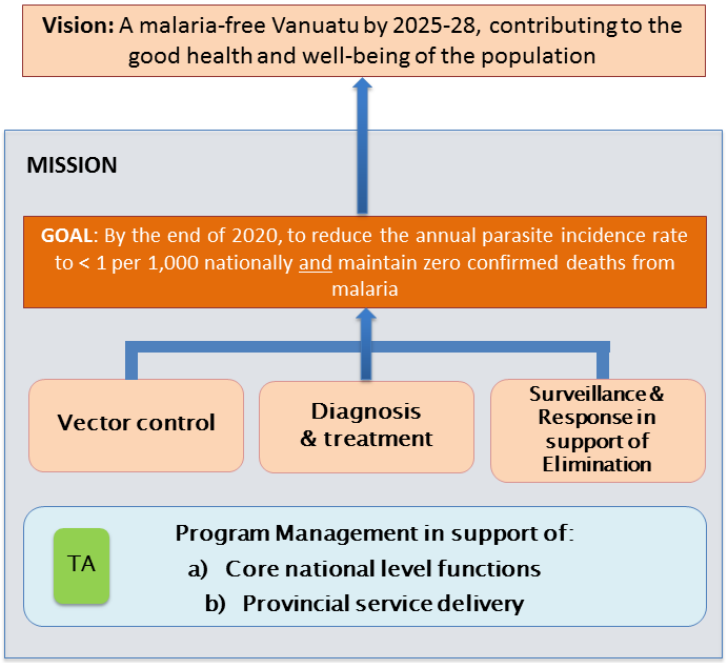
Section 7 (*Monitoring and Evaluation*) explains how the achievement of these intermediate progress markers and the overall impact of the Strategy will be measured.

4.4.2 Thematic areas and Strategic Objectives

Under the Strategy, Malaria Program activities are grouped into three thematic operational areas, each with its own strategic objective. These are shown in diagrammatically in Figure 13 (which also demonstrates how each of the thematic areas relates to the Vision, Mission and Goal); the logic model and theory of change are summarised more comprehensively in the diagram on page xiii.

These operational objectives are supported by a specific programmatic management objective, including the management of technical assistance, which will also be actively monitored (see Section 6).

Figure 13: Logic diagram showing relationship between thematic areas, mission, goal and vision, National Malaria Strategic Plan, Vanuatu, 2015-20



Thematic Area 1: VECTOR CONTROL

Strategic Objective: *To maintain universal coverage with LLINs for the whole population of Vanuatu and accelerate reduction in malaria transmission in selected areas using IRS*

Thematic Area 2: DIAGNOSIS AND TREATMENT

Strategic Objective: *To achieve 100% testing of suspected malaria cases by microscopy or RDT and provide prompt treatment and care for 100% of confirmed malaria cases according to the national 'Guidelines for Treatment of Malaria'*

Thematic Area 3: ACTIVE SURVEILLANCE AND RESPONSE IN SUPPORT OF ELIMINATION

Strategic Objective: *Once a province has entered the elimination phase, to investigate and manage all malaria cases and identify, investigate and manage foci of infection according to national 'Guidelines for Malaria Elimination'*

Additional Objective: PROGRAM MANAGEMENT TO MAINTAIN CORE NATIONAL FUNCTIONS AND SUPPORT PROVINCIAL SERVICE DELIVERY

Objective: *To strengthen Malaria Program leadership and management capacity at provincial and national level to plan, deliver and report on malaria interventions in a well-coordinated, efficient and timely manner*

The service delivery areas (SDA) and activities to be implemented under each of these Strategic Objectives are discussed in more detail in Section 5, *Interventions and Implementation Strategies*, below.

4.4.3 Health promotion

Health promotion is not represented as a separate, stand-alone thematic area under the new Strategy.

Behaviour change communication (BCC) using approaches like CoMBI (community mobilisation for behavioural impact) and the development of information, education and communication (IEC) materials are integrated horizontally, where needed, as activities within each of the other thematic areas. Costs and budgets for BCC activities and development of IEC materials are integrated with the relevant thematic area rather than as a vertically managed element under Program Management.

A separate **advocacy, communication and social mobilisation (ACSM) strategy** is currently under development and will be finalised prior to inception of the new NMSP in 2015. Priority areas of focus will include advocacy and engagement with political and community leaders, World Malaria Day activities, community engagement and preparation for IRS operations, community mobilisation for bed net distribution, utilisation and replacement, and piloting VHW-led activities for recycling and/or disposal of retired bed nets.

In designated elimination areas, a key activity under the ACSM strategy will be to support community engagement for local level vigilance and participation (Thematic Area 3). Approaches are being piloted in Tafea in 2014, and this will inform the evolution of those strategies in other pre-elimination and elimination provinces and areas.

As capacity within the central MOH Health Promotion Unit allows, malaria-specific health promotion functions will be progressively integrated as recommended by the MPR (MOH 2013).

4.4.4 Operational research

Similarly, operational research is horizontally integrated at the activity level within each of the other thematic areas (i.e. rather than existing as a separate menu of inputs managed vertically by an external agency or through a technical assistance function under Program Management).

Subject to available funding, an **operational research plan** will be developed prior to inception of the new NMSP in 2015, and updated within each annual operational plan according to evolving needs and priorities. Each TAG meeting will review operational research activities and emerging needs. Where budgets or technical assistance are required, this will be proposed to the MSC for authorisation. These processes are explained further in Section 6.5.2.

5. Interventions and Implementation Strategies

5.1 Thematic Area 1: Vector control

Strategic Objective: *To maintain universal coverage with LLINs for the whole population of Vanuatu and accelerate reduction in malaria transmission in selected areas using IRS*

Core vector control interventions will be central to attaining the goal of the Strategy. These include achieving high levels of personal protection using long lasting insecticide treated bed nets, and the use of indoor residual spraying with insecticide in selected areas to accelerate the reduction in malaria transmission. Where feasible and supported by the results of operational research, larval source management may be added in elimination foci.

SDA 1.1: Maintain universal LLIN coverage

The whole population of Vanuatu is regarded as at risk of malaria (Section 1.1). In order to reach and maintain universal coverage with LLINs, the Program will undertake systematic full replacement of LLINs throughout the entire country. This will be effectively supported by behaviour change communication to ensure a high level of bed net utilisation.

Target population

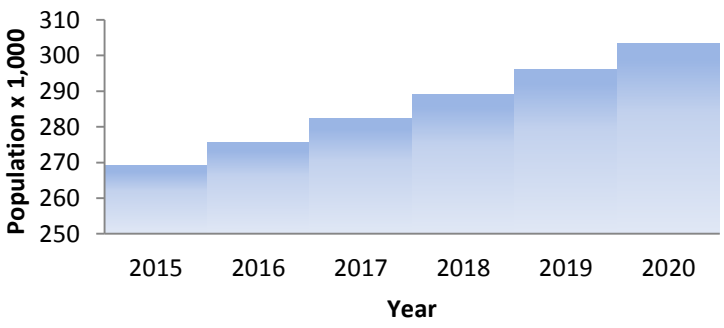
The whole population is targeted.

Residents living in urban environments are also targeted, even though they are less vulnerable than those living in rural areas and more remote islands. This is because population movement between rural and urban areas potentially increases the risk of introduction or re-introduction of malaria anywhere and at any time if the level of protective measures decreases.

Maintaining high levels of bed net coverage and utilisation among the population will contribute to mitigating and eventually interrupting malaria transmission in the entire country.

It is estimated that the population of Vanuatu will grow from about 269,000 in 2015 to 303,000 in 2020; this is summarised graphically in Figure 14.

Figure 14: Annual estimated population growth, Vanuatu (2015-2020)



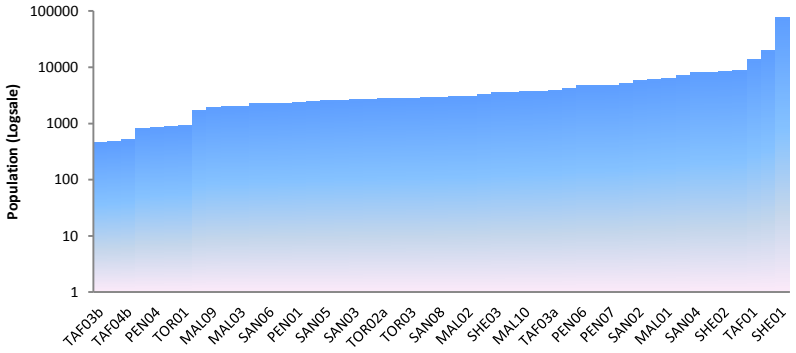
It is not yet certain for how long universal bed net coverage will need to be maintained after the achievement of zero transmission. This will be addressed by the Program review scheduled for 2017 (see Section 7.3, *Mid-term and end-of-Strategy evaluations*), by which time zero transmission should have been achieved in Tafea and possibly elsewhere in the country (Figure 20).

Geographic coverage

All villages in all health zones are targeted for bed net replenishment and distribution.

In total, there are 49 health zones across the 6 provinces. The number of health zones in each province varies according to population distribution and geographic topography. There is a significant variation in population between health zones (Figure 15); in 2015, for example, the highest population size in a health zone will be around 77,000 residents while the lowest (in a more scattered, outer island health zone) will be around 500 residents. (Note, Figure 15 has a logarithmic scale on the Y-axis).

Figure 15: Projected population distribution by health zone, Vanuatu, 2015



For logistic and operational reasons, and in order to maintain possible highest LLIN coverage, distribution will need to continue in a phased manner (i.e. by health zone), continuing on from the previous cycles with particular provinces and health zones targeted each year. Based on the current distribution cycle, the provincial populations targeted for LLIN implementation are summarised Table 8.

Table 8: Populations targeted for LLIN replacement and distribution, by year and province, Vanuatu, 2015-20

PROVINCE	2015	2016	2017	2018	2019	2020
TORBA	1,382	9,810	544	1,462	10,380	576
SANMA	8,376	37,320	13,999	8,992	40,073	15,031
PENAMA	5,577	17,998	14,188	5,831	18,820	14,836
MALAMPA	10,211	21,803	11,935	10,584	22,596	12,369
SHEFA	16,488	13,264	84,321	18,386	14,791	94,031
TAFEA	13,203	23,548	1,776	13,642	24,333	1,836
VANUATU	**55,236**	**123,743**	**126,763**	**58,898**	**130,993**	**138,678**

Adequate access policy

The policy for adequate access under the new Strategy has been formulated based on evidence generated during the present *Strategic Vision*. The number of nets given to each household should be proportional to the number of sleeping places in the household. Analysis of data from the 2011 Malaria Indicator Survey (Annex 2 and Supplement) found that the ratio of people per net used was 1.48. However, the ratio of available nets to sleeping places was 1.0 (regardless whether or not those sleeping places were occupied the night of the survey), indicating that the quantity of nets was sufficient for universal access even in the presence of population movement.

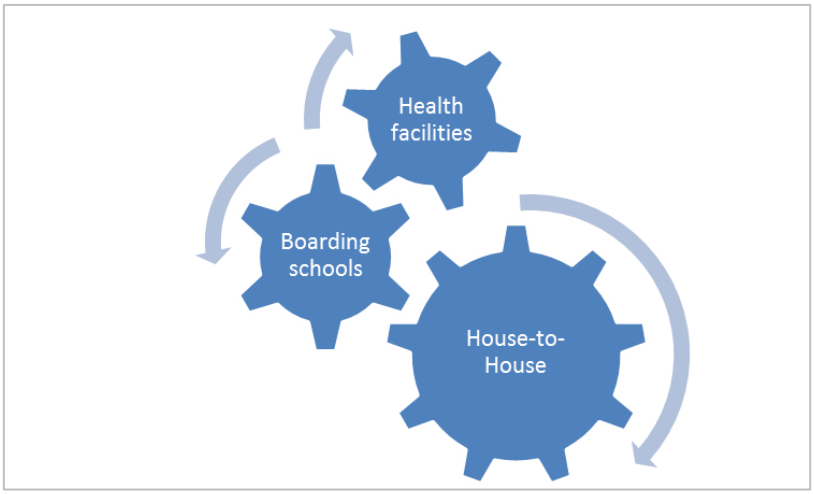
This bed net policy can greatly simplify the field distribution of LLINs, i.e. by basing distribution on existing sleeping patterns (which inherently reflect the age and gender structure of the household), as opposed to other, more complex distribution formulae. Coverage can be readily maintained through a systematic three-year cycle of distribution, in line with the expected three-year lifespan of LLIN (as per manufacturers' recommendations and the results of operational research under similar usage patterns.

Distribution channels

Relevant operational guidelines are already is available to the distribution teams, including recording and reporting tools. A small number of updates will be needed to recognize the new NMSP.

Three interacting distribution channels will be used (Figure 16): house-to-house, boarding schools, and selected health facilities providing antenatal services (e.g. hospitals, Health Centres with midwives).

Figure 16: Logic diagram showing relationship between various bed net distribution channels, Vanuatu, 2015-20



House-to-house distribution, extending the current three-year provincial cycle of mass outreach campaigns, will ensure high access to LLIN is for every household. This distribution approach will deliver more than 90% of the LLINs targeted for delivery annually.

About 5% of nets targeted for distribution annually will be made available to boarding schools for the exclusive use of students during the term. The boarding school distribution channel is supplementary to

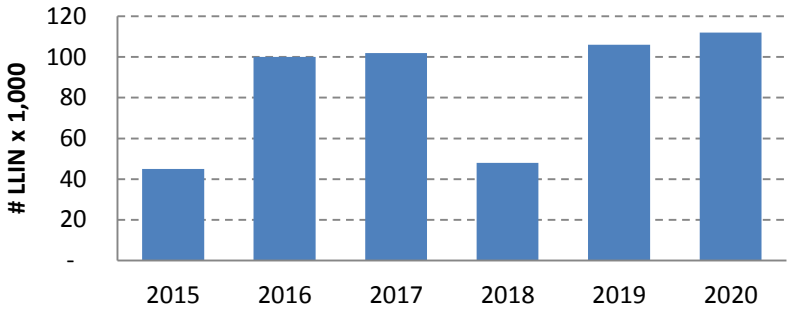
house-to-house delivery as some of residents (students) stay in the boarding schools away from their family homes during the school term. The nets will remain the property of the school, as a net will have been distributed and be available for the student's sleeping space at home during term break.

Distribution through selected health facilities providing antenatal care is a top-up approach to provide maximum access to LLIN among pregnant women and their new-born baby. This is a passive approach and, from existing delivery data, will represent less than 5% of annual LLIN distribution. Subject to logistic demands and performance, bed nets may also be made available at lower levels of health facility for distribution to positive malaria cases who report that they do not have access to a bed net.

Micro-planning and operational distribution mechanisms

One-third of provinces will be targeted annually. As noted above, this cycle is based on the observed three-year functional lifespan of the majority of nets under field conditions in Tafea (Dutta 2014) and procurement and organizational management considerations (which would provide more stable, regulated coverage than a one-off nationwide distribution once every three years). The VBDCP currently operates their LLIN interventions based on this. This approach gives a procurement forecast as shown in Figure 17.

Figure 17: Forecast number of LLIN to be procured and distributed, by year, Vanuatu, 2015-2020



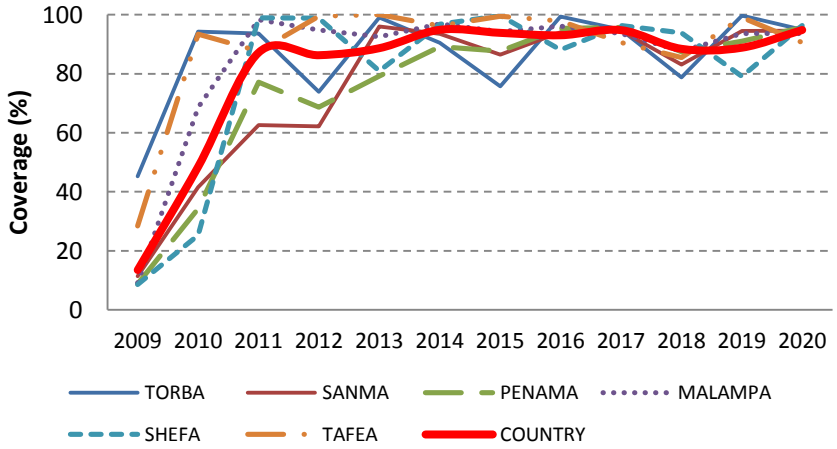
Each operational team at provincial level will be responsible for micro-planning its own LLIN distribution rounds. The national Program team will provide training, technical assistance and operational guidance to each provincial team to ensure they are well oriented and skilled in developing, managing, and implementing their LLIN operational plan. A micro-planning tool has already been developed, but may need to be revised to make it more user-friendly in the provincial planning context.

The provincial operational team will prepare and organize their team according to the standard operating procedures (SOP) for LLIN distribution (as revised). Generally, the team will comprise provincial Malaria Program officers, peripheral health staff if they are available (nurses, HPOs and VHWs), and volunteers in their respective village as part of community participation and engagement. Each community operation will be coordinated and monitored by the provincial Malaria Program officer in charge.

LLIN distribution will take place according to pre-planned schedules. Whenever possible, where LLIN distribution is scheduled for the same place as IRS, the operational schedules will be combined.

Current experience is that rounds of LLIN distribution may occasionally need to be deferred for financial or operational reasons. Although this has caused coverage (and coverage-based distribution data) to fluctuate, it has nevertheless remained at acceptable levels (generally >80% by province; Figure 18).

Figure 18: LLIN coverage (actual and forecast), by province, Vanuatu, 2009-2020



Procurement and supply management

The quantity of nets for procurement is determined from existing distribution records combined with population projections and the findings of the 2011 Malaria Indicator Survey. These support the current distribution policy at one net per sleeping place, which gives an equivalent procurement ratio by population of one net per 1.25 people. The total quantity of LLIN needed for the period 2015-2020 can therefore be forecast as follows (Table 8):

Table 8: Procurement (upper) and distribution (lower) projections for LLIN replacement, by year and province, Vanuatu, 2015-20

PROCUREMENT	2015	2016	2017	2018	2019	2020
VANUATU	45,000	100,000	102,000	48,000	106,000	112,000

DISTRIBUTION	2015	2016	2017	2018	2019	2020
TORBA	1,200	7,900	500	1,200	8,400	500
SANMA	6,800	30,000	11,300	7,300	32,100	11,100
PENAMA	4,600	14,500	11,500	4,800	15,100	12,000
MALAMPA	8,300	17,500	9,700	8,600	18,200	10,000
SHEFA	13,300	10,700	67,500	14,800	11,900	75,300
TAFEA	10,600	18,900	1,500	11,000	19,600	1,500
VANUATU	**44,800**	**99,500**	**102,000**	**47,700**	**105,300**	**111,400**

Currently, LLIN procurement for Vanuatu is outsourced by international tender according to the policies of the donor (Global Fund). In-country procurement capacity is limited, and would most likely attract price increases due to the small quantity to be ordered under a single-country model. Collaboration with neighbouring countries under a pooled procurement approach will be considered (subject to decisions about a Global Fund submission during 2014).

In-country supply management will use the existing inventory system and sub-national storage depots.

Support for high levels of utilisation

The Program will support and inform effective behaviour change communication at both national and provincial level to ensure continued high utilisation rates.

Disposal or recycling of expired or 'retired' nets

Continued cyclical distribution of large quantities of new nets poses an operational question of what to do with 'retired' nets. The Program will undertake operational research to guide domestic and other re-use of old nets. Options include using them as window or door-way screens, using them as raw materials for cottage industries (e.g. to make pillows, sleeping mats), or weaving them into ropes for fishing, farming and other uses.

Monitoring

The operational success of this intervention will be measured by periodic household surveys, with targets of at least 80% accessibility and 80% usage at population level.

Dialogue and collaboration with other agencies undertaking household and population based surveys will be needed at times where a malaria indicator survey is not scheduled, e.g., demographic and health survey (DHS), multiple indicator cluster survey (MICS), etc.

SDA 1.2: Achieve full coverage of selected populations with IRS

Experience from Tafea province enables the Program to extrapolate and forecast the potential impact of targeted IRS in selected populations if it were applied in a similar way (assuming similar patterns of malaria transmission).

Model of accelerated control using IRS

To support this, the Program can strategically classify the population by health zone, using the TPR as the stratification factor. This enables four strata to be identified, as follows:

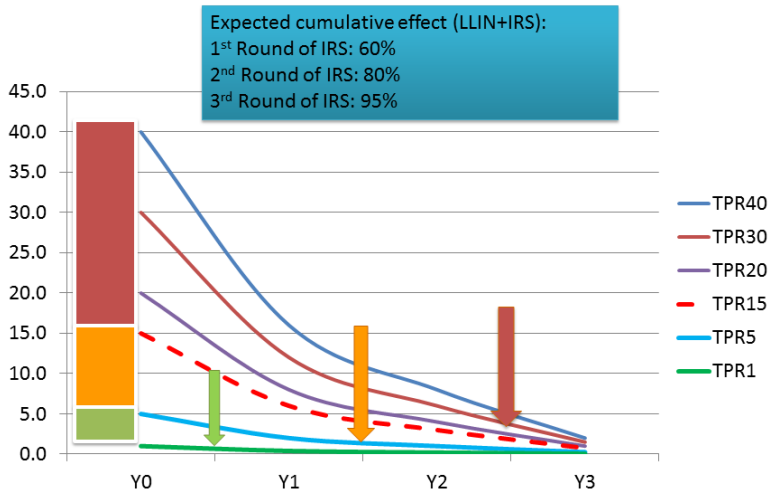
- Category A: TPR below 1%
- Category B: TPR between 1% (inclusive) and 5% (exclusive)
- Category C: TPR between 5% (inclusive) and 15% (exclusive)
- Category D: TPR above 15% (inclusive)

Based on this approach, and applying the expected cumulative effect of 60%, 80%, and 95% reduction in TPR from one, two and three rounds of IRS (identified in Tafea and elsewhere, in conjunction with **high background LLIN coverage and other interventions**), four likely scenarios to reduce TPR close to 1% can be forecast as shown in Figure 19.

These scenarios can guide the Program on how to strategically target IRS preventive intervention to achieve an accelerated reduction in malaria transmission, as follows:

- **Category A** – maintain LLIN coverage, but no accelerated IRS intervention needed; ready to apply surveillance and response interventions according to national elimination policy and guideline.
- **Category B** – targeted for at least one round of IRS to accelerate reduction in transmission
- **Category C** – targeted for at least two consecutive rounds of IRS
- **Category D** – targeted for at least three consecutive rounds of IRS

Figure 19: Number of rounds of IRS (+ maintaining high LLIN coverage) needed to reach Test Positivity Rate < 5 according to initial TPR, based on Tafea experience, Vanuatu



The basis for this mathematical modelling is explained further in Annex 3.

Based on the model, and taking into account the operational feasibility (forecast program workload and logistics), it appears that targeted IRS should be able to accelerate the reduction in the national malaria burden to below 1 per 1,000 (as measured by API) or 1% (as measured by TPR) by 2020. This would be contingent on targeted introduction of supplementary IRS, phased by province as shown in Figure 20.[12]

Based on the model, it is predicted that the API would decline by province and year as shown in Table 9.

[12] Penama and Sanma provinces would lag slightly behind the other provinces in term of reducing the malaria burden below the average national goal, and would require continued interventions after 2020.

Figure 20: Proposed phasing of IRS-based program acceleration, by province, based on Tafea experience, Vanuatu, 2014-2020

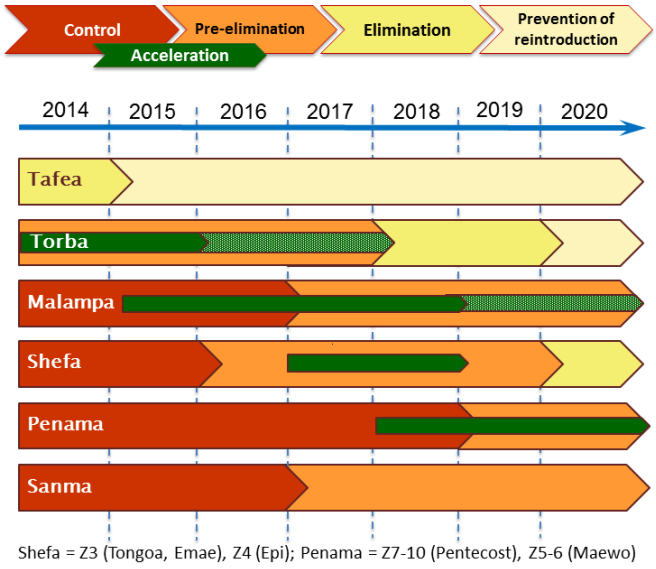


Table 9: Expected reduction in API as a result of targeted IRS (+ high LLIN coverage), by year and province, Vanuatu, 2015-20

PROVINCE	2015	2016	2017	2018	2019	2020
TORBA	2.4	1.2	0.6	0.4	0.3	0.3
SANMA	6.3	5.0	4.0	3.2	2.6	2.1
PENAMA	9.7	7.7	6.2	5.0	3.0	1.3
MALAMPA	10.9	7.0	4.7	2.4	1.3	0.8
SHEFA	3.2	2.5	2.0	1.3	0.9	0.7
TAFEA	---------- Zero (or very low) transmission ----------					
VANUATU	**5.0**	**4.0**	**3.01**	**2.09**	**1.43**	**0.97**

Targeting by province and health zone

As shown in Figure 21, 7 health zones will be targeted for one round of IRS preventive intervention (Category B) and 7 health zones will be targeted for two consecutive rounds (Category C). Another five health zones will be targeted for three consecutive rounds of IRS, and three health zones might require more than three rounds to reduce transmission below 1 per 1,000 (API) or 1% (TPR) level (all Category D).

Under this approach, 27 health zones (or 55% of health zones throughout the country, including Tafea) will continue to be targeted for maintaining high LLIN coverage and utilisation but will not be targeted for IRS at all between 2015 and 2020.

Figure 21: Number of targeted health zones requiring 0, 1, 2, 3 or more rounds of IRS for acceleration of malaria control (based on Tafea experience), Vanuatu, 2014-2020

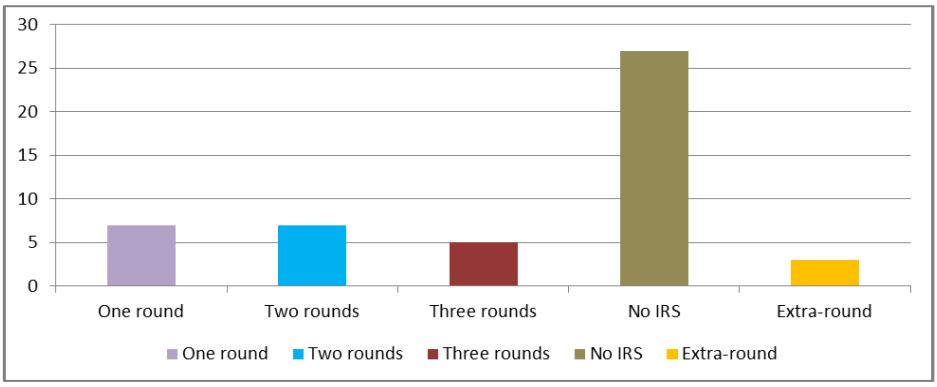


Figure 22 summarises the detail of proposed IRS operations by province. The main focus will be on Malampa, Penama and Shefa provinces. Torba province will be targeted if additional rounds are required beyond 2015, while Tafea province will no longer require program acceleration through supplementary IRS preventive interventions.

Figure 22: Projected number of health zones requiring one, two, three or more rounds of IRS, Vanuatu, 2015-2020

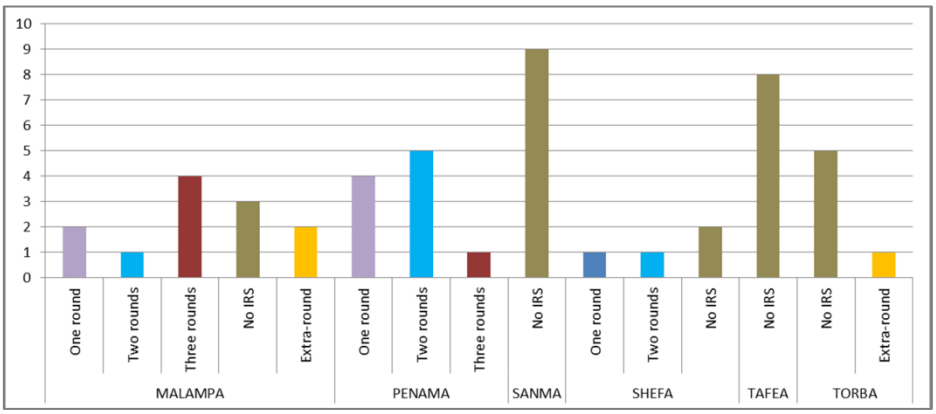


Figure 23 and Table 10 show the expected work load by health zone and by number of households targeted, by province and year. The work load each year is similar to Tafea in 2011-12, and is deemed to be feasible.

Monitoring

This intervention will be monitored using operational data, aiming for ≥ 90% of the targeted population to be covered by IRS.

Figure 23: Total number of health zones to be sprayed, by year, Vanuatu, 2015-2020

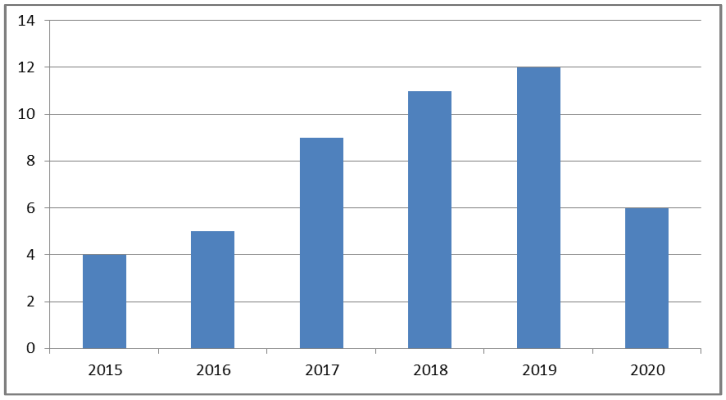


Table 10: Expected number of households targeted for IRS (upper) and population protected (lower), by year and province, Vanuatu, 2015-20

HOUSEHOLDS	2015	2016	2017	2018	2019	2020
TORBA	471	484	498	—	—	—
SANMA	—	—	—	—	—	—
PENAMA				2,849	5,764	4,095
MALAMPA	2,348	2,858	4,280	2,849	3,001	583
SHEFA	—	—	3,075	2,344	—	—
TAFEA	—	—	—	—	—	—
VANUATU	**2,819**	**3,342**	**7,853**	**8,041**	**8,764**	**4,678**

POPULATION	2015	2016	2017	2018	2019	2020
TORBA	2,720	2,772	2,824	0	0	0
SANMA	0	0	0	0	0	0
PENAMA	0	0	0	15,047	27,286	18,479
MALAMPA	11,319	13,705	20,700	14,281	13,851	3,201
SHEFA	0	0	13,123	9,691	0	0
TAFEA	0	0	0	0	0	0
VANUATU	**14,039**	**16,477**	**36,647**	**39,019**	**41,137**	**21,680**

Health promotion for vector control interventions

Currently, the Program has expanded its efforts to promote safer behaviours for malaria prevention through regular and appropriate use of ITNs received, and to promote the acceptability of IRS where applicable (i.e. in targeted elimination areas, for outbreak response).

Knowledge of the cause and prevention of malaria is well maintained. In the 2011 MIS, up to 99% of householder respondents mentioned mosquitos as the cause of malaria transmission (although only 84% reported mosquito nets as an effective preventive method against malaria).

Net utilisation correlated with accessibility. The MIS indicated that, while country-wide bed net coverage (based on at least one LLIN per household) was 70%, the reported net usage was just 52%. Similar

findings also emerged from Tafea, where household coverage was 94% but the reported net usage the night prior to the survey was 84%. This suggests that, even with saturation levels of bed net access (100%) based on the operational coverage, the expected usage would not be less than 80%. However, to maintain knowledge, attitudes, behaviour and practices (KABP) in relation to bed net utilisation, on-going communication will need to be continued – in particular, looking for any early indication of a relaxing of bed net utilisation as perceived malaria risk declines.

The Program's BCC channels currently use mass media broadcasting (mainly radio), printed materials and interactive communication channels (teaching and community based behavioural change communication through community health committees). The 2013 MPR found that, in the Vanuatu context, the most effective means of BCC are through direct (i.e. person-to-person) voice communication.

The Program will work closely with national and provincial HPOs to explore the possibility of integration with other public health interventions, such as Healthy Island or Primary Health Care package to promote healthy and safe behaviours.

Health messaging will also be important to prepare communities for IRS, and to ensure good compliance with management of household items and animals before the spray teams arrive.

Operational research for vector control

Larval site management

Areas where malaria is near the point of elimination (especially if cases are mainly *P vivax*) could be suitable for studies to evaluate the effectiveness of LSM strategies to reduce receptivity to malaria. This may have contributed to the reduction in transmission already seen on Tanna (although there have been similar reductions in other islands of Tafea and in the Torres group without LSM; Section 3.2.2). It was agreed during the NMSP consultations to further monitor the results from Erromango and Torba before including LSM as a routine strategic intervention. LSM will also be considered part of the surveillance and response intervention, if it is feasible and appropriate, during the elimination phase and the prevention of re-introduction (see Section 5.3).

LSM initiatives should interlink with 'village clean-up campaigns' (as promoted under the Healthy Islands concept), which are useful for promoting community participation and may be an effective strategy – direct or indirect – in mosquito control.

Bed net durability studies

Pilot studies will also be undertaken at community level on durability of LLINs and options for recycling of expired or damaged bed nets.

According to a recent review of LLIN prequalification, it recommended that countries where *NetProtect* LLINs have been used should monitor the durability of this product (WHO 2013c). This includes Vanuatu, and the Program will need to undertake durability monitoring to further inform policy and procurement decision. A proposed study will commence in 2014 but, as monitoring should continue for at least three years, will not be complete until 2017 (i.e. into the period of the NMSP 2015-20). The main indicators to be monitored are physical integrity and residual insecticide effect. [13]

[13] An emerging option is to use a new Insecticide Quantification Kit (IQK) for cyano-pyrethroids that is about to become available commercially (Innovative Vector Control Consortium); it can determine the amount of residual insecticide in bed nets

Other operational research may look at the use of alternate pesticides to pyrethroids for IRS, and use of personal repellents where outdoor transmission is a risk (including in occupational settings).

It may also be possible to resume studies of insecticide resistance among mosquitoes – perhaps in collaboration with the Solomon Islands and a WHO Collaborating Centre.

5.2 Thematic Area 2: Diagnosis and treatment

Strategic Objective: *To achieve 100% testing of suspected malaria cases by microscopy or RDT and provide prompt treatment and care for 100% of confirmed malaria cases according to the national 'Guidelines for Treatment of Malaria'*

Malaria case management is a vital component of malaria control strategies. Quality assured diagnosis by microscopy or RDT and prompt, effective treatment of *P falciparum* and *P vivax* according to the national *Guidelines* are the mainstays of case management in Vanuatu. The new Strategy seeks to maintain universal access to diagnosis and treatment while, at the same time, seeking greater efficiency for diagnostic processes and QA.

SDA 2.1: Maintain quality assured diagnosis by microscopy or RDT

Target population

The target population for this intervention is all cases of suspected malaria according to the case definition in the *Guidelines for Treatment of Malaria in Vanuatu* – essentially, all individuals presenting to any level of Government health facility with a fever or a recent history of fever. The current definition of a suspected case is quite restrictive (it allows for exclusion of obvious other causes of fever, thereby compromising health workers' ability to detect inter-current malaria infections). All fever patients should be suspected of having malaria (irrespective of inter-current pathology), and should receive prompt parasitological confirmation by microscopy or by RDT before treatment is started (WHO 2013b).

Non-immune tourists and other visitors presenting to a private health facility or pharmacy in Port Vila with fever following a trip to an outer island may be a useful indicator population; the target therefore includes appropriate referral from the private sector for testing by RDT or microscopy in a public facility.

New guidelines for diagnosis

The national *Guidelines for Treatment of Malaria in Vanuatu* are due to be revised in 2014; all cadres of health care worker will be consulted and represented in the revision process. While continuing many directions of the existing *Guidelines*, this revision will include the following strategic adjustments for the diagnosis of malaria and other causes of fever:

- The case definition of suspected malaria cases will be aligned with global technical guidance (WHO 2012a, WHO 2013b) to ensure that all patients presenting with fever or a history of recent fever receive a parasitological test (RDT or microscopy) and those returning a negative test result are investigated for other causes of fever (user-friendly flow charts will be developed, suitable for use in different types of health facility)

(thus providing a measure of duration of efficacy in physically intact nets) and on walls (as a quality control [QC] check for IRS operations). The IQK uses a standard (visual) colorimetric scale and does not require investment in expensive equipment.

- Introduction of an Integrated Community Case Management (ICCM) approach for VHWs (Uganda MOH 2010, Kalyango 2013), using a new algorithm integrating investigation and management of pneumonia and diarrhoea with malaria diagnosis (user-friendly flow charts will be developed, suitable for use in different types of health facility)

These revised guidelines and strategies will then be integrated in pre-service and refresher training for VHWs and other health workers.

Hospital medical staff will be engaged in the revision of the *Guidelines*, and will be oriented to the strategic directions of the new NMSP for malaria diagnosis and case ascertainment.

Strategic balance between microscopy and RDTs

The new Strategy responds to the findings and recommendations of the MPR, i.e. that microscopy services are under-utilised and will become more so as Vanuatu enters a period of steep decline in malaria incidence nationally (MOH 2013). Experience with RDTs since 2009 has been generally favourable, and this gives rise to an opportunity to strengthen the efficiency of malaria diagnostic services and, at the same time, extend their reach into the community.

Extending the reach and maintaining an ABER at or above 15% will be an important part of the strategy (i.e. ensuring adequate ascertainment and testing of fever cases as many provinces of Vanuatu move progressively into the pre-elimination and elimination phase and an era of very low malaria incidence).

The following strategic adjustments will be made to the balance between microscopy and RDTs:

- Microscopy will be limited mainly to hospitals (where it is important to monitor the severity and response to treatment of inpatients with severe or complicated malaria) and selected high case load outpatient settings where it will be cost effective to maintain microscopy services [14]
- Diagnosis by RDT will be available and consolidated in all community settings, thereby reducing the time from onset of symptoms to diagnosis and treatment at community level and potentially accelerating the recognition and reporting of outbreaks
- RDTs will be available in hospitals to complement microscopic diagnosis for after-hours presentations
- External QA of sampled microscopy slides will be undertaken by an independent visiting expert microscopists, with remedial training provided as necessary during the same visit
- External QC of sampled used RDTs will be undertaken by comparing them with PCR (annual or batch sample size to be determined with the help of external technical assistance)

Engagement with the private sector

The Program will explore mechanisms to allocate RDTs within the small private sector in Vanuatu. Principles will be developed to assist and enable private practitioners to prescribe ACT on the basis of a positive RDT, in return for reporting positive cases to the national MIS.

[14] Cost effectiveness will be guided by the number of slides examined per day and the prospects for existing laboratory workers and microscopists to either be trained or re-trained to diagnose other conditions, e.g. tuberculosis, intestinal parasites, etc.

Centralised procurement and supply management

All RDTs will be procured by CMS, ensuring adherence to international quality standards under the WHO/FIND evaluation scheme

Including buffer stock and unused wastage from the current supply chain, the Program estimates an annual target utilisation of 20 RDTs per 100 population – approximately 50,000 RDTs per year.

Based on an estimate of four malaria slides per day (among 6 hospitals @ 250 working days per year), the annual number of slides examined by microscopy will be around 6,000. Based on this estimate, Table 11 shows the calculated projection for diagnostic consumables that will need to be procured and the numbers that will need to be sent for QC during the period of the Strategy.

Table 11: Expected quantities of microscopy slides and RDT and sample sizes for diagnostic quality control, Vanuatu, 2015-20

	2015	2016	2017	2018	2019	2020
Microscopy slides	6,000	6,000	6,000	6,000	6,000	6,000
Positive slides	240	200	140	100	60	40
10% negative for QC	576	580	586	590	594	596
RDT	34,350	35,400	36,300	37,350	38,400	39,450
Positive RDT	1,374	1,180	847	623	384	263
10% negative for QC	3,298	3,422	3,545	3,673	3,802	3,919

Monitoring

This intervention will be monitored using MIS routine surveillance data, incorporating outputs from the MMLL.

Stock outs of RDTs and microscopy consumables are routinely monitored through the MMLL.

The objectives are that 100% of the suspected cases are tested (see Section 7.1, *Performance Framework* for details), and that an ABER of 15% is maintained

SDA 2.2: Ensure prompt and effective treatment according to national Guidelines

In addition to promoting prompt clinical recovery in infected individuals, prompt and effective malaria treatment can also have a public health effect against *P falciparum* by reducing the number of circulating gametocytes. Among the drugs available to treat malaria in Vanuatu, artemisinins are reliably able to destroy young gametocytes (although they have less effect on mature gametocytes), while PQ is highly active against mature gametocytes and can accelerate gametocyte clearance (as well as being used for the prevention of relapses in *P vivax*) (WHO 2013b).

Target population

The target population for this intervention is all confirmed malaria cases (by microscopy or RDT) according to the case definition in the *Guidelines for Treatment of Malaria in Vanuatu*.

New guidelines for treatment

The 2014 revision of the national *Guidelines* will maintain the following strategies (or strategic adjustments) for the treatment of malaria and other causes of fever:

- ACT (AL) for uncomplicated *P falciparum*
- ACT (AL) for uncomplicated *P vivax*
- Radical cure using a 14-day course of PQ for *P vivax* cases in patients with no G6PD deficiency
- Injectable artesunate for management of severe cases of malaria in hospitals and Health Centres
- Artesunate *rectocaps* as pre-referral treatment in Dispensary and Aid Post settings

Training and supervision

The Strategy has a strong emphasis on maintaining and boosting quality of clinical care through targeted and corrective supervision of clinical staff – by provincial hospital staff for Health Centre nurse practitioners, and then cascading though Dispensaries to Aid posts. Supervision will be integrated to improve case management of other diseases.

Clinical pre-service and in-service training will be adapted according to health facility type.

Hospital medical staff will be provided with the appropriate clinical *Guidelines* for managing severe and complicated cases. A Particular area of focus will be new medical graduates returning from Cuba (WHO and SPC 2013), whose strong PHC focus in their training is likely to see them posted to provincial and community settings both during and after their internship.

Introduction of G6PD screening

As the number of cases of malaria declines, it becomes increasingly important that the proportion of P vivax cases adhering to the full 2-week course of PQ increases from the present very low level of compliance (Section 3.2.4).

Introducing cost-effective screening for G6PD in-country will strengthen the Program's ability to push for high levels of compliance with PQ among patients with normal G6PD activity. The Program will therefore continue to explore mechanisms to introduce testing for G6PD deficiency, initially in one selected hospital laboratory but with the option of extension to other hospitals and health facilities, with a view to eventual introduction of point-of-care testing.

In addition, ACT has an incomplete effect on clearing the gametocytes of *P falciparum* from the peripheral blood and the policy option of introducing a single gametocytocidal dose of PQ following three days of ACT needs to be explored.

Discontinuation of preventive therapy

As recommended by the MTR (MOH 2013), preventive chemotherapy for infants and pregnant women will be discontinued in favour of strengthened preventive strategies and wider availability of diagnosis and treatment in community settings.

Engagement with the private sector

The Program will explore mechanisms to allocate AL to private practitioners and pharmacies, in return for their compliance in reporting cases – based on parasitological diagnosis – to the national MIS.

Centralised procurement and supply management

All ACT will be procured and distributed by CMS following WHO prequalification standards

Taking in account consumption, progressive coverage of PQ treatment of *P vivax*, minimum stock and including buffer stock and unused wastage from the current supply chain, the Program estimates an annual requirement of the following quantities of drugs (Table 12).

Table 12: Expected quantities of antimalarial formulations to be procured, by year, Vanuatu, 2015-20

FORMULATION	2015	2016	2017	2018	2019	2020
Coartem (adjusted for age)	8,000	8,000	8,000	8,000	8,000	8,000
Primaquine 7.5 mg tablet	7,000	8,000	8,000	8,500	6,000	5,000
Artesunate Rectocap 200mg	800	—	800	—	800	—
Artesunate Rectocap 50mg	800	—	800	—	800	—
Artesunate Injectable	200	—	200	—	200	—

Monitoring

Stock outs of ACTs are routinely monitored via the MMLL. This intervention will be monitored using MIS routine surveillance data, incorporating outputs from the MMLL. The objective is that 100% of confirmed malaria cases receive first line anti-malaria treatment as per the national *Guidelines*.

Health promotion for case management interventions

The Program will work closely with the national health promotion unit and provincial HPOs to develop a comprehensive IEC/BCC package targeting communities, health personnel and teachers. The messages and objective are designed to ensure that every person with a fever seeks care in their nearest health facility within 24 hours.

Operational research for case management

Batch-testing of RDTs will be undertaken immediately after procurement and, for selected sentinel sites, after a period of "shelf time" in peripheral health facilities and settings

Attempts to monitor the efficacy of first line treatment (ACT) on *P falciparum* over the last 2 years using a standard *in vivo* study protocol have been unsuccessful (see comments on studies in Epi in 2011 and Santo in 2013 in Section 3.2.4). The incidence of *P falciparum* appears to be overestimated by current routine diagnosis and the minimum number of cases required for TES is unlikely to be identified in any location in Vanuatu over one year. The current WHO recommendations for TES in every country every two years can obviously not be applied in Vanuatu. Novel tools to capture *in vitro* evidence of resistant strains or molecular markers are likely to become available in the near future (Ariey 2014).

To monitor the incidence of malaria among pregnant women, the Program may initiate a screening program in antenatal care settings in the most highly affected health zones.

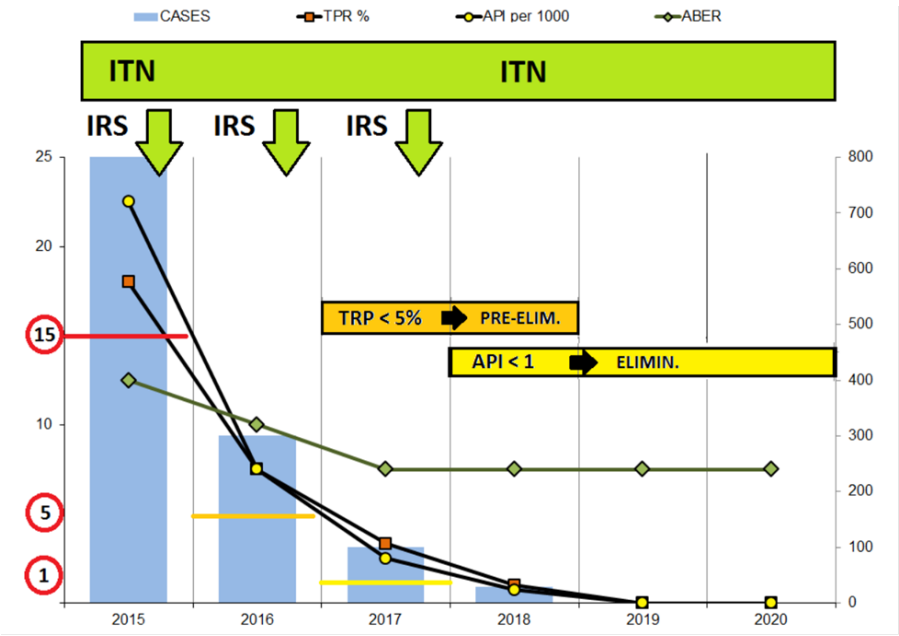
5.3 Thematic Area 3: Active surveillance and response in support of elimination

Strategic Objective: *Once a province has entered the elimination phase, to investigate and manage all malaria cases and identify, investigate and manage foci of infection according to national "Guidelines for Malaria Elimination"*

Under this Strategic Objective, surveillance and response are implemented as an active intervention in support of malaria elimination activities once a province, health zone or area passes below elimination thresholds – not simply as routine health system functions. (Routine surveillance and information management as part of the regular malaria and health system are discussed separately under Section 6).

Based on lessons learned from pilot elimination activities in Tafea province (Section 3.2.5), we aim to use universal access to LLINs, diagnosis and treatment and targeted IRS to accelerate progression towards elimination levels (noting that pre-elimination is reached with a TPR <5% and the elimination phase when the API is <1 per 1000, while maintaining an ABER of at least 10%; Figure 10). The experience from Tafea (Figure 11) may be extrapolated to a generic population as shown in Figure 24.

Figure 24: Use of high LLIN coverage and up to three rounds of targeted IRS to accelerate progress towards pre-elimination and elimination phases.



Based on Tafea experience; indicative population of 25,000 with commonly observed TPR, API and ABER

(Note also the inherent assumptions in applying a model developed in the lower transmission settings in the south to higher transmission risk areas elsewhere in the country; the assumptions underlying the model are explained further in Annex 3).

Box 3 summarises the policy and strategy direction involved as a province moves towards malaria elimination. These are discussed in more detail in the national *Guidelines for Malaria Elimination*.

Box 3: Core strategies and policies for malaria elimination

Diagnosis

All cases confirmed by quality assured parasitological diagnosis

Treatment

ACT as first line treatment for all malaria infections
Radical treatment of *P vivax* infections using PQ
Gametocytocidal treatment with PQ for *P falciparum* infections

Prevention and vector control

Full coverage of ITNs
Focal IRS in active foci (and newly activated foci)

Surveillance, investigation and response

Entomological surveillance
Foci investigation and classification
Pro-active case detection
Immediate notification of cases
Case investigation and classification
Re-active case detection
Central registration of cases and foci

Section 6.3.2, *Progressive harmonisation of MIS with HIS*, describes how the surveillance and response systems for malaria will be used to strengthen the public health management of other epidemic-prone diseases or those targeted for elimination.

Based on the above guiding policies and strategies, two main service delivery areas will be used under the Strategy to reach the strategic objective: management of foci, and the detection of and response to cases.

Prevention of reintroduction is a specific concern of areas that have moved through the elimination phase. Strategically, the approach is actually a component of the elimination approach and will be implemented and monitored as an activity under each of the two SDAs.

SDA 3.1: Management of malaria transmission foci

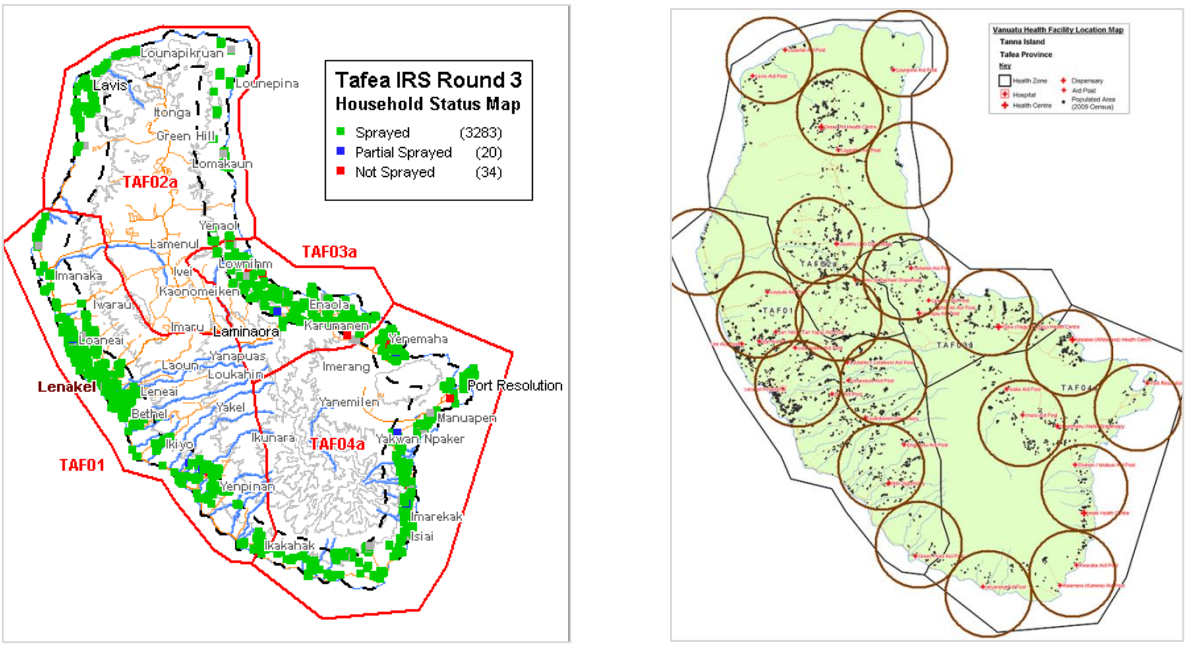
The purpose of this intervention is to ensure management of identified and emerging foci of malaria transmission (detection, classification, re-classification and response) in designated elimination areas according to national *Guidelines for Malaria Elimination*.

In the Vanuatu context, it is sometimes not easy to delineate individual foci precisely as inhabitants may not be clearly clustered into a well-defined geographical area – i.e. clusters or villages might overlap.

Delimitation of foci using geo-referenced household data

The existing detailed geo-referenced household information system (GIS; Figure 25) is used to help document and monitor clusters of households with recent malaria cases, based on past malaria epidemiological data. This will continue to be used to locate and delimit active foci at the beginning of the elimination phase.

Figure 25: Use of GIS to map IRS activities by health zone (left) and delineation of foci using geo-referenced household data (right), Tanna, 2012



Investigation and classification of foci

The GIS allows foci to be defined according to the clustering of households within a specified radius (in the case of Tanna, two kilometres; Figure 25). This allows identification of the households clustered around a notified index case that will need to be investigated and then – as necessary – sprayed and/or fully covered with top-up LLIN distribution.

Existing SOPs describe tasks and personnel needed to classify, investigate and respond to foci of transmission in this way.

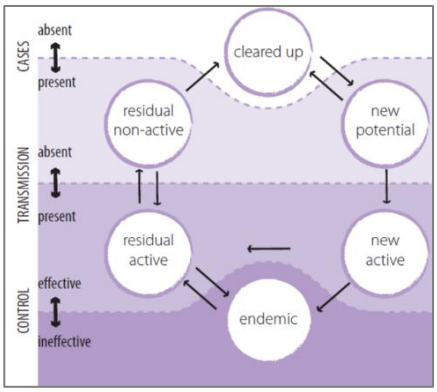
Every year (or more frequently) in elimination phase areas, all existing foci will be reclassified (Figure 26 and Table 11) – both routinely and as a result of any confirmed cases being notified.

Active investigation of newly notified cases and entomological surveillance (i.e. searching for active or suitable breeding sites) are both part of proper foci classification. Interventions like IRS and LLINs will be implemented as part of the response to newly identified foci (defined as two or more cases occurring in a single focus over a short period of time).

The response should ideally occur within one week (as per current national *Guidelines for Malaria Elimination*.[15]

Subject to local capacity, cleared-up foci may be managed as non-active if there is continuous presence of malaria mosquitoes (i.e. suggesting ongoing receptivity to malaria).

Figure 26 (left) and Table 11 (right): Classification of foci of malaria transmission



Source: WHO (2007)

	Past 2 years	This year
Endemic: Transmission is occurring in an area that had transmission within the past 3 years and is not effectively controlled	**Local**	**Local**
Residual active: Transmission is occurring in an area that had transmission within the past 3 years but is effectively controlled	**Local**	**Local**
Residual non-active: There is no local transmission in an area that had transmission within the past 2 years	**Local**	**No Local**
New active: Transmission is occurring in an area that had no transmission within the past 2 years	**No Local**	**Local**
New potential: Imported cases are occurring in a area that had no transmission within the past 2 years	**No Local**	**Imported**
Cleared-up: No local transmission has been recorded during the past 3 years in an area	**No Local**	**No Local**

Provincial malaria elimination team

A small Malaria Elimination Team will be established in each province as it transitions from the pre-elimination to the elimination phase. The Team will receive extensive training on elimination. It will operate under the leadership of the Provincial Malaria Supervisor and the overall authority of the provincial Chief Medical Officer (CMO), with strong and regular technical support provided by the national VBDCP team.

The Elimination Team will work closely with provincial health staff and with community based health workers (nurse practitioners, nurses and VHWs) to undertake passive and active malaria surveillance activities; the national VBDCP team will assist with training and orientation of health workers as required.

[15] A "1-3-5" rule may be applied: new case(s) reported within one day of diagnosis, investigated within three days and a definitive response implemented within 5 days.

Proactive case detection

Focal screening and treatment (FSaT) using RDTs, provision of ACTs and top-up distribution of LLINs will be conducted at least every two years in previously active foci.

Consolidation and updating of classification

The central information unit in the national VBDCP will consolidate and update the classification of foci and update household mapping on at least an annual basis, based on reports submitted by Provincial Supervisors from elimination areas. Feedback will be provided via the Provincial Supervisor to community health staff through annual provincial planning meetings.

SDA 3.2: Detect and respond to individual cases

The purpose of this intervention is to detect and respond to individual cases in designated elimination areas according to national *Guidelines for Malaria Elimination*.

Enhanced passive case detection

As soon as a targeted area enters the pre-elimination phase, efforts will be made to increase the performance of the community level PHC system (including VHWs) to attract and test all fever patients from communities according to the strategy outlined under SDA 2.2. Monthly supervision of health facilities down to Aid Post level will take place according to the overall annual provincial supervisory work plan. Particular attention will be given to health facilities that are either not reporting or underperforming in case management, surveillance and timely submission of reports.

Those testing positive will be immediately treated according to national *Guidelines*.

Quality assured diagnosis

All positive RDTs and slides have to be confirmed by external QC using either PCR or second reading by expert microscopist. A sample of 10% of the negative RDTs and slides is sent to be challenged by second reading or PCR.

All RDTs and slides are correctly labelled and recorded so that they can be traced back following QC activities.

Immediate notification and treatment

Those individuals testing positive will be notified immediately to the provincial Malaria Elimination Team and, through them, to the national VBDCP level. Rapid communication mechanisms will be supported, including by ensuring that all health staff have access to standard mobile phone communications.

Supervised treatment by DOT will be provided to all positive patients (including radical cure with PQ for *P vivax* cases, subject to G6PD screening).

Early case investigation and systematic response

In the event of a case being notified, the Malaria Elimination Team will mobilise a case investigation within 3 days.

In addition, a systematic response is conducted in at least 50 households around the index case according to national *Guidelines* and SOPs including:

- Re-active case detection using mass screening and treatment of all members
- Verification of LLIN availability and use
- Breeding sites assessment and larviciding

Cases will be classified as indigenous or imported according to national *Guidelines* and SOPs.

If the index case is classified as indigenous, or if secondary cases are confirmed (irrespective of the classification of the index case), this will trigger a response within 5 days according to the national protocol. This response may include IRS and top-up LLIN distribution in all households around the index case (or the whole defined focus) and renewed community mobilisation and vigilance.

Coordination, monitoring and supervision

The provincial Malaria Elimination Team will organise periodic provincial meetings with health staff from all health zones to review program implementation and identify and resolve critical constraints. All case notifications, reporting (completeness and timeliness) and response will be discussed. Findings and feedback from provincial supervisory visits to Health Centres, Dispensaries and Aid Posts will also be reviewed.

The Provincial Teams will also file operational records and prepare Monthly Elimination Reports to inform the national level and report on foci classification every year.

Staff from the national VBDCP will visit provincial teams at least quarterly. On at least one of these visits each year, the provincial Malaria Elimination Team will organise a peer review meeting for key representatives from Health Centres and zonal committees to present, discuss and consolidate essential zonal classification data, prepare action plans and consider budget requirements for the following year.

Visits by the national VBDCP should also address provincial staff performance and take advantage of opportunities for training and knowledge enhancement.

To facilitate oversight of these activities, a National Malaria Elimination Committee will be created.

Establishment of a national data base of cases and foci

All records of cases in foci investigation will be entered initially on a provincial register in each province and subsequently merged into a national data base.

Ultimately, and subject to appropriate strategic alliances with a reference laboratory, genotyping of all positive cases verified by PCR will be undertaken and the results stored against case records in the national database.

Community engagement and prevention of reintroduction

Community engagement is an essential part of active surveillance and mounting a timely response (for individual fever cases as well as monitoring foci). However, maintaining community involvement in the context of a disappearing disease can be challenging.

The provincial Malaria Elimination Team will help zonal nurses to organise periodic meetings of VHWs and community members from within their health zones to review their local program. Community actions, roles and responsibilities in relation to the response to any notified cases will be reviewed, and community vigilance networks discussed.

Members of communities in designated elimination areas will be encouraged to contribute to the identification of suspected cases (e.g. those with a travel history from endemic zones) by maintaining a high level of awareness of risk and vigilance for fever among their relatives. Public information campaigns and notifications will ensure that community members, migrants, travellers and tourists are aware of the status of a community as a "malaria free zone" and know: a) that anybody entering from a known malaria-affected area and anyone with a fever should attend for testing by RDT or microscopy; b) where the appropriate testing and treatment centres are located; and c) that diagnosis and treatment more malaria are available free of charge.

The "Small Island" strategy: a specific approach for small, isolated communities

Vanuatu has many small communities that are relatively isolated from the rest of the country (and even the rest of their province), with limited transportation linkages.

Undertaking repeated visits to investigate possible cases in remote locations represents an expensive and logistically complex exercise. As an alternative, the "small island" or isolated community setting (e.g. population up to 500 people) lends itself to a more inclusive strategy such as was piloted on Aneityum during the malaria elimination program in the 1990s.

Unlike the Aneityum approach (which had mass drug administration as one of its pillars) (Kaneko 2010), the "small island strategy" would be based on proactive case detection using mass screening by RDT and treatment of positive cases for the entire community. Positive cases would be identified and treated simultaneously by a local or visiting VHW using a DOT approach. At current prevalence rates, the number of cases would generally be small enough for it to be feasible to send specimens for G6PD screening (once available in-country; see SDA 2.2), which would allow follow-up PQ administration for *P falciparum* gametocyte clearance or radical cure of *P vivax* in non-deficient individuals.

For operational and cost efficiency, MaST could be undertaken at the same time as bed nets are being distributed, houses sprayed and other public health outreach services provided.

To investigate the presence of below-threshold parasitaemia, positive RDTs (and a sample of negatives) would be sent for confirmation by PCR.

Operational research in the context of malaria elimination

Studies on population movement and internal migration patterns in Vanuatu will be undertaken to inform the feasibility and effectiveness of conducting point of entry screening trials.

Subject to available funding, the efficiency and efficacy of proactive case detection in foci, small islands and among travelers using pooled or un-pooled PCR will be assessed by small studies before being translated into the general *Guidelines*. This will guide the feasibility of introducing newer technologies such as loop mediated isothermal amplification (LAMP) in field sites to detect malaria infections with very low parasite density.

6. Program Management

Management of the Malaria Program will have its own **Objective**:

> *To strengthen Malaria Program leadership and management capacity at provincial and national level to plan, deliver and report on malaria interventions in a well-coordinated, efficient and timely manner*

The effectiveness of program management in supporting the achievement of the Program's three operational objectives and overall Goal and will be monitored through specific outcomes and selected higher order outputs (see M&E, Section 7).

6.1 Planning and implementation

6.1.1 Functional delineation – policies, standards and advocacy

The focus of program management under the new strategy will be to deliver and maintain core national functions – policy and planning, interaction with donors, assurance of quality and standards, capacity development, cost-effective bulk procurement, and national level monitoring and evaluation – while, at the same time, supporting stronger provincial service delivery.

A detailed functional analysis of central (national) and peripheral (provincial level and below) functions in relation to malaria control and elimination has been undertaken and is included at Annex 4.

6.1.2 Annual planning cycle

The Program will deliver efficient and timely malaria operational planning.

Stronger harmonisation between national and provincial health planning processes will be achieved through consultative planning activities. Each year, between March and June, the national VBDP will undertake consultations with provincial health teams to review malaria activities and interventions and examine priorities for the coming year, their likely cost and available resources.

In July, provincial CMOs and Malaria Supervisors will participate in a national malaria review meeting ("mini-conference"), which donors, development partners and focal points for other public health programs will also attend. All aspects of the performance of the Malaria Program will be reviewed, and priorities for the coming year identified.

Immediately following the national "mini-conference", in consultation with provincial partners, the Program will develop an integrated annual malaria operational plan and budget (national and for each province) for the coming year. This will be in a form that can be readily reflected in national (MOH) and provincial health office business plans.

Based on the findings and outcomes of the national "mini-conference", the planning meeting will also review and update relevant policies and guidelines.

6.1.3 Governance structures and partnership coordination

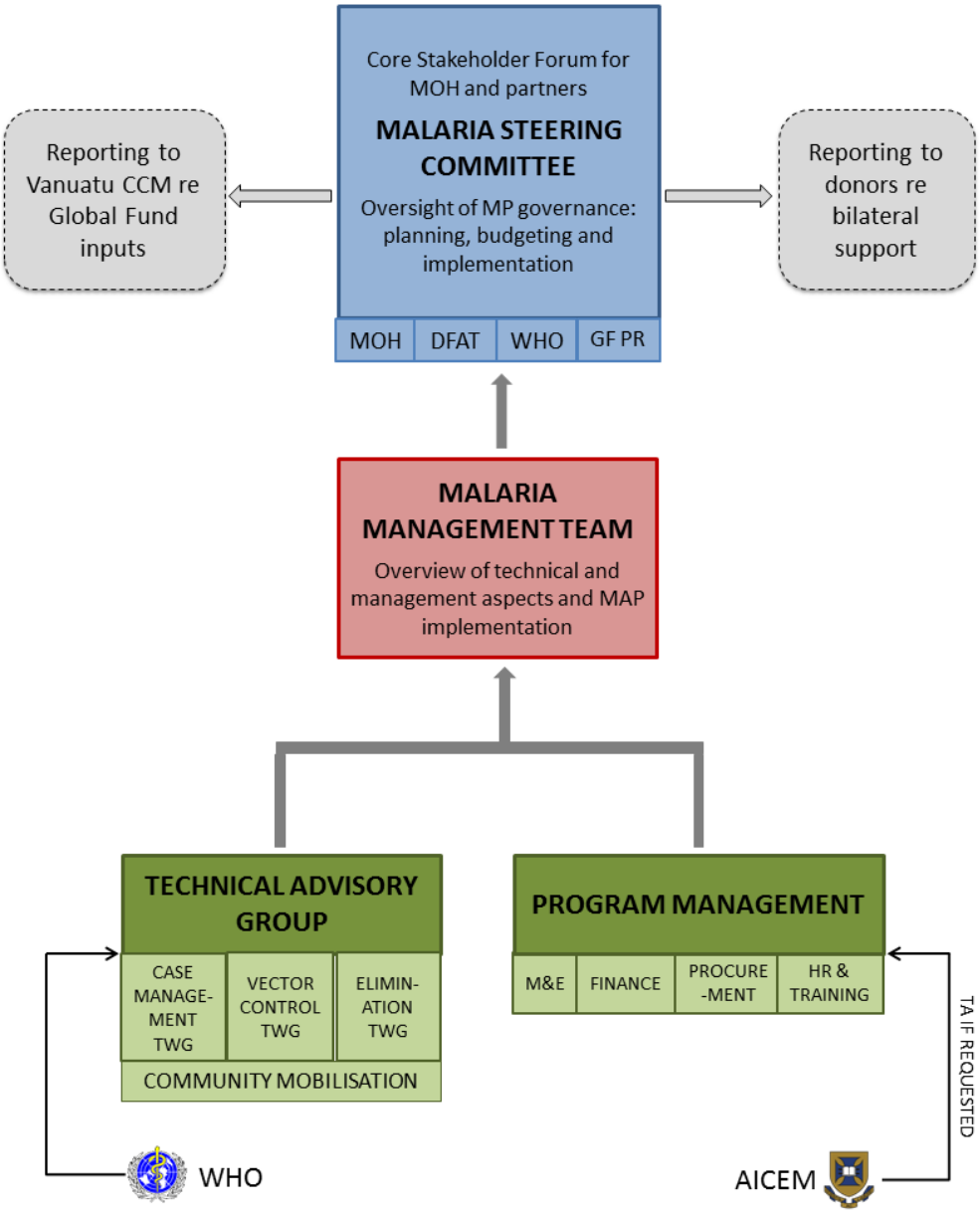
The Program's existing governance bodies – the TAG and the MSC (Section 2.5.2) – will be retained.

The TAG will continue to provide technical oversight for the Program and technical recommendations for the MSC to consider, while the MSC will provide higher level inputs on the management and overall strategic directions of the Program. MSC membership includes donors and non-technical development

partners, and so represents a valid forum for partnership coordination and review of financing mechanisms and decisions.

Figure 27 shows the various relationships and reporting lines for the TAG and MSC. The TAG and Program Management functions will report to the MSC via a combined Malaria Management Team.

Figure 27: Governance diagram, Malaria Program, Vanuatu



Additional legend: TWG = technical working group, GF PR = Global Fund Principal Recipient

The TAG will explore opportunities to progressively engage with interested potential non-health sector partners (e.g. the tourism sector).

6.1.4 Provincial level coordination

The greater degree of harmonisation with provincial health service functions will need to be actively managed, and relatively frequent (quarterly) consultations between the central VBDCP team managers and CMOs and Provincial Malaria Supervisors will be needed. Noting the challenges of implementing this more integrated approach simultaneously across all provinces, it is proposed that this is undertaken progressively – i.e. starting with more intensive engagement in one or two provinces and gradually extending to other provinces in line with the strategic expansion of accelerated control activities (e.g. as per Figures 11 and 20).

6.2 Financial resource management

6.2.1 Financial management system

As the Program moves towards a more collaborative implementation model with provincial health offices, harmonisation of work plans will also ensure that available resources are reflected where relevant in both the national and provincial business plans.

Financial management capacity will be retained within the national VBDCP to ensure that expenditure on malaria is occurring as per the annual MAP and provincial business plans, and that reporting and acquittal of expenditure is timely and accurate.

Disbursement for field expenses will gradually migrate from the present "imprest" system to the proposed decentralised model as Financial Services Bureaux become operational in provincial centres. Advances for malaria-related activities will need to be jointly authorised by both the VBDCP Manager and the CMO, according to the national MAP and provincial business plan. Acquittal of field expenses will follow Ministry of Finance and Economic Management regulations.

The VBDCP Finance Officer will work closely with the MOH Finance Manager. Expenditure tracking reports for the malaria components of both national and provincial health business plans will be produced in conjunction with the Finance Manager. Together, they will ensure that donor liaison and reporting are completed as required.

6.2.2 Trials of innovative service delivery mechanisms

To make more efficient use of both malaria-specific and other MOH resources, the Program will undertake trials of innovative service delivery options at the community level. This will build on activities conducted under the present *Strategic Vision*, where some MNCH and immunisation services were given the opportunity to use Malaria Program funded transport that was conducting outreach in communities (e.g. bed net distribution).

Internal efficiencies will be sought by undertaking multiple interventions during community visits (e.g. bed net distribution combined with IRS, environmental assessment, health promotion and other community level activities), instead of the current single-purpose community visits.

Under the new Strategy and its greater degree of harmonisation with provincial health services, the Program's provincial work plans will also look for opportunities for cost sharing between public health programs with independently identifiable funding. This will support integrated community outreach more efficiently and effectively.

Examples of integrated primary and preventive care outreach include:

- Malaria related interventions (e.g. bed net distribution, IRS, MaST, targeted community level treatment, health promotion and community health committee engagement)
- Primary MNCH care (e.g. U5 screening and growth monitoring, immunisation, de-worming, IMCI, antenatal care and delivery planning)
- Follow-up for other community public health programs (e.g. tuberculosis, yaws, leprosy, oral health and hygiene)
- Environmental health and hygiene (malaria vector breeding site investigation and evaluation, but also integrated vector management [IVM] and broader community sanitation and water supply interventions)
- Animal health interventions modelled on the "one health" principles (e.g. domestic animal de-worming and fertility control)

While the VBDCP may initially need to take the lead on planning and managing these joint initiatives, responsibility will be progressively shared with provincial health teams as their capacity improves.

6.3 Surveillance and information systems

6.3.1 Malaria information system

The current MIS will be maintained and strengthened through the addition of one additional officer based at the national level. The national information management unit will work increasingly closely with provincial information and surveillance officers, and will contribute to their orientation, training and supervision.

Data collection from the field will continue through the MMLL, and the completeness and timeliness of reporting will be strengthened as provincial supervision and communication systems improve.

Provincial health teams and information managers will develop the capacity to produce and interpret their own monthly data and monitor provincial trends for selected indicators. They will progressively be able to identify under-performing health zones or facilities for corrective intervention and provide follow-up supervision.

The Program will generate a comprehensive national annual malaria report, and semi-annual reports at provincial, health zone and even facility level to guide and support the planning and implementation of malaria interventions in the community.

The GIS-based register in support of elimination mapping and stratification of interventions will be maintained, with external technical assistance as required. It can be readily adapted to support mapping of the incidence of other outbreak-prone diseases, other diseases of public health importance, and potentially the delivery of services (e.g. immunisation, family planning).

6.3.2 Progressive harmonisation of MIS with HIS

The Program will support closer links between the HIS and MIS though co-location of provincial information managers. Information will be routinely shared between the two systems to enable cross-checking of data that may have been supplied to one system but not the other (including suspected malaria deaths, which will need to be investigated).

Increasingly, development of the HIS and selected MIS indicators will be harmonised. In elimination provinces, the immediate case based malaria notification and investigation can benefit surveillance of other diseases – especially those that are epidemic prone or targeted for elimination. The more prominent role of provincial health teams under the new reforms will see monthly MMLL reporting being directed through provincial HIS managers before being sent to the national Malaria Information Manager.

An additional malaria information management position will be co-located with the HIS unit with a view to supporting coordination and increased harmonisation of the two systems (in addition to supporting the existing MID manager in producing provincial and national level reports).

6.3.3 Supplementary performance information through surveys

Data for some coverage indicators can only be obtained through community surveys. A follow-up malaria indicator survey is planned for 2016.

In between major survey cycles, VHWs and provincial HPOs may be engaged in ongoing monitoring activities for selected outcome and coverage indicators.

6.3.4 Move towards village level micro-stratification

As better data become available on malaria incidence at village or community level, the Program will move towards stratification of transmission risk at that level. This will generate more precise estimates of API and TPR at the local (rather than zonal) level, allowing more accurate and cost-effective targeting of IRS during acceleration phase interventions and deciding malaria intervention shifts in malaria free areas.

The costs of the IRS "acceleration" strategy presented in Section 8 and Annex 6 (Budget) therefore represent a maximum cost and could ease back if preventive IRS can be more precisely targeted.

6.4 Procurement and supply management system

Under the functional delineation of the Malaria Program (Annex 4), cost-effective commodities procurement remains a central role. This is because national procurement of large-scale commodities like LLINs, RDTs and pharmaceuticals can generate significant efficiencies and cost savings compared with individual provincial procurement. If commodities procurement can be pooled with neighbouring countries (e.g. Solomon Islands, Papua New Guinea), the economies of scale are likely to be even greater.

It is therefore proposed that LLIN, RDT and drug procurement arrangements are maintained as they are, using the tried and proven donor-assisted mechanisms that are currently available through SPC (as principal recipient [PR] for Global Fund assistance to both Vanuatu and the Solomon Islands) and WHO (which has existing channels for procurement of WHO pre-qualified anti-malarial drugs, Foundation for Innovative New Diagnostics [FIND] assessed RDTs, and WHO Pesticide Evaluation Scheme [WHOPES] approved insecticides).

Other, smaller scale local procurement will be directed through the Assets, Infrastructure and Procurement unit in the MOH (as per existing arrangements).

Distribution of pharmaceuticals, diagnostics and small-scale equipment and infrastructure will follow the present policy of increasingly using CMS systems (if feasible).

As demand for RDTs and related consumables increases (to maintain ABER) and for microscopy reagents and drugs reduces (in line with reduced use of community-based microscopy and reduced malaria incidence), forecasting mechanisms and formulae will be re-evaluated and adjusted. As is currently being piloted by CMS, the provincial pharmacy officers will be increasingly involved in assessing orders and quantities of malaria consumables placed from peripheral centres to ensure they are consistent with projected requirements.

6.5 Human resources and technical assistance

6.5.1 Human resources

This new Strategy places a much stronger focus on integration with the provincial PHC work force at Health Centre, Dispensary and Aid Post level. In particular, there will be a much stronger engagement with VHWs as a key resource for fostering community level vigilance and adequate population screening in designated elimination areas.

The Program will maintain central level support and supervision for provincial health office staff, including developing tools for their supervisory outreach visits and feed back to staff working in more peripheral levels.

A medium term **malaria work force plan** and a strategy for engagement with the broader primary care work force is overdue, but has been deferred until the final health sector work force has been determined under the health sector reforms. The plan will be developed during 2014 (i.e. prior to commencement of the new NMSP) once the work force distribution under health sector reforms is determined.

The balance between the centrally-located and provincial workforce will be guided by the functional analysis (Annex 4) and progress with the current health sector reforms. In support of a more prominent focus on IRS during the "acceleration" phase, stronger skills in entomology and IRS management and supervision will be needed. The Program will support the progressive placement and up-skilling of IRS supervisors in each province according to the phased approach shown in Figure 19; two of these supervisors will be designated and further up-skilled to the level of "master" IRS supervisors – one covering the northern provinces and once covering the central and southern provinces. Their training may include participation in the Malaria Management for Field Operations (MMFO) course offered though the Manila-based Asian Collaborative Training Network for Malaria (ACT-Malaria).

6.5.2 Technical assistance

Ongoing technical assistance (TA) will be available through resident in-country WHO malaria officers and on-demand visiting technical specialists funded through the Australian aid program's continuing agreement with the University of Queensland (UQ) School of Population Health, funded through the Australian Initiative for the Control and Elimination of Malaria (AICEM).

As part of annual planning processes, the Program will analyse TA needs for the coming year and develop a **technical assistance plan** that justifies the placement of long term advisers and the engagement of *ad*

hoc TA. Provision has been made for ongoing engagement of TA in the indicative costing schedule ("budget") for the Strategic Plan.

Both WHO and UQ will be represented on the TAG. Mobilisation of additional technical assistance will be authorised by the MSC, subject to the prior recommendation of the TAG and the availability of funding.

6.6 Risks and risk management

The principal risks associated with the Strategic Plan reflect:

- the early stage of implementation of the Vanuatu health sector reforms, with uncertainty about the feasibility of proposed central management structures for public health programs and models for delivery of primary and preventive health services at community level;
- uncertainties in the current domestic funding environment, including the inability of the Government of Vanuatu to meet its financial obligations (see Section 2.5.2);
- uncertainties in the regional and global funding environment, in particular the contraction in the Australian aid budget, sharply reduced allocations from the Global Fund in 2014, and the absence of an alternative donor for the Vanuatu Malaria Program;

These and other risks are assessed in Annex 5, where they are grouped under 5 sub-headings:

- Risks related to Vanuatu Health Sector Policy and Planning Context
- Programmatic and Performance Risks
- Fiduciary and Financial Risks
- Risks related to Health Products and Services
- External Risks

Only one risk is rated "Very High": the risk that available funding will be inadequate to provide the necessary Program inputs (commodities, personnel, operational costs). Various approaches are being negotiated at the time of writing, and are briefly summarised in Section 8.3 (*Financing the National Malaria Strategic Plan*) and in Annex 5 ("Risk Mitigation Strategy" column).

The TAG and MSC are strongly encouraged to address identified and emerging risks regularly and systematically – i.e. as a recurring agenda item on their respective TORs.

7. Monitoring and evaluation

7.1 Performance framework

The following tables summarise the key impact and outcome level indicators that will be used to monitor progress under the Strategy, plus a small number of selected higher-level output indicators relevant to monitoring the effectiveness of program management. (A detailed formulation of indicators and data sources will be undertaken separately from this NMSP).

Table 12 summarises the key outcome indicators and intermediate milestones predicted under the proposed Strategy.

Table 12: Progressive Impact level indicators, National Malaria Strategic Plan, Vanuatu, 2015-20

Impact Indicator	Data Source	Intermediate and Final Targets		
		2016	2018	2020
National API per 1,000 by RDT and Microscopy	MIS	< 5	< 2.5	< 1
Number of provinces with 0 local transmission	MIS	1	1	2
Number of provinces with API < 1 per 1,000	MIS	1	1	3
Number of confirmed malaria deaths	MIS, VanPHIS	0	0	0

Note: Provinces expected to reach API < 1 per 1,000 and then zero local transmission are (in order) Tafea, Torba and Shefa. WHO is working with the Health information Unit to establish a system for mortality audits.

Based on current population projections, Table 13 summarises the expected number of cases, by species for each of the intermediate API milestones and intervening years across the duration of the Strategy.

Table 13: Expected number of cases, by species, based on annual API target, Vanuatu NMSP, 2015-20

	2012	2015	2016	2017	2018	2019	2020
Population (projected)	251,000	269,000	276,000	282,000	289,000	296,000	303,000
Indicator	**Current**	**Objectives from NSP 2015-2020**					
API per 1,000	13.2	6	**5**	3.5	**2.5**	1.5	**1**
Confirmed cases	3,300	1,614	1,380	987	723	444	303
% *P falciparum* or mixed *	50%	40%	35%	30%	20%	15%	10%
Confirmed *P falciparum*	1,650	646	483	296	145	67	30
Confirmed *P vivax*	1,650	968	897	691	578	377	273

* Based on assumed declining proportion of *P falciparum* over time

Table 14 shows core outcome and selected higher-level output indicators and targets for each thematic area / strategic objective.

Table 14: Outcome and higher-level output indicators, by thematic area, National Malaria Strategic Plan, Vanuatu, 2015-20

SDA	Level	Indicator (year)	Data Source	Target
Objective 1 – To maintain universal coverage with LLINs for the whole population of Vanuatu and accelerate reduction in malaria transmission in selected areas using IRS				
1.1	Outcome (LLIN)	% people who have access to LLINs in the household (at a coverage rate of one LLIN to 1.5 persons)	Survey	≥ 90%
1.1	Outcome (LLIN)	% people reporting having slept under an LLIN the previous night	Survey	≥ 80%
1.2	Outcome (IRS)	% of targeted population covered by IRS	Operational data (provincial and zonal MAPs)	≥ 90%
Objective 2 – To achieve 100% testing of suspected malaria cases by microscopy or RDT and provide prompt treatment and care for 100% of confirmed malaria cases according to the *Guidelines for Treatment of Malaria in Vanuatu*				
2.1	Outcome (Diagnosis)	% of suspected cases tested by RDT or microscopy	MMLL	100%
2.1	Output (Diagnosis)	Annual Blood Examination Rate	MIS	15%
2.2	Outcome (Treatment)	% of confirmed malaria cases receiving anti-malaria treatment as per national treatment guidelines	MMLL	100%
Objective 3 – Once a province has entered the elimination phase, to investigate and manage all malaria cases and identify, investigate and manage foci of infection according to national *Guidelines for Malaria Elimination*				
3.1	Outcome (Management of Foci)	% of active foci investigated, classified and updated each year according to Elimination Guidelines and SOP	Operational records	Target 100%
3.2	Outcome (Identification and Management of Cases)	% of cases in elimination provinces investigated and managed (including response in surrounding area) within 5 days according to Elimination Guidelines and SOP ("1-3-5")	Operational records	100% (subject to ABER ≥ 10%)
Program Management Objective – To strengthen Malaria Program leadership and management capacity at provincial and national level to plan, deliver and report on malaria interventions in a well-coordinated, efficient and timely manner				
Planning	Output	Integrated costed annual malaria operational plan (by province)	Operational records	Completed annually
Planning	Output	Malaria operational budget also reflected in national (MOH) and provincial health office business plans	Operational records	Completed annually
Planning	Output	Relevant policies and guidelines formulated (as per functional delineation) and reviewed annually	Operational records	Completed annually
Finance	Output	Expenditure tracking reports (national and provincial health business plans)	Operational records	Completed quarterly

SDA	Level	Indicator (year)	Data Source	Target
M&E	Outcome	% of complete, routine HIS/MIS reports submitted	Operational records	≥ 90% (monthly)
M&E	Output	Completeness on reaching national VBDCP M&E unit	Tracked at national level	≥ 90% (monthly)
M&E	Output	Timeliness of reaching provincial health office data encoder	Tracked at health facility and/or provincial level	≥ 90% (monthly)
M&E	Output	Comprehensive national annual malaria report	Operational records	Completed annually
Logistics	Outcome	% of health facilities reporting continuous supply (without stock-outs) of ACT and RDTs during reporting period	MMLL, supervisory and operational records	100% (monthly)
HRH	Outcome	% of health facilities receiving quarterly supervisory (outreach) visits	Supervisory and operational records	100% (quarterly, as scheduled)

7.2 Tools and measurement

The principal data source will be the malaria surveillance and information system (based on the MMLL and related reports).

Other data sources will include national and provincial operational records and surveillance data (including for provincial level classification of transmission) and, for certain coverage indicators, specific surveys. Survey data will be obtained from the malaria indicator survey (scheduled for 2016) and, by negotiation, other periodic national level surveys such as the DHS and MICS.

To meet the needs of the M&E systems, the capacity of the Malaria Program M&E unit will be increased by the equivalent of 0.5 of a full-time position (working in collaboration with the MOH Health information Unit.

7.3 Mid-term and end-of-Strategy evaluations

It will be important to monitor the performance of the Program closely to assess the effectiveness of IRS as an “acceleration” strategy, the additional efficiencies provided by village or community level stratification, and the impact of the MOH decentralisation policies and integration of some Malaria Program functions on community level PHC service delivery and surveillance.

A relatively early mid-term review will therefore be conducted in 2017 (which will also take advantage of the malaria indicator survey data from 2016).

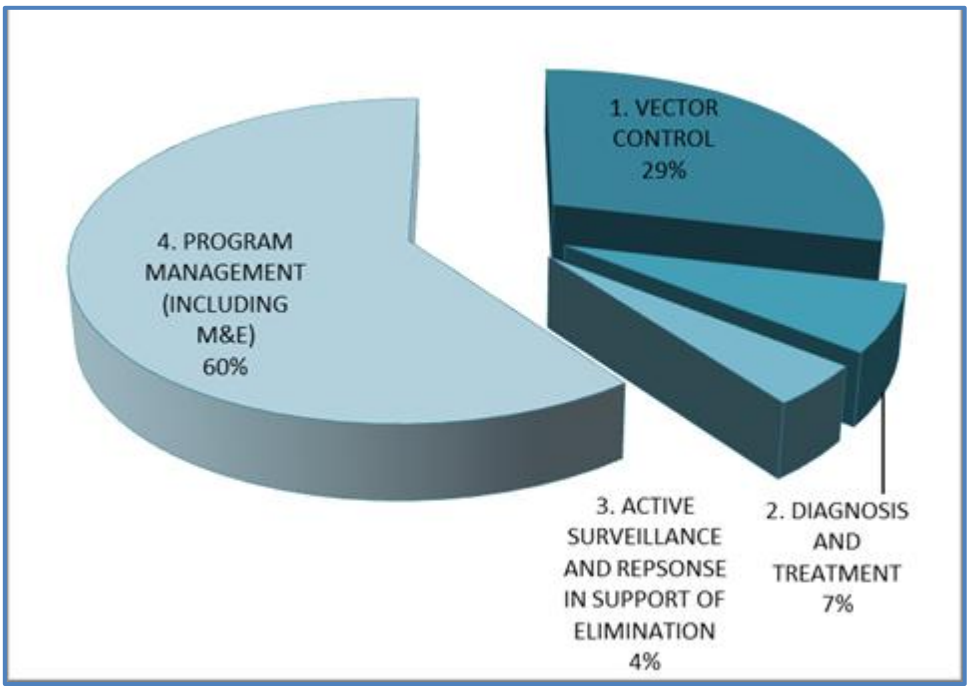
An end-of-Strategy review will be conducted in late 2019 or early 2020 to prepare for the “end game” and eventual certification of malaria elimination.

8. Indicative budget and financing plan

8.1 Budget summary

The cost of implementing this strategy is estimated at USD 24.35 million (excluding grant management costs). The budget has been developed using a conservative exchange rate of VUV 90 / USD 1. Costs have been adjusted by an annual inflationary factor of 3 percent. Figure 28 summarises the budget by strategic component across the 6 years of the Strategic Plan.

Figure 28: Budget distribution by main expenditure category, National Malaria Strategic Plan, Vanuatu, 2015-20



The full, detailed budget and costing analysis is included at Annex 6.

Annual expenditure peaks at USD 4.75 million in 2019, reflecting the peak intensity of the IRS campaign and LLIN replenishment, coupled with scheduled periodic national surveys.

8.2 Further analysis

USD 7 million is forecast to be spent on **vector control** during the period 2015-2020; this includes the procurement and distribution of 513,000 LLINs, ensuring universal access to bed nets throughout the country in accordance with Objective 1. Indoor residual spraying of 35,500 houses will be conducted during the Plan period.

Further, detailed breakdown of vector control costs is shown in Table 15.

Table 15: Overall cost of vector control, by activity (whole-of-strategy level), National Malaria Strategic Plan, Vanuatu, 2015-20

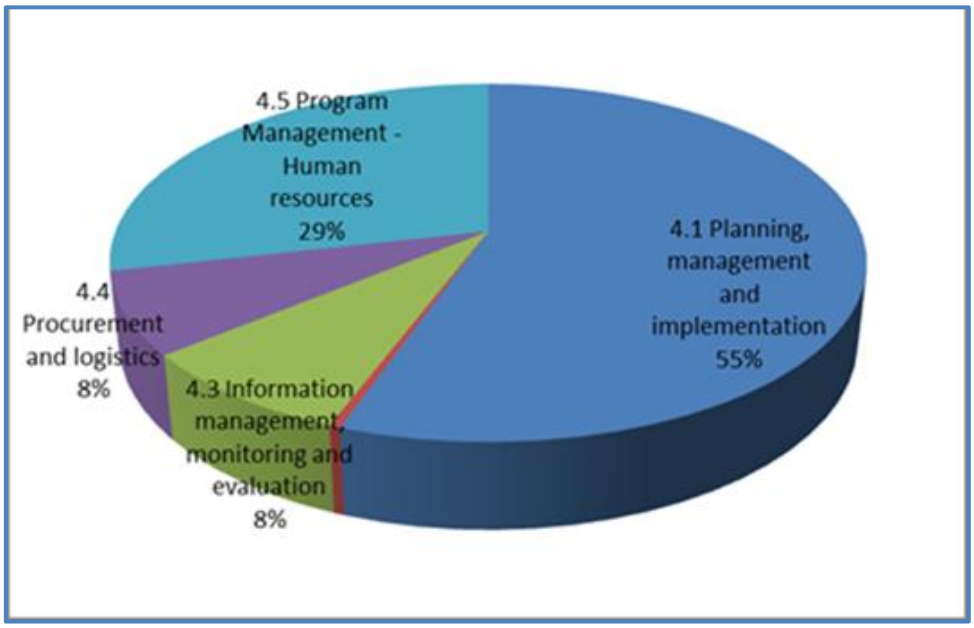
Activity	Cost (USD)	Percent
Maintain universal coverage of LLIN	4,156,596	17.1%
Achieve full coverage of selected populations with IRS	2,479,836	10.2%
Entomological Monitoring	15,188	0.1%
Vector Control – human resources	350,698	1.4%

Diagnosis and treatment costs amount to USD 1.6 million, enabling 257,000 tests to be conducted using either microscopy or RDT, and treatment of 5,451 confirmed cases of malaria.

USD1.0 million (4 percent) is allocated to **active surveillance and response in support of elimination**, with the majority of this amount being allocated to management of foci (detection and response) and to human resources.

Program management costs amount to USD 14.6 million (60 percent) of the total budget, with USD 7.8 million allocated to the provision of short and long term technical assistance in support of the Program. The procurement of replacement assets, equipment and transportation amounts to USD 0.7 million, a further USD 1.1 million to routine supervisory visits and USD 1.0 million to program evaluations and surveys. The breakdown in program management costs by budget sub-heading across the 6 years of the Strategic Plan is shown in Figure 29.

Figure 29: Program management budget distribution by sub-heading, National Malaria Strategic Plan, Vanuatu, 2015-20



The major expenditure categories across all strategic objectives and the whole Strategy are shown in Table 16.

Table 16: Expenditure categories, by activity (whole-of-strategy level), National Malaria Strategic Plan, Vanuatu, 2015-20

Expenditure category	Cost (USD)	Percent
Human Resources	7,634,278	31.4%
Technical Assistance	4,243,645	17.4%
Training	1,553,873	6.4%
Health Products & Health Equipment	2,196,546	9.0%
Medicines & Pharmaceutical Products	114,141	0.4%
Procurement and Supply Management costs	2,346,439	9.6%
Infrastructure and other equipment	963,507	4.0%
Communications and materials	189,609	0.8%
Monitoring and Evaluation	3,235,457	13.3%
Planning and Administration	1,873,095	7.7%
Total:	**24,350,590**	**100.0%**

8.3 Financing the National Malaria Strategic Plan

There have been some significant changes in the donor landscape that has impacted on the projected availability of funds to support the new NMSP.

The Global Fund has introduced a *New Funding Model* to replace the traditional country demand driven rounds based model. Now categorised as a Band 4 country, Vanuatu is considered to be at the limit of eligibility for Global Fund support, and consequently has been allocated very limited funding through until 2017. In order to access this funding, Vanuatu is expected to demonstrate a mandatory 40 percent co-financing of its NMSP through government sources.

The Australian Aid Program Direct Funding Agreement (DFA) budget support has also contracted significantly compared to previous years.

A financial gap analysis covering the first three years of the NMSP is presented in Table 17. The following assumptions are used in determining the gap:

- Global Fund funding of USD 1.27 million for the period 2015-2017 will be secured through the *New Funding Model*;
- The Australian Aid Program will support the NMSP to the amount of USD 0.6 million per annum;
- MOH direct funding (mainly through support for positions) will continue at current levels as a minimum; and
- AICEM funding has been aligned to the current contract with Australia's Department of Foreign Affairs and Trade, which expires by mid-2016.

Table 17: Financial Gap Analysis (USD millions, whole-of-strategy level), National Malaria Strategic Plan, Vanuatu, first three years (2015-17)

	2015	2016	2017
Total Budget	**$3.41**	**$3.90**	**$4.36**
GFATM funding (projected)[16]	$0.42	$0.42	$0.42
Direct Funding Agreement, Australia	$0.60	$0.60	$0.60
AICEM [17]	$0.80	$0.44	n/a
MOH – Vanuatu (estimate)	$0.26	$0.27	$0.28
Funding to be secured (USD millions)	**$1.33**	**$2.17**	**$3.06**

A prioritisation exercise has been undertaken to ensure that elements of the Program that are absolutely indispensable – continued universal access to LLINs, diagnosis, treatment, outbreak detection and response, and protecting the gains made in Tafea province – can be maintained, albeit with some unavoidable relaxation in overall elimination targets and achievement dates.

[16] Assumes Vanuatu receives approved *New Funding Model* funding equivalent to 85 percent of USD 1.5 million over 3 years **and** is able to achieve the mandatory 40 percent co-financing requirement

[17] AICEM funding is only projected through until the end of the current contract in mid-2016

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Annexes

1. Provincial API and TPR stratification maps, by health zone, 2012 (from Gerard Kelly report)
2. Data from Malaria Indicator Survey on which LLIN policy is based

    Supplement: Estimation of LLIN needs at household level, reflecting ratio of people per net
3. Description of TPR impact modelling used in developing the National Strategic Plan 2015–20
4. Malaria Program functional delineation – national vs. provincial level
5. Risk analysis and management plan
6. Detailed cost estimates, Vanuatu NMSP 2015-20