

NATIONAL FRAMEWORK FOR MALARIA ELIMINATION IN INDIA (2016–2030)

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ACRONYMS

ABER	annual blood examination rate
ACT	artemisinin-based combination therapy
ACT-AL	artemisinin-based combination therapy – artemether lumefantrine
ACT-SP	artemisinin-based combination therapy – sulfadoxine pyrimethamine
AIM	Action and Investment to defeat Malaria 2016–2030
An	<i>Anopheles</i>
API	annual parasite incidence
APLMA	Asia Pacific Leaders Malaria Alliance
APMEN	Asia Pacific Malaria Elimination Network
ASHA	accredited social health activist
BCC	behaviour change communication
CHC	community health centre
CRPF	Central Reserve Police Force
CSR	corporate social responsibility
DDT	dichlorodiphenyltrichloroethane
GTS	WHO Global Technical Strategy for Malaria 2016–2030
G6PD	glucose-6-phosphate dehydrogenase
HCH	hexachlorocyclohexane
IEC	information, education and communication
IPHS	Indian Public Health Standards
IRS	indoor residual spraying
ITN	insecticide-treated net
JMM	joint monitoring mission
LLIN	long-lasting insecticidal net
MDG	Millennium Development Goals
MDR	multi-drug resistance

MIS	Malaria Information System
NGO	non-governmental organization
NHM	National Health Mission
NVBDCP	National Vector Borne Disease Control Programme
<i>Pf</i>	<i>Plasmodium falciparum</i>
PHC	primary health centre
<i>Pv</i>	<i>Plasmodium vivax</i>
RBM	Roll Back Malaria Partnership
RDT	rapid diagnostic test
SC	sub-centre
SP	synthetic pyrethroids
SPR	slide positivity rate
TMAP	Tribal Malaria Action Plan
UMS	Urban Malaria Scheme
UT	union territory
WHO	World Health Organization

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The *National Framework for Malaria Elimination (NFME) in India 2016–2030* has been developed through an extensive consultative process beginning in October 2015, culminating in the launching of the Framework by the National Vector Borne Disease Control Programme (NVBDCP) of the Ministry of Health and Family Welfare on February 11 2016. The Framework was developed in close collaboration with officials from NVBDCP, experts from the Indian Council of Medical Research, WHO and representatives from civil society institutions, professional bodies and partners. The final document is the result of several rounds of review and consultations under the overall leadership of Dr A. C. Dhariwal, Director, NVBDCP.

The development of the Framework was coordinated by Dr G. S. Sonal, Additional Director, NVBDCP, with overall responsibility of compilation assumed by Dr S. N. Sharma, Joint Director, NVBDCP. The work of drafting and revision of the document throughout the consultative process was undertaken by Saloni Mehra, Consultant, NVBDCP. Critical contributions for refinement of the Framework were received from Dr Avdhesh Kumar, Additional Director; Dr P. K. Srivastava, Joint Director; Dr Sukhvair Singh, Joint Director; Dr Suman Lata Wattal, Deputy Director; and Dr Sher Singh, Assistant Director of NVBDCP. Valuable inputs were also received from consultants Dr Amrish Gupta, Dr Disha Agarwal, Dr Pritam Roy and Dr Munish Joshi.

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The NFME 2016–2030 was developed in close alignment with the *Global Technical Strategy for Malaria 2016–2030*, *Action and Investment to defeat Malaria 2016–2030* and the *Asia Pacific Leaders Malaria Alliance Malaria Elimination Roadmap*. Other WHO publications on malaria elimination and the national strategic plans of neighbouring countries served as important reference documents for development of this Framework.

PREFACE

डा० ए.सी. धारीवाल

निदेशक

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PREFACE

Malaria burden in India has reduced significantly over the years which has been made possible with the introduction of new interventions for case management and vector control, namely Rapid Diagnostic Tests (RDT), Artemisinin based combination therapy (ACT), Long Lasting Insecticidal Nets (LLINs) and effective Monitoring & Evaluation. The recent trends of malaria indicate that with the concerted efforts malaria can be reduced substantially and elimination can be achieved. However, the achievement can be quite fragile, making sustenance of efforts extremely vital.

WHO has recently developed the Global Technical Strategy for Malaria 2016- 2030 which advocates global acceleration of malaria elimination efforts by 2030. The Strategy for Malaria Elimination in the Greater Mekong Subregion (2015-2030) follows the same target. Similarly, the Asia Pacific Leaders Malaria Alliance (APLMA), of which India is a member, has set a target for malaria elimination in all countries of the Asia Pacific by 2030. The Hon'ble Prime Minister of India was among the 18 leaders, who endorsed the APLMA Malaria Elimination Roadmap at the East Asia Summit held in Kuala Lumpur, Malaysia in November, 2015, emphasizing the political commitment towards malaria elimination in the Region.

The main goal is to eliminate malaria (zero indigenous cases) throughout the entire country by 2030, to maintain malaria free status and prevent re-introduction. The objective of the framework is to eliminate malaria from 15 low endemic states/UTs by 2020, from moderate endemic states by 2022, ultimately eliminate malaria from the country by 2027 and sustain zero transmission till 2030 for proceeding for WHO certification.

The framework will be shared with States/UTs for implementation under the technical, financial and logistic support of the Directorate of National Vector Borne Disease Control Programme (NVBDCP) under the aegis of the Directorate General of Health Services within the Ministry of Health & Family Welfare, Government of India.

The document has been prepared in consultation with International and national experts as well as stakeholders including research institutions, states, civil society, non-governmental organisations, private sector, other sectors and development partners.

However, in order to achieve these targets, necessary resources and intensification of efforts will be needed to translate the commitment into effective action in order to achieve malaria elimination from the nation and to sustain it.

A.C. Dhariwal
Dr A C Dhariwal 13/2/2016



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FOREWORD

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FOREWORD

Ministry of Health & Family Welfare, Government of India is announcing the launch of Malaria Elimination Campaign with the release of "The National Framework for Malaria Elimination in India: 2016-2030". This framework is an attempt to eliminate malaria from the country and contribute to improved health and quality of life and alleviation of poverty. It is in line with WHO Global Technical Strategy (GTS) for Malaria 2016-2030 and Asia Pacific Leaders Malaria Alliance (APLMA) Malaria Elimination Roadmap for the Asia Pacific.

Malaria remains a public health problem in India. Malaria contributes not only to mortality and morbidity but imposes economic burden, loss of working days, school absenteeism and impact quality of life. Fortunately, the health system of the country does have a comprehensive response system to address these problems through National Vector Borne Disease Control Programme. A robust and more focused intervention detailed in "National Framework for Malaria Elimination in India: 2016-2030" will help in attaining unfinished dream of malaria elimination from country.

This document addresses broad issues of strengthening institutional framework, logical stratification of endemic areas, processes and evidence based decision required for intensifying efforts towards malaria control in India.

I would like to thank Director, NVBDCP and his entire team, State Programme Officers, Research Institutions, Academia, Civil Society Representatives, Non-governmental Organizations, World Health Organization, Donors, Foundations and all partners for drafting this document which will lay down roadmap in achieving malaria elimination in country. I trust and hope that this framework will pave the path for coordinated and collaborative approach in malaria elimination from India and will create a milestone in malaria history of India.


(Dr. Jagdish Prasad)

MESSAGE



भानु प्रताप शर्मा
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Message

Malaria exerts an enormous economic and social burden on the affected population groups, individuals and communities. In light of malaria being an entirely preventable condition, efforts need to be intensified for the prevention, control and elimination of this disease. Over the years, there has been a significant reduction in malaria cases in India from 2 million cases in 2000 to 1.1 million cases in 2015. This was made possible through integrated general health services, strengthening of health systems and implementation of globally accepted tools and standards. In spite of this reduction, India still accounts for 70% of the malaria burden in the South-East Asia Region (SEAR) of the WHO.

Globally, malaria endemic countries are intensifying efforts towards prevention, control and elimination of malaria. Few countries in SEAR have also demonstrated that with concerted efforts, malaria elimination is an achievable target.

I am happy to learn that the Directorate of National Vector Borne Disease Control Programme (NVBDCP) has prepared the 'National Framework for Malaria Elimination (NFME) in India 2016-2030', which envisages achieving malaria-free status in the country by 2030. It is good to note that this framework has intermediate milestones to monitor the progress all through this ambitious journey.

This goal can be achieved through effective partnerships, coordination with states, involvement of communities and interested stakeholders.

I wish this endeavor the very best and hope that through a very focused and targeted approach, this will be a major public health achievement for India.

(B. P. Sharma)

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FRAMEWORK AT A GLANCE

VISION

Eliminate malaria nationally and contribute to improved health, quality of life and alleviation of poverty.

GOALS

In line with the *WHO Global Technical Strategy for Malaria 2016–2030* (GTS) and the *Asia Pacific Leaders Malaria Alliance Malaria Elimination Roadmap*, the goals of the *National Framework for Malaria Elimination in India 2016–2030* are:

- Eliminate malaria (zero indigenous cases) throughout the entire country by 2030; and
- Maintain malaria-free status in areas where malaria transmission has been interrupted and prevent re-introduction of malaria.

OBJECTIVES

The Framework has four objectives:

- Eliminate malaria from all 26 low (Category 1) and moderate (Category 2) transmission states/union territories (UTs) by 2022;
- Reduce the incidence of malaria to less than 1 case per 1000 population per year in all states and UTs and their districts by 2024;
- Interrupt indigenous transmission of malaria throughout the entire country, including all high transmission states and union territories (UTs) (Category 3) by 2027; and
- Prevent the re-establishment of local transmission of malaria in areas where it has been eliminated and maintain national malaria-free status by 2030 and beyond.

STRATEGIC APPROACHES

1. Programme phasing

Malaria elimination in India will be carried out in a phased manner because various parts of the country differ in their malaria endemicity due to differences in their eco-epidemiological settings, socioeconomic conditions, health system development and malaria control accomplishments. Malaria incidence in high transmission areas (Category 3) must be lowered first before it is possible and rational to investigate each case. States/UTs will be subdivided into four categories with annual parasite incidence (API) as the primary criteria, and the annual blood examination rate (ABER) and slide positivity rate (SPR) as secondary criteria (see Table 1). Category specific milestones and targets will be set up and strategies implemented subsequently.

Table 1: Classification of states/UTs based on API as primary criteria

S. No.	Categories of states/UTs	Definition
1.	Category 0: Prevention of re-establishment phase	States/UTs with zero indigenous cases of malaria.
2.	Category 1: Elimination phase	States/UTs (15) including their districts reporting an API of less than 1 case per 1000 population at risk .
3.	Category 2: Pre-elimination phase	States/UTs (11) with an API of less than 1 case per 1000 population at risk, but some of their districts are reporting an API of 1 case per 1000 population at risk or above.
4.	Category 3: Intensified control phase	States/UTs (10) with an API of 1 case per 1000 population at risk or above.

2. District as the unit of planning and implementation

Apart from the category to which they belong, each state/UT will be advised to further classify their districts so that even if a state/UT is not yet in the elimination phase, but has some districts with an API below 1 case per 1000 population at risk, those may be considered eligible for initiating elimination phase activities provided they meet the secondary criteria. In addition, states/UTs may also sub-classify districts into community health centres, community health centres into primary health centres, primary health centres into sub-centres, and sub-centres into villages for localized planning and implementation.

3. Focus on high transmission areas

The majority of malaria is being reported from states in the eastern, central and north-eastern part of the country, such as Odisha, Chhattisgarh, Jharkhand, Madhya Pradesh, Maharashtra, Tripura and Meghalaya. Most of these states are characterized by widespread hilly, tribal, forested and conflict-affected areas which are pockets of high malaria transmission. An aggressive scaling up of existing interventions, intensification of all malaria control activities and innovative strategies and partnerships will be carried out in these high endemic pockets to rapidly reduce malaria morbidity and mortality.

4. Special strategy for *P. vivax* elimination

According to the World Malaria Report 2015, more than 80% of the global *P. vivax* burden is contributed by 3 countries including India¹. This serious challenge to malaria elimination efforts within the country will require special measures to be undertaken, such as good quality microscopy to detect all *P. vivax* infections, operational research to estimate prevalence of G6PD deficiency in the population, appropriate vector control measures, and ensuring good compliance to 14-day radical treatment with primaquine in affected individuals. These measures are in line with the WHO *Control and Elimination of Plasmodium vivax Malaria – A Technical Brief*.²

MILESTONES AND TARGETS

By end of 2016

All states/UTs have included malaria elimination in their broader health policies and planning frameworks.

By 2020

- Transmission of malaria interrupted and zero indigenous cases and deaths due to malaria attained in all 15 states/UTs under Category 1 (elimination phase) in 2014 (base year).
- All 11 states/UTs under Category 2 (pre-elimination phase) in 2014 enter into Category 1 (elimination phase).
- Five states/UTs under Category 3 (intensified control phase) in 2014 enter into Category 2 (pre-elimination phase).
- Five states/UTs under Category 3 (intensified control phase) in 2014 reduce malaria transmission but continue to remain in Category 3.

- An estimated reduction in malaria of 15–20% at the national level compared with 2014.
- Additionally, progressive states with strong health systems such as Gujarat, Maharashtra and Karnataka may implement accelerated malaria elimination programmes to achieve interruption of transmission and demonstrate early elimination followed by sustenance of zero indigenous cases.

By 2022

- Transmission of malaria interrupted and zero indigenous cases and deaths due to malaria attained in all 26 states/UTs that were under Categories 1 and 2 in 2014.
- Five states/UTs which were under Category 3 (intensified control phase) in 2014 enter into elimination phase.
- Five states/UTs which were under Category 3 (intensified control phase) in 2014 enter into pre-elimination phase.
- An estimated reduction in malaria of 30–35% at the national level compared with 2014.

By 2024

- All states/UTs and their respective districts reduce API to less than 1 case per 1000 population at risk and sustain zero deaths due to malaria while maintaining fully functional malaria surveillance to track, investigate and respond to each case throughout the country.
- Transmission of malaria interrupted and zero indigenous cases and deaths due to malaria attained in all 31 states/UTs.
- Five states/UTs which were under Category 3 (intensified control phase) in 2014 enter into elimination phase.

By 2027

The indigenous transmission of malaria in India interrupted.

By 2030

- The re-establishment of local transmission prevented in areas where malaria has been eliminated.
- The malaria-free status maintained throughout the nation.

EXECUTIVE SUMMARY

Malaria is a major public health problem in India but is preventable and curable. Malaria interventions are highly cost-effective and demonstrate one of the highest returns on investment in public health. In countries where the disease is endemic, efforts to control and eliminate malaria are increasingly viewed as high-impact strategic investments that generate significant returns for public health, help to alleviate poverty, improve equity and contribute to overall development.

Each case of malaria has been shown to cost households at least US\$ 2.67 (range US\$ 0.34–7.66) in direct out-of-pocket expenses. In adults, this leads to an average of 3.4 days (range 2–6 days) of lost productivity, at a minimum additional indirect cost of US\$ 10.85. Mothers and other carers sacrifice a further 2–4 days each time a child or other family member contracts malaria, generating yet more indirect costs for households³. Even though such estimates and studies are few and still evolving in India, the total economic burden from malaria could be around US\$ 1940 million. Death rates are not a significant factor because 75% of the burden comes from lost earnings and 24% from treatment costs⁴. A malaria burden analysis inferred that every Rupee invested in malaria control in India (1994) produces a direct return of Indian Rupees 19.70⁵.

From the beginning of the 21st century, India has demonstrated significant achievements in malaria control with a progressive decline in total cases and deaths. Overall, malaria cases have consistently declined from 2 million in 2001 to 0.88 million in 2013, although an increase to 1.13 million cases occurred in 2014 due to focal outbreaks. The incidence of malaria in the country therefore was 0.08% in a population of nearly 1.25 billion. In 2015, 1.13 million cases (provisional) were also reported. It is worthwhile to note that confirmed deaths due to malaria have also declined from 1005 in 2001 to 562 in 2014. In 2015, the reported number of deaths has further declined to 287 (provisional). Overall, in the last 10 years, total malaria cases declined by 42%, from 1.92 million in 2004 to 1.1 million in 2014, combined with a 40.8% decline in malaria-related deaths from 949 to 562.

India contributes 70% of malaria cases and 69% of malaria deaths in the South-East Asia Region. However, a WHO projection showed an impact in terms of a decrease of 50–75% in the number of malaria cases by 2015 in India (relative to 2000 baseline), which showed that the country has been on track to decrease case incidence 2000–2015¹.

During 2000, 17 states and union territories (UTs) had an annual parasite incidence (API) of less than one case per thousand population at risk. Overall, in 2014 and 2015, in 26 and 27 states/UTs respectively, the incidence of malaria was brought down to an API of less than one case per thousand. In 2000, 370 districts also had an API of less than one case per thousand population at risk. In 2014 and 2015, of a total of 677 districts (reporting units), 527 (78%) reported an API of less than one case per thousand population at risk.

Presently, 80% of malaria occurs among 20% of people classified as “high risk”, although approximately 82% of the country’s population lives in malaria transmission risk areas. These populations at high-risk for malaria are found in some 200 districts of Andhra Pradesh, Chhattisgarh, Gujarat, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Odisha, West Bengal and seven north-eastern states.

Undoubtedly, such reduction of malaria morbidity and mortality reflects tangible success relative to the pre-independence era, before the launch of the National Malaria Control Programme (NMCP) in 1953, when malaria was a major public health problem with 75 million cases and 0.8 million deaths, causing enormous human suffering and loss to the nation, both in terms of manpower and money.

Previously, there were tremendous achievements made in bringing down the malaria burden with the overwhelming success of the NMCP leading to the launch of the *National Malaria Eradication Programme (NMEP)* in 1958. The NMEP was also initially a great success with malaria incidence dropping to 0.1 million cases with no deaths reported in 1965. However, the resurgence of malaria due to technical, operational and financial complexities resulted in an escalation of incidence to 6.4 million cases in 1976. With the Urban Malaria Scheme (UMS) implemented in 1971–1972 and a renewed focus and commitment, in 1977 the Modified Plan of Operation (MPO) and the *Plasmodium falciparum* containment programme (PfCP) were launched and malaria incidence was reduced to around two million cases per year by 1984.

Amply demonstrating the success of the National Vector Borne Disease Control Programme (NVBDCP) is the fact that 75 million cases and 0.8 million deaths annually due to malaria in the pre-independence era fell to 1.1 million cases and 562 deaths in 2014.

These achievements in reducing the malaria burden in the country were also due to new tools such as rapid diagnostic tests, artemisinin-based combination therapy (ACT) and long-lasting insecticidal nets (LLINs). Also playing a part were major initiatives and interventions including additional human resources, capacity building, community level awareness building and mobilization, partnerships, strengthened monitoring and evaluation, and investments from domestic and external sources such as the Global Fund and the World Bank. Under the umbrella of the National Health Mission, overall health systems strengthening also contributed.

The WHO has recently released the *Global Technical Strategy for Malaria 2016–2030*⁶, which advocates acceleration of global malaria elimination efforts and has set targets to reduce malaria mortality rate and malaria case incidence globally by 90% by 2030 (baseline 2015); eliminate malaria from at least 35 countries in which malaria was transmitted in 2015; and prevent re-establishment of malaria in all countries that are malaria-free.

In November 2014, the Asia Pacific Leaders Malaria Alliance (APLMA) representing 18 countries, including India, agreed to the goal of a region free of malaria by 2030. The *APLMA Malaria Elimination Roadmap* was endorsed in November 2015 in alignment with the WHO *Global Technical Strategy for Malaria 2016–2030*, and the Roll Back Malaria Partnership document *Action and Investment to defeat Malaria 2016–2030*. By committing to the roadmap, leaders can catalyse united action across the Asia Pacific through a multipronged approach: greater coordination as a key path to progress; unifying national approaches; linking and harmonizing regional efforts; and increasing partnerships⁷. Further, malaria reduction and elimination efforts will be a measure of progress and contribute to and benefit from the attainment of the Sustainable Development Goals (SDGs) by 2030, especially Goal 3: ensure healthy lives and promote well-being for all at all ages. The goal explicitly sets the target of ending the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases.

In line with international strategies, timelines, and with solid commitments at the highest leadership level in India and, importantly, buoyed by the achievements of a declining malaria trend, India is confident to embark upon a paradigm shift from control to elimination in 2016. Tailor-made and targeted interventions will be aimed at the continuous and gradual transition of states/UTs, districts, primary health centres and sub-centres to malaria-free areas. Special emphasis will be on hilly, tribal, forested and border areas that are difficult to reach, often conflict prone/affected, lacking optimal health systems and infrastructure and seeing large population movements. These areas have specific socio-demographic conditions including a multiplicity of ethnic groups, who are often migrant/mobile, poor, marginalized, and illiterate, with variable living conditions and health-seeking behaviours. Additionally, prevention of the possible emergence or importation of malaria multi-drug resistance including resistance to artemisinin-based combination therapies from neighbouring countries will be underscored. Available tools also need to be scaled up before they become ineffective. Throughout, evidence generation, successes and lessons learnt will guide course corrections.

As malaria is characterized by focal occurrences and achievements made with reduction in mortality and morbidity are fragile without constant attention to the existing malaria challenges, the sustaining of gains is critical as there is a risk of turning low endemic areas back into high risk areas.

Against this background and in consideration of the WHO GTS and *APLMA Malaria Elimination Roadmap*, the *National Framework for Malaria Elimination (NFME) 2016–2030* has been developed together with partners and key stakeholders. The vision is to eliminate malaria nationally and contribute to improved health, quality of life and alleviation of poverty. The NFME has clearly defined goals, objectives, strategies, targets and timelines and will serve as a roadmap for advocating and planning malaria elimination throughout the country in a phased manner. Necessary guidance is expressed for rolling out the strategies and related interventions in each state/UT as per respective epidemiological situation.

The objectives are to:

- (1) Eliminate malaria from all Category 1 and Category 2 states/UTs (26) with low and moderate-transmission of malaria by 2022;
- (2) Reduce the incidence of malaria to less than one case per 1000 population per year in all states/UTs and their districts and achieve malaria elimination in 31 states/UTs by 2024;
- (3) Interrupt indigenous transmission of malaria in all states/UTs (Category 3) by 2027; and
- (4) Prevent re-establishment of local transmission of malaria in areas where it has been eliminated and maintain malaria-free status nationally by 2030.

The milestones and targets are set for 2016, 2020, 2022, 2024, 2027 and 2030. It is expected that by 2030 the entire country will have sustained zero indigenous cases and deaths due to malaria for three years and initiated the process for WHO certification of malaria elimination.

By the end of 2016, all states/UTs are expected to include malaria elimination in their broader health policies and planning framework; and by end of 2020, 15 states/UTs under Category 1 (elimination phase) are expected to interrupt transmission of malaria and achieve zero indigenous cases and deaths due to malaria. It is also envisaged that in states with relatively good capacity and health infrastructure, namely, Gujarat, Karnataka and Maharashtra, accelerated efforts may usher in malaria elimination sooner.

The NFME 2016–2030 defines such key strategic approaches as: programme phasing considering the varying malaria endemicity in the country; classification of states/UTs based on API as primary criteria (Category 0: Prevention of re-establishment phase; Category 1: Elimination phase; Category 2: Pre-elimination phase; Category 3: Intensified control phase); districts as the unit of planning and implementation; focus on high endemic areas; and a special strategy for *P. vivax* elimination. An enabling environment and necessary resources are critical to achieving the objective of malaria elimination.

1. INTRODUCTION

Disease burden due to malaria in India has been reduced significantly over the years with an overall decline in malaria-related morbidity and mortality (see Annexes 4 and 6). This has been made possible by a series of interventions undertaken in the last decade, such as the introduction of artemisinin-based combination therapy (ACT) for *P. falciparum* malaria in 2004–2005, introduction of malaria rapid diagnostic tests (RDTs) for detection of *P. falciparum* cases in 2004–2005, imposition of a country-wide ban on oral artemisinin monotherapy in 2009, introduction of long-lasting insecticidal nets (LLINs) in 2009 and revision of the National Drug Policy for malaria in 2013⁸ (see Annexes 1, 2 and 3).

However, a number of challenges have emerged in recent years which pose a threat to the country's progress in its fight against malaria (see Annex 5). These include the development of antimalarial drug resistance and insecticide resistance in some parts of the country, development of malaria multi-drug resistance including ACT resistance in neighbouring countries, rapid urbanization leading to emergence of malaria in urban areas, existence of high endemic malaria pockets in hard-to-reach areas and in tribal populations, climate change and increased tourism and migration^{9, 10}. All these factors can seriously hamper the country's malaria control efforts and therefore deserve urgent attention. In order to address these challenges, a national strategy for malaria elimination has been envisaged prompting the development of the *National Framework for Malaria Elimination in India 2016–2030*.

The main focus of this Framework is to propel India on the path towards malaria elimination in a phased manner. Under this Framework, all states/UTs have been grouped into one of four categories based on their malaria burden, specific objectives have been established for each of these categories and a mix of interventions will be implemented in each of them. Efforts for malaria elimination will be simultaneously undertaken in low-transmission areas (states/UTs under Category 1); efforts for pre-elimination will be undertaken in moderate transmission areas (states/UTs under Category 2); and efforts for intensified control will be undertaken in high transmission areas (states/UTs under Category 3) to achieve and sustain malaria elimination in the entire country by 2030. Additionally, areas with moderate or high transmission of malaria but progressive health systems may proceed towards elimination earlier than the stated milestones and targets based on their performance.

This Framework will be implemented by the Directorate of National Vector Borne Disease Control Programme (NVBDCP) which is the umbrella programme for prevention and control of malaria and five other vector borne diseases. The programme functions under the aegis of the Directorate General of Health Services within the Ministry of Health & Family Welfare, Government of India.

2. THE NEED FOR MALARIA ELIMINATION IN INDIA

Recent trends in malaria control efforts globally and in India demonstrate that achievements can be fragile, making sustained efforts vital. Scientific breakthroughs in recent years have provided better tools such as new drugs, diagnostics and vector control strategies. These tools need to be utilized and scaled up rapidly before they become ineffective in preventing or controlling malaria^{11, 12}. Additionally, there is also a growing threat of the spread of malaria multi-drug resistance including resistance to artemisinin-based combination therapies from the neighbouring Greater Mekong Subregion countries¹³, coupled with the shortage of new and effective antimalarials^{14, 15}. All these reasons underscore the importance of shifting the country's focus from malaria control to malaria elimination.

WHO has recently developed the *Global Technical Strategy for Malaria 2016–2030* which advocates global acceleration of malaria elimination efforts.⁶ *The Strategy for Malaria Elimination in the Greater Mekong Subregion (2015–2030)* sets 2030 as a target for the six Greater Mekong Subregion countries¹⁶. Similarly, the Asia Pacific Leaders Malaria Alliance (APLMA), of which India is a member, has set a target for malaria elimination in all countries of the Asia Pacific region by 2030 as per its Malaria Elimination Roadmap⁷. India endorses these global and regional strategies for malaria elimination and has aligned its own national strategy on the same timelines.

Malaria incidence has dropped to such low levels in some states/UTs in India that interruption of transmission has become a feasible objective in these states/UTs, and in another few years the interruption can be expected even in states/UTs with moderate transmission of malaria. In states/UTs with high transmission of malaria, a massive scale-up of preventive and curative interventions is expected to substantially reduce the transmission intensity and reservoir of infection.

There is also a need to ensure close coordination of malaria elimination activities with neighbouring countries, particularly where frequent movement takes place across international borders. With reports of artemisinin resistance emerging from bordering countries such as Myanmar¹³, moving towards malaria elimination will be a step in the right direction, as is being done by countries in the Greater Mekong Subregion. Any further delay in addressing

the problem of *P. falciparum* malaria could lead to the deterioration of the malaria situation and the emergence of multi-drug resistance, including resistance to artemisinin-based combination therapies.

Finally, there is now an increasing political commitment and participation of partners in the country's march towards malaria elimination. This is shown by the participation of the Indian Prime Minister among the 18 leaders who endorsed the APLMA Malaria Elimination Roadmap released at the recently concluded East Asia Summit held in Kuala Lumpur, Malaysia, in November, 2015.¹⁷

3. NATIONAL FRAMEWORK FOR MALARIA ELIMINATION IN INDIA 2016–2030

VISION

Eliminate malaria nationally and contribute to improved health, quality of life and alleviation of poverty.

GOALS

In line with the *WHO Global Technical Strategy for Malaria 2016–2030 (GTS)* and the *Asia Pacific Leaders Malaria Alliance (APLMA) Malaria Elimination Roadmap for the Asia Pacific*, the goals of the *National Framework for Malaria Elimination in India 2016-2030* are:

- Eliminate malaria (zero indigenous cases) throughout the entire country by 2030; and
- Maintain malaria-free status in areas where malaria transmission has been interrupted and prevent re-introduction of malaria.

OBJECTIVES

The Framework has four objectives.

- Eliminate malaria from all 26 low (Category 1) and moderate (Category 2) transmission states/union territories (UTs) by 2022;
- Reduce the incidence of malaria to less than 1 case per 1000 population per year in all states and UTs and their districts by 2024;
- Interrupt indigenous transmission of malaria throughout the entire country, including all high transmission states and UTs (Category 3) by 2027; and
- Prevent the re-establishment of local transmission of malaria in areas where it has been eliminated and maintain national malaria-free status by 2030 and beyond.

STRATEGIC APPROACHES

1. Programme phasing

The epidemiological situation of malaria in India is diverse. States and UTs are presently in various stages of malaria elimination, based on differences in their eco-epidemiological settings, socioeconomic conditions, health system development and malaria control accomplishments. Bearing this in mind, it has been envisaged that malaria elimination in India will be carried out in a phased manner. Programme phasing is necessary, because certain parts of the country belong to different phases and malaria transmission must be lowered before it is possible and rational to investigate each case. This prioritization does not mean that efforts to eliminate malaria in low endemic areas (Category 1) will be put on hold, only that such efforts will go on simultaneously with efforts to reduce malaria transmission in high endemic areas (Category 3).

As detailed in Table 2 below, states/UTs will be subdivided into four categories with annual parasite incidence (API) as primary criteria and other malaria indicators such as the annual blood examination rate (ABER) and slide positivity rate (SPR) as secondary criteria. Subsequently, category specific milestones and targets will be set and specific strategies will be implemented. The category data on malaria for all 36 states and UTs is provided at Annex 7.

Table 2: Classification of states/UTs based on API as primary criteria

S. No.	Categories of states/UTs	Definition
1.	Category 0: Prevention of re-establishment phase	States/UTs with zero indigenous cases of malaria.
2.	Category 1: Elimination phase	States/UTs (15) including their districts reporting an API of less than 1 case per 1000 population at risk.
3.	Category 2: Pre-elimination phase	States/UTs (11) with an API of less than 1 case per 1000 population at risk, but some of their districts are reporting an API of 1/1000 or above.
4.	Category 3: Intensified control phase	States/UTs (10) with an API of 1 case per 1000 population at risk or above.

The intensified control phase will aim to bring malaria incidence down in all high-transmission districts (Category 3) to an API of less than 1 case per 1000 population at risk, when elimination can be considered.

In areas that are in the pre-elimination phase (Category 2), particular attention will be paid to revision of the surveillance system and development of an elimination programme that must be completed before entering into the elimination phase.

Setting up a case-and foci-based surveillance with population-based reporting from all public health facilities and full participation of the private sector assuming well developed health services, mandatory reporting of/notifying each case of malaria, and a strong conviction that nothing is being missed is crucial and a core function in the elimination phase (Category 1) states and UTs with an API of less than 1 case per 1000 population at risk in all districts.

Finally, all states/UTs which have achieved elimination through interruption of indigenous transmission of malaria will qualify for the prevention of re-establishment phase (Category 0), with the main focus on sustaining malaria elimination status and preventing onward transmission.

2. District as the unit of planning and implementation

Apart from the category to which they belong, each state/UT will be advised to further classify their districts so that even if a given state/UT is not yet in the elimination phase, but has some districts with an API of less than 1 case per 1000 population at risk, those district(s) may be considered eligible for initiating elimination phase activities provided they meet the secondary criteria. In addition, states/UTs may also sub-classify districts into community health centres, community health centres into primary health centres, primary health centres into sub-centres, and sub-centres into villages for localized planning and implementation.

Such an approach is necessary because of the tremendous variation in the epidemiological situation of malaria within each state/UT. A state/UT with an API of less than 1 case per 1000 population at risk may have several districts with very low API. Similarly, states/UTs with an overall API of less than 1 case per 1000 population at risk may have a few high transmission districts with an API of less than 1 case per 1000 population at risk or more. It warrants the tailoring of interventions to the local situation and as such, the district is considered to be a useful functional unit for planning as well as monitoring malaria elimination interventions.

3. Focus on high transmission areas

In the year 2014, five out of 36 states/UTs contributed to more than 70% of the total malaria cases in the country. These were Odisha (36%), Chhattisgarh (12%), Jharkhand (9%), Madhya Pradesh (9%) and Maharashtra (5%). Historically, the above mentioned states and north-eastern states such as Meghalaya, Mizoram, Nagaland, which have a wide coverage of forest, hilly, tribal and conflict-affected areas, contributed the majority of malaria in the country. An aggressive scaling up of existing interventions and intensification of all malaria control activities will be carried out in these high transmission areas. Intersectoral collaboration and partnerships will be strengthened for filling gaps in programme implementation wherever needed. Innovation,

research and regular progress monitoring will play a crucial role in reducing the high transmission of malaria in these areas.

4. Special strategy for *P. vivax* elimination

As per the World Malaria Report 2015, more than 80% of the global *P. vivax* burden is contributed by 3 countries including India.¹ *P. vivax* malaria is a serious challenge to malaria elimination efforts within the country due to a multitude of reasons. The parasite can survive in cooler climates, is less responsive to conventional methods of vector control, is more difficult to detect using conventional diagnostic tools, treatment of liver stage parasites requires a 14 day course of primaquine which can produce some serious side effects. Moreover, a significant proportion of *P. vivax* cases are being reported from urban areas. Special measures such as good quality microscopy to detect all *P. vivax* infections, operational research to estimate prevalence of G6PD deficiency in the population, appropriate vector control measures and ensuring good compliance to 14-day radical treatment with primaquine in affected individuals will be undertaken to address this challenge. Intensive measures to reduce malaria transmission in urban areas will also help to address the *P. vivax* burden in the country. These measures will be in line with the WHO technical brief on control and elimination of *P. vivax* malaria.²

MILESTONES AND TARGETS

The following time-frame, with milestones and targets, is proposed for implementation of the *National Framework for Malaria Elimination in India 2016–2030*.

By end of 2016

All states/UTs have included malaria elimination in their broader health policies and planning frameworks.

By 2020

- Transmission of malaria interrupted and zero indigenous cases and deaths due to malaria attained in all 15 states/UTs under Category 1 (elimination phase) in 2014 (base year).
- All 11 states/UTs under Category 2 (pre-elimination phase) in 2014 enter into Category 1 (elimination phase).
- Five states/UTs under Category 3 (intensified control phase) in 2014 enter into Category 2 (pre-elimination phase).

- Five states/UTs under Category 3 (intensified control phase) in 2014 reduce malaria transmission but continue to remain in Category 3.
- An estimated reduction in malaria of 15–20% at the national level compared with 2014.
- Additionally, progressive states with strong health systems such as Gujarat, Maharashtra and Karnataka may implement accelerated malaria elimination programmes to achieve interruption of transmission and demonstrate early elimination followed by sustenance of zero indigenous cases.

By 2022

- Transmission of malaria interrupted and zero indigenous cases and deaths due to malaria attained in all 26 states/UTs that were under Categories 1 and 2 in 2014.
- Five states/UTs which were under Category 3 (intensified control phase) in 2014 enter into elimination phase.
- Five states/UTs which were under Category 3 (intensified control phase) in 2014 enter into pre-elimination phase.
- An estimated reduction in malaria of 30–35% at the national level compared with 2014.

By 2024

- All states/UTs and their respective districts reduce API of less than 1 case per 1000 population at risk and sustain zero deaths due to malaria while maintaining fully functional malaria surveillance to track, investigate and respond to each case throughout the country.
- Transmission of malaria interrupted and zero indigenous cases and deaths due to malaria attained in all 31 states/UTs.
- Five states/UTs which were under Category 3 (intensified control phase) in 2014 enter into elimination phase.

By 2027

The indigenous transmission of malaria in India interrupted.

By 2030

- The re-establishment of local transmission prevented in areas where malaria has been eliminated.
- The malaria-free status maintained throughout the nation.
- India initiates the process of WHO certification of malaria elimination.

KEY INTERVENTIONS

In order to attain the stated goals, objectives, milestones and targets formulated under this national Framework, key interventions and their specific packages have been identified. All activities, milestones and targets envisaged under the national Framework are in line with global and regional goals set under the GTS, the *APLMA Roadmap for Malaria Elimination Roadmap* and the *Action and Investment to defeat Malaria 2016- 2030* document and in line with national goals and targets set under the *Strategic Action Plan for Malaria Control in India 2012–2017*, the National Health Policy 2002, and India's planning and development cycle. However, these may be modified for implementation purposes as per feasibility.

In order to succeed, the *National Framework on Malaria Elimination in India 2016–2030* has been translated into a national plan of action by establishing category specific interventions. These interventions will be detailed in an operational manual for malaria elimination which will serve as a practical guide for implementation of this Framework. The specific objectives and key interventions recommended for each category are detailed below.

Category 3 (Intensified Control Phase)

The specific objectives and key interventions recommended for Category 3 (intensified control phase) states/UTs are detailed in Table 3.

Table 3: Specific objectives and key interventions in intensified control phase

Specific Objectives	Key Interventions
• Achieve universal coverage with malaria preventive and curative services. • Establish an efficient system to reduce ongoing transmission of malaria. • Reduce malaria-specific morbidity and mortality. • Contain and prevent possible outbreaks of malaria, particularly among non-immune high risk mobile and migrant population groups. • Emphasize reducing malaria morbidity and mortality in high transmission pockets such as tribal, hilly, forested and conflict affected areas.	• Massive scaling up of existing disease management and preventive approaches and tools, aimed at a significant reduction in the prevalence and incidence of malaria as well as associated deaths. • Screening of all fever cases suspected for malaria. • Classification of areas as per local malaria epidemiology and grading of areas as per risk of malaria transmission followed by implementation of tailored interventions. • Strengthening of intersectoral collaboration. • Special interventions for high risk groups such as tribal populations and populations residing in conflict affected or hard-to-reach areas. • One-stop centres or mobile clinics on fixed days in tribal or conflict affected areas to provide malaria diagnosis and treatment, and increasing community awareness with the involvement of other agencies and service providers as required. • Timely referral and treatment of severe malaria cases to reduce malaria-related mortality. • Strengthening all district and subdistrict hospitals in malaria endemic areas as per Indian Public Health Standards with facilities for management of severe malaria cases. • Establishment of a robust supply chain management system. • Maintenance of an optimum level of surveillance using appropriate diagnostic measures. • Equipping all health institutions (primary health care level and above), especially in high-risk areas, with microscopy facilities and RDTs for emergency use and injectable artemisinin derivatives for treatment of severe malaria.

Category 2 (Pre-elimination Phase)

The states/UTs in pre-elimination phase are those close to entering the elimination phase. Therefore, malaria elimination interventions will be introduced with particular focus on setting up an elimination surveillance system and initiating elimination phase activities in those districts where the API has been reduced to less than 1 case per 1000 population at risk per year. The planning of elimination measures will be based on epidemiological investigation and classification of each malaria case and focus.

Table 4: Specific objectives and key interventions in elimination phase

Specific Objectives	Key Interventions
• Interrupt transmission of malaria. • Immediately notify each detected case. • Detect any possible continuation of malaria transmission. • Determine the underlying causes of residual transmission. • Forecast and prevent any unusual situations related to malaria, ensure epidemic preparedness and respond in a timely and efficient manner to outbreak situations. • Prevent re-establishment of local transmission of malaria. • Ascertain elimination of malaria.	• In elimination areas, where transmission is focal and incidence/risk has become extremely low, all efforts will be directed at interrupting local transmission in all active foci of malaria. • Mandatory notification of each case of malaria from the private sector, other organized government sectors or any other health facility. • Adequate case-based surveillance and complete case management established and fully functional across the entire country to handle each case of malaria. • Investigation and classification of all foci of malaria. • A strict total coverage of all active foci by effective vector control measures. • Early detection and treatment of all cases of malaria by means of active and/or passive case detection to prevent onward transmission. • State and national level malaria elimination database established and operational. • Implementation of interventions for effective screening, management and prevention of malaria among mobile and migrant populations. • Establishment of an effective epidemic forecasting and response system. • Ensuring rigorous quality assurance of all medicines and diagnostics. • Setting up a national-level reference laboratory which will serve the following two functions. — All positive and a fixed percentage of negative slides will be referred to this laboratory for confirmation of diagnosis and cross-checking. After elimination has been achieved in each State/UT, 100% of cases will be notified to this laboratory for confirmation of diagnosis. The laboratory will be notified immediately on all positive cases of malaria by each state/UT through either SMS, e-mail or telephone with information on name, gender, address (village and district), date and type of testing and type of parasite for each positive case of malaria so that a national level database can be maintained. — Training of master trainers and accreditation/certification of microscopists as per Indian Public Health Standards shall also be undertaken at this laboratory. • During investigation of foci, all suspected cases of malaria are to be screened for malaria. These could include household members, neighbours, schoolchildren, workplace colleagues and relatives. • Surveillance of special groups, migrant populations or populations residing in the vicinity of industrial areas are also to be covered under surveillance operations.

Category 1 (Elimination Phase)

The specific objectives and key interventions recommended for the Category 1 (elimination phase) states/UTs are detailed in Table 4 above.

Category 0 (Prevention of Re-establishment Phase)

The probability of malaria becoming re-established in a malaria free area varies with the level of receptivity and vulnerability of the area. If either of these factors is zero, the probability of malaria becoming re-established is zero even if the other factor has a high value. When importation of malaria due to the arrival of migrants from a malaria area coincides with increase in receptivity because of halted vector control measures or socioeconomic development of an area for example, re-establishment of malaria transmission is possible. In the absence of appropriate action, the area is likely to become malarious again and the duration is determined by the level of receptivity and vulnerability.

When any area, whether a state/UT or a district within a state/UT, has achieved malaria elimination, the specific objectives will be as follows:

- detect any re-introduced case of malaria;
- notify immediately all detected cases of malaria;
- determine the underlying causes of resumed local transmission;
- apply rapid curative and preventive measures;
- prevent re-introduction and possible re-establishment of malaria transmission; and
- maintain malaria-free status in these areas.

Cross-cutting interventions

Some interventions will be common to all categories of states/UTs and are detailed below.

Policy and planning

1. Formation of a National Malaria Elimination Committee comprising of representatives from NVBDCP, WHO, research institutions, academia, private and civil society stakeholders for oversight of all malaria elimination activities in the country.

2. Form a technical working group as part of the National Malaria Elimination Committee for formulation of relevant policies and guidelines as well as for regular monitoring of progress towards elimination and prevention of re-introduction in areas which have achieved elimination.
3. Revision of national guidelines for vector control, quality assurance, intersectoral collaboration, information, education and communication (IEC)/behaviour change communication (BCC) and other relevant areas for prevention, intensified control and elimination of malaria.
4. Revision of national or state level policy/legislation for all states and UTs planned for elimination to classify malaria as a notifiable disease.
5. Formulation of a new surveillance and reporting strategy on the lines of China's '1-3-7' strategy¹⁸ for case notification, diagnosis, treatment and follow-up at the community level in a time bound manner. This will be different for each category of state/UT and based on the lines of 3Ts or *Test, Treat and Track* approach.
6. Formulation of clear parameters for states/UTs to qualify for a certain category or transition from one category to another, as per stratification norms.
7. Verification of each state/UT for malaria elimination by the National Malaria Elimination Committee, based on fixed parameters.
8. Formulation of a mechanism for ensuring ownership of the programme by concerned authorities and participation of stakeholders at each level.

Monitoring and evaluation

1. Introduction of a new web-based reporting system to facilitate timely notification and analysis of malaria transmission.
2. Revision of monitoring and evaluation formats.
3. Estimation of vector control coverage, including long-lasting insecticidal mosquito net (LLIN) or insecticide treated nets (ITN) use and indoor residual spraying (IRS) coverage, in each state/UT at district, sub-district, block and village levels.
4. Use of an annual scoring system for evaluating progress against elimination milestones and targets at national, state and district levels.
5. Data validation by an external agency when any state/UT achieves malaria elimination or transitions from one category of malaria elimination into another.
6. Grading of all areas within a state/UT for endemicity or risk of malaria on the basis of fixed parameters.

Stratification

1. Stratification of all states/UTs into four categories based on their API, APER and SPR.
2. Sub-stratification of all districts within each state/UT using the same criteria.
3. Further stratification of CHCs, PHCs, SCs and villages within each district using the same criteria and implementation of strata-specific strategies.
4. Feasibility assessment of each state/UT before planning elimination.

Surveillance

1. Entomological surveillance: all entomological units in the country to be made functional and strengthened.
2. Strengthening of routine surveillance for reducing malaria transmission in high transmission areas, and establishing case-based surveillance as a core intervention for elimination areas.

Quality assurance

1. Quality assurance of all medicines, diagnostics, treatment and vector control supplies as per internationally accepted standards.
2. All malaria microscopy services in the country to be quality assured as per internationally accepted standards to ensure quality of services provided for malaria diagnosis.
3. All testing facilities for malaria across states/UTs to be part of a national quality management network.
4. Private sector laboratories providing malaria diagnosis in the country to be identified and laboratory technicians certified.

Intersectoral collaboration

1. Formulation of clearly defined roles and responsibilities for private providers, NGOs as well as other organized government sector organizations such as the Armed Forces, Central Reserve Police Force, Border Security Force.
2. District-wide mapping of all private hospitals and NGOs in all states/UTs.

3. Collaboration with private sector organizations and non-governmental organizations (NGOs) under the Corporate Social Responsibility (CSR) Act in every state/UT.
4. Training and refresher trainings (continuing medical education) of private practitioners in malaria diagnosis, treatment and reporting as per national guidelines.
5. Integration of data on malaria endemicity collected by private hospitals with the national Malaria Information System (MIS).
6. Advocacy with private hospitals and practitioners on a regular basis to ensure adoption of national guidelines for diagnosis and treatment of malaria.
7. Explore scope and establish collaboration with public works department for environmental management, meteorological department for early warning system for outbreaks, agricultural department for safe irrigation and agricultural practices, education sector for promoting awareness on malaria prevention and control, water department for safe water practices and tourism industry for preventing malaria in travellers and cross-border spread of malaria.

Cross-border collaboration

1. Screening of populations at international border crossings.
2. Training of security personnel at international border crossings with provision of diagnostic and treatment facilities.
3. Implementation of a mechanism for monthly data collection from international border areas and integration into national MIS.
4. Joint planning and implementation of malaria prevention and control activities with neighbouring countries.
5. Sharing of information and policies for malaria prevention and control with neighbouring countries.
6. Harmonization of policies and synchronization of activities for malaria elimination in bordering countries.
7. Support from multilateral agencies for facilitation of cooperation and information sharing between countries.

Initiatives for special population groups

1. Implementation of the Tribal Malaria Action Plan (TMAP) for intensification of malaria prevention and control activities in tribal and ethnic population groups spread across different states/UTs. A total of 96 districts with an API of more than 1 case per 1000 people at risk and a tribal population of more than 25% are being included under this plan for intensified control measures. The following areas will receive special emphasis under TMAP.
 - a. Strengthening of existing health systems and introduction of mobile-based surveillance where routine health services/facilities are not available.
 - b. On the spot, species-specific treatment of all positive cases of malaria with a full course of antimalarials as per NVBDCP guidelines.
 - c. Referral of severe cases to referral centre/district hospital/any other health facility.
 - d. Follow-up of all positive cases to ensure completion of treatment, and integrated vector management for appropriate vector control.
 - e. Prioritization of villages according to degree of risk, for example, a high proportion of *Pf* cases, type of vectors, forest-based economy or outdoor sleeping habits for appropriate vector control measures (IRS/LLIN or treatment of community-owned bed nets with insecticides).
 - f. Social marketing to increase usage of bed nets and community mobilization by utilizing traditional IEC/BCC tools and practices.
2. Provisions for screening of mobile or migrant workers in each state/UT.
3. Formation of community action groups for sensitization about malaria prevention, intensified control and elimination. These groups may comprise community volunteers such as NGO staff, teachers or local leaders.
4. Training of mobile or migrant workers, military personnel, tribal or other population groups in malaria diagnosis and treatment.
5. Instituting a mechanism for systematically collecting data from these population groups.
6. Consideration of providing treatment to clinically indicative cases or standby treatment for small isolated population groups especially in hard-to-reach areas.

IEC/BCC

1. Revision of IEC/BCC strategy with special emphasis on malaria elimination.
2. This strategy will be tailored according to the endemicity of malaria in a region, i.e. different strategies for low and high transmission settings, target groups as well as media habits of different target groups.

Innovation

1. Vector control
 - a. Promotion of LLINs using new approaches such as community awareness campaigns, regular surveys to assess utilization of LLINs by community health volunteers.
 - b. Use of alternative methods of community-based vector control such as personal repellents, mosquito proofing of houses, use of vapour-phase insecticides, insecticidal wall linings, as per available evidence on their effectiveness on pilot basis in selected areas, according to indoor/outdoor transmission pattern of malaria. The decision regarding future use of these methods within the programme will be based on the outcome of such pilot studies.
 - c. Integration of malaria control into agricultural practices.
 - d. Experimental hut facilities may also be established at one or two sentinel sites in each state/UT with relevant vector species for testing the efficacy of different vector control interventions.
2. To address malaria in outbreak and other special situations, Standard Operating Procedures for outbreaks and other situations such as in the case of a natural disasters or emergencies, will be formulated and circulated to states/UTs.
3. Avenues for innovative financing to be explored for increasing and sustaining investments in malaria elimination efforts.
4. Innovative ways of service delivery such as integration with Ministry of Tribal Affairs for providing services to tribal populations, collaboration with NGOs, community-based organizations, other ministries and private sector organizations for reaching populations in hard-to-reach and conflict affected areas.

Capacity building

1. Preparation of annual training curricula and schedules for health officials at different implementation levels.
2. Review of training status and schedules by programme twice annually.
3. Identification and training of a group of national level trainers in areas such as programme implementation, management, supervision, quality assurance and supply chain management.

Research

1. Facilitating research on devising methods to increase efficacy of IRS/LLIN such as through use of enhanced ingredients and new formulations.
2. Surveys by states/UTs on behaviour of mosquito vectors to better inform choices of vector control methods in different settings such as studies of vector feeding and resting behaviour, malaria vector population dynamics.
3. Surveys on community behaviour such as resource use, means of livelihood, patterns of sleeping for better tailored IEC/BCC strategies and prevention, intensified control and elimination of malaria in different population groups.
4. Longitudinal surveys on malaria vector population dynamics, community or district-based mosquito trapping schemes.
5. Research on drug resistance monitoring, therapeutic efficacy studies.
6. Cost-benefit analysis of interventions used for malaria elimination once every five years.

4. MEASURING PROGRESS AND IMPACT

Implementation of the *National Framework for Malaria Elimination in India (2016–2030)* will be evaluated at regular intervals for compliance with milestones, targets and objectives to be achieved. Parameters will be established to monitor and evaluate all programme areas, with a particular focus on monitoring the operational aspects of the programme such as: coverage and quality of interventions; measuring operational and epidemiological indicators to ensure that programme activities are yielding desired results in achieving milestones, targets and objectives; documenting progress towards malaria elimination; and advising on revisions in policies and strategies when needed.

National and state level independent malaria elimination committees will be set up to oversee progress towards reaching elimination goals. An elimination database that can serve as the state- and national repository for all information related to malaria elimination will also be established. Table 5 summarizes the minimal set of key indicators that will be used to measure the country's progress towards elimination at national and subnational levels. Details of monitoring indicators by category will be provided in the Operational Manual for Malaria Elimination.

Table 5: Key indicators to measure progress towards malaria elimination

S. No.	IMPACT
1.	Number and incidence rate of confirmed malaria cases classified according to sex, age, parasite species and other relevant parameters.
2.	Number and incidence of severe malaria cases as well as case fatality rate.
3.	Number of malaria cases in pregnancy.
4.	Number and type of malaria foci (in areas eligible for elimination).
5.	Number of confirmed deaths due to malaria.
6.	Number of states/UTs which have eliminated malaria and are currently in the phase of prevention of re-establishment of local transmission.
7.	Number of states/UTs which are in elimination phase.
8.	Number of states/UTs which are in pre-elimination phase.
9.	Number of states/UTs which are in intensified control phase.
	OUTCOME
10.	Proportion of population at risk who slept under an insecticide-treated net/LLIN the previous night.
11.	Proportion of population at risk protected by indoor residual spraying within the past 12 months.
12.	Proportion of patients with confirmed malaria who received anti-malarial treatment as per national policy.
13.	Proportion of cases investigated and classified (in areas eligible for elimination).
14.	Proportion of foci investigated and classified (in areas eligible for elimination).
15.	Proportion of expected monthly reports received from health facilities at the national and subnational level.

5. COST OF IMPLEMENTING THE FRAMEWORK

BACKGROUND

Besides being a major health problem, malaria also adversely affects the socioeconomic conditions of communities. Regions affected by malaria are not only poor, but economic growth in these areas has been dismal. Estimates show that growth of per capita income (1965–1990) in countries with a high burden of malaria has been 0.4% per year, whereas the average growth for other countries has been 2.3%, over 5-fold higher. It has also been estimated that a 10% reduction in malaria is associated with 0.3% increase in growth¹⁹.

In May 2015, the *Global Technical Strategy for Malaria 2016–2030* (GTS) was adopted by the World Health Assembly. The GTS provides a comprehensive framework to guide countries in their efforts to accelerate progress towards malaria elimination. The cost of implementing the GTS was estimated at about US\$ 101.8 billion over 15 years. By 2020, global investments of US\$ 6.4 billion in malaria control would be required, compared to the current level of US\$ 2.5 billion as estimated in 2015. By 2025, the annual requirement is estimated at US\$ 7.7 billion, and by 2030, US\$ 8.7 billion. A further estimated US\$ 673 million is also needed each year to fund malaria research and development.

The benefits of investing in malaria control are described in the *Action and Investment to Defeat Malaria 2016–2030 (AIM)*³ document developed by the Roll Back Malaria Partnership. The AIM document estimates that the GTS implementation will translate into US\$ 4 trillion of additional economic output over the 2016–2030 timeframe. The global return on investment is estimated at 40:1.

EXPECTED BENEFITS OF INVESTING IN MALARIA ELIMINATION IN INDIA

In 2012, it was estimated that the total economic burden of malaria in India was around US\$ 1940 million, with 75% from lost earnings and 25% from treatment costs borne by households⁴. Besides saving lives, eliminating malaria in India would also avert these socioeconomic losses.

Estimates for India during the late 90's, showed that for every Rupee invested in malaria control a direct return of Rupees 19.70 could be expected²⁰. This means that implementing the malaria elimination framework 2016-2030 would bring benefits at least 20 times greater than the total investments made or the total estimated cost of implementing this Framework.

It is expected that cost sharing would be possible between different agencies, sectors, states, local governments and centers.

THE WAY AHEAD

To eliminate malaria from India by 2030 will require additional resources. At present, public spending on malaria control in India represents a small proportion of the country's overall expenditure on health¹⁹. There may be scope to increase the funding to a level that will reduce significantly the burden currently being placed on households by their out-of-pocket payments for the diagnosis and treatment of malaria. In 2016, a costing exercise based on the all the above mentioned factors will be done for estimating the total cost as well as expected benefits of implementing the Framework and achieving elimination in India.

6. NEXT STEPS

This Framework will serve as a guide for states and UTs for planning malaria elimination. The strategy detailed under this national policy document will be helpful for the states/UTs in rolling out specific interventions for eliminating malaria.

After launching of the NFME 2016–2030, a consultation will be held with states and UTs for finalization of the Operational Manual for Malaria Elimination. This manual will provide category-specific details on guidelines and packages of interventions for implementation of the national Framework. Subsequently, a Strategic Action Plan 2016–2020 will be developed for rolling out malaria elimination activities with details of finance, human resources, capacity building, supply and logistics etc. States and UTs will then prepare their annual action plans based on these guidelines and restructure their programmes to achieve stated goals for elimination.

One of the key priorities for this Directorate would be to secure and sustain adequate financial resources for implementing the elimination programme through domestic funding. Additionally, innovative financing models, partnerships and integration with other government departments will also be explored.

For overall guidance and monitoring of progress towards elimination, a National Malaria Elimination Committee and National Malaria Elimination Technical Working Group will be constituted with representatives from different stakeholders. Similarly, a Malaria Elimination Committee and a Malaria Elimination Taskforce will be constituted at the state as well as district levels.

Since monitoring and evaluation will be a key component in all planning activities, the national monitoring and evaluation database will be strengthened. All states and UTs eligible for elimination in the first phase will undergo data validation and situation assessment followed by signing of a memorandum of understanding (MoU) with states/UTs eligible for elimination. Engagement with private sector and other organized government sector organizations such as the Indian Medical Association, medical colleges, railways etc. will be established on priority basis for integration of various aspects of the programme.

The first five years after launching the Framework would be crucial as all activities shall be intensified in this time period to gain maximum mileage from advocacy, commitment and ownership and of all stakeholders on malaria elimination.

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Annex 1

India Country Profile

India is the largest democracy and the second most populous country of the world with a population of more than 1.2 billion. It is located in South-East Asia bordering Sri Lanka (South), Pakistan (North-West), China (North and North-East), Nepal (North), Bhutan (North), Myanmar (East) and Bangladesh (East). It is the seventh-largest country in the world in terms of land area and hosts a variety of geographical and topographical conditions including high mountains, plateaus, wide plains and two groups of islands, namely Lakshadweep in the Arabian Sea and Andaman & Nicobar Islands in the Bay of Bengal. The country has four major seasons namely winter (January–February), summer (March–May), monsoon (June–September) and post- monsoon period (October–December).

India operates under a federal or quasi-federal system of governance as per the Constitution of India, which is the country's supreme legal document. The sex ratio, according to the Census 2011, is 943 females per 1000 males with an overall literacy rate of 73%. The population is extremely diverse with a mix of people from various religions including Hindus, Muslims, Christians, Sikhs, Jains, Zoroastrians, Bahais, and Buddhists among others. The country is divided into 29 states and 7 union territories (UTs), making a total of 36 sub-national units. Each state and UT is further divided into administrative districts and/or towns. These districts are divided into sub-districts, blocks or *tehsils* which are further sub-divided into villages. As per Census 2011, there are 640 districts, 5924 sub-districts, 7933 towns and 640 930 villages in the country.

8.6% of India's population is tribal, 11.3% in rural areas and 2.8% in urban areas. The Infant Mortality Rate (IMR) of India is 42 per 1000 live births; Maternal Mortality Ratio (MMR) is 178 per 100 000 live births; Under Five Mortality Rate (U5MR) is 52 per 1000 live births; Crude Birth Rate (CBR) is 21.6 per 1000 population; and Crude Death Rate (CDR) is 7 per 1000 population as per the Annual Health Report 2013–2014 of the National Health Mission (NHM) for data available till 2012.

Annex 2

History of Malaria Control in India

In the early 1900s, malaria control operations in India were centred on vector control, particularly the use of anti-larval operations. These operations were mainly initiated in areas of economic importance such as tea gardens and railways, and areas with presence of military and paramilitary personnel. Space spraying with pyrethrum extract was added as a control intervention only around the 1930s when evidence in favour of the same emerged from other countries. In the pre-National Malaria Control Programme (NMCP) phase around the year 1947, 22% of the country's population suffered from malaria, i.e. there were a total of 75 million cases and 0.8 million deaths due to malaria in a population of about 344 million. Soon after the Second World War, when DDT was released for use in public health, several successful trials demonstrating the effect of DDT spraying on malaria control were conducted in the country. This was followed by the launching of the National Malaria Control Programme (NMCP) in 1953. Indoor residual spraying, monitoring and surveillance of cases and antimalarial treatment of patients were the key activities implemented under this programme.

This programme achieved remarkable results in causing a decline in malaria-related morbidity and mortality so that nearly 165 million people were protected and there was a general reduction in malaria epidemiological parameters. Around this time however, reports of DDT resistance in anopheline mosquitoes started emerging from countries across the globe and as a result, the focus of the malaria programme was shifted from control to eradication and the *National Malaria Eradication Programme (NMEP)* was launched in India in 1958.

In accordance with WHO's malaria eradication policy, the NMEP comprised four phases: the preparatory phase, attack phase, consolidation phase and maintenance phase. By 1965, there was such a drastic reduction in malaria incidence that only 0.02% percent of the population suffered from malaria, i.e. there were only 0.1 million cases of malaria with nil deaths in a population of nearly 466 million.

However, an increasing trend of malaria was observed in some towns/cities which led the Madhok Committee (1969) to recommend implementation of effective anti-larval measures in urban areas. Accordingly, the Urban Malaria Scheme (UMS) was launched in 1971. However, for various reasons, including slow development of health infrastructure, sub-optimal monitoring, and logistics issues, there was a reintroduction and large scale resurgence of malaria. By 1976, there were over 6 million malaria cases reported from different parts of the country.

Subsequently, a revised strategy named the *Modified Plan of Operations (MPO)* was launched in 1977 with a three-pronged strategy: government efforts, malaria research and public

participation. In its first few years, MPO was a 100% centrally sponsored programme, but with the passage of time programme expenditure was shared on a shared equally between the centre and states by the 1980s. By 1984, the incidence of malaria had come down to nearly 2 million cases and 247 deaths.

In the following years, malaria control projects were launched in selected high endemic areas of the country with funds from the World Bank and the Global Fund. Monovalent RDTs were introduced in 2005, followed by the introduction of LLINs in 2009 and bi-valent RDTs in 2013. The key milestones in the evolution of India's malaria control programme are listed in Table 6 below.

Table 6: Milestones in the Malaria Control Programme in India

Prior to 1940	No organized national malaria control programme
Prior to 1953	Estimated malaria cases in India: 75 million; estimated deaths due to malaria: 1 million
1953	Launching of National Malaria Control Programme (NMCP)
1958	Launching of National Malaria Eradication Programme (NMEP)
1965	Cases reduced to 0.1 million
Early 1970's	Resurgence of malaria
1971	Urban Malaria Scheme launched
1976	Malaria cases 6.46 million; highest in post DDT era
1977	Modified Plan of Operations (MPO) implemented
1984–1998	Annual incidence of malaria restricted to 2 to 3 million cases
1995	Modified Action Plan for malaria control implemented
1997	World Bank assisted Enhanced Malaria Control Project (EMCP) launched
1999	Renaming of programme to National Anti-Malaria Programme (NAMP)
2002	Integration of malaria control programme into the National Vector Borne Disease Control Programme (NVBDCP)
2005	RDT (monovalent) introduced in the programme
2005	Global Fund assisted Intensified Malaria Control Project (IMCP)
2006	ACT introduced in areas showing chloroquine resistance in falciparum malaria
2008	Revised NVBDCP Drug Policy, ACT introduced in high <i>Plasmodium falciparum</i> predominant districts
2008	World Bank assisted National Vector Borne Disease Control Support Project
2009	LLIN introduced, oral artemisinin monotherapy banned in the country
2010	Revised NVBDCP Drug Policy 2010 extending ACT for all <i>Plasmodium falciparum</i> cases. Global Fund (Round 9) assisted Intensified Malaria Control Project (IMCP-II)
2013	RDT (bi-valent) introduced in the programme, National Drug Policy for Malaria Cases introduced ACT-AL in north-eastern states
2014–2015	Newer insecticides and larvicides introduced

Annex 3

Overview of the National Vector Borne Disease Control Programme

The Programme

The Directorate of NVBDCP is an umbrella programme for the prevention and control of six vector borne diseases namely malaria, dengue, chikungunya, Japanese encephalitis, kala-azar and lymphatic filariasis. This programme is an integral part of India's National Health Mission (NHM). NVBDCP is responsible for framing technical guidelines and policies for guiding the states towards implementation of disease specific strategies for prevention and control of these vector borne diseases. It is also responsible for budgeting and planning the logistics pertaining to the central sector. It also provides financial and commodity assistance to states for programme activities as per approved pattern. The implementation of the programme is the responsibility of states. The Directorate carries out evaluation of programme implementation from time to time.

Government of India also has 19 Regional Offices for Health and Family Welfare (ROHFW), located in 19 states. One or more states are covered under the jurisdiction of each ROHFW. They perform a vital role in monitoring of NVBDCP activities in the states. Besides conducting entomological studies (in collaboration with the states), these regional offices also perform therapeutic efficacy studies in collaboration with the National Institute of Malaria Research (NIMR), cross-checking of blood slides for quality control and capacity building at the state level along with monitoring and supervision of vector borne diseases.

The states are responsible for implementing the programme activities including monitoring in accordance with programme guidelines. Every state has a vector-borne disease control unit under its Department of Health and Family Welfare. It is headed by the State Programme Officer, who is responsible for day-to-day management. Each state has a State Health Society at the state level and District Health Society at district level through which funds are dispersed. They play a role in planning and monitoring of programme activities within the districts.

At the district level, the vector borne disease control programme is managed by the District Malaria Officer (DMO) or District Vector Borne Disease Control Officer (DVBDCO) in order to

synchronize prevention and control activities for all six vector borne diseases covered under the programme. The district level officers are under the control of the District Health Officer who has different designations in different states, such as Chief Medical Officer (CMO), District Medical Officer, Civil Surgeon and Chief Medical & Health Officer. The programme is also monitored under NHM through the District Health Societies under the chairmanship of respective District Collectors. Within the district, the staff under primary health care system is involved in implementation at block level through community health centre (CHC), at primary health centre (PHC), sub-centre (SC) and village level. The institutions created under NHM, such as Village Health Sanitation & Nutrition Committees (VHSNCs) and Accredited Social Health Activists (ASHAs), are involved at the grassroots level.

The key strategies for prevention and control of malaria under the NVBDCP, as per the Operational Manual for Implementation of Malaria Programme 2009, are:

1. Surveillance and case management
 - Case detection (passive and active)
 - Early diagnosis and complete treatment
 - Sentinel surveillance
2. Integrated vector management
 - Indoor residual spraying
 - Insecticide treated bed nets (ITNs)/Long-lasting insecticidal nets (LLINs)
 - Anti-larval measures including source reduction
3. Epidemic preparedness and early response
4. Supportive interventions
 - Capacity building
 - Behaviour change communication
 - Intersectoral collaboration
 - Monitoring and evaluation (M&E)
 - Operational and applied field research

Urban Malaria Scheme

There is an emerging problem of increasing malaria incidence reported from urban areas. This is due to a multitude of reasons. The proportion of urban population to the total population has increased in the last few decades due to rapid urbanization. Haphazard and unplanned growth of towns has resulted in creation of slums with poor housing and unsanitary conditions

promoting vector mosquito breeding potential for malaria, lymphatic filariasis and dengue. Restricted water supply has led to water storage practices in artificial containers which have generated breeding potential for *An. stephensi* vectors of urban malaria and *Ae. aegypti*, the vector of dengue.

The Urban Malaria Scheme (UMS) was launched in 1971. At present, the Urban Malaria Scheme covers a population of nearly 130.3 million vulnerable to malaria and other mosquito-borne diseases in 131 towns in 19 states and union territories. The scheme is soon to merge with the National Urban Health Mission as the Urban VBD Scheme, which will function as a part of NVBDCP. The main aim of this scheme is the reduction of malaria to a level in which populations can be protected from malaria transmission with available means. The two main aims of this scheme are to prevent deaths due to malaria and reduce transmission and morbidity.

The norms for towns to be included under this scheme are as follows:

- towns should have a minimum population of 50 000;
- API of towns should be 2 cases per 1000 population at risk or above; and
- towns should promulgate and strictly implement the civic by-laws to prevent/eliminate domestic and peri-domestic breeding places.

The two main malaria control strategies employed under UMS are parasite control and vector control.

- Parasite control through treatment of patients is done through hospitals and dispensaries in both the private and public sectors and by private practitioners. In mega cities, malaria clinics are established by each health sector/malaria control agency, such as municipal corporations, railway and defence services.
- Vector control is comprised of the following components:
 - Source reduction
 - Use of larvicides
 - Use of larvivorous fish
 - Space spraying
 - Environmental management and modification
 - Legislation

The control of urban malaria lies primarily in the implementation of urban bylaws to prevent mosquito breeding in domestic and peridomestic areas, or residential blocks and

government/commercial buildings and construction sites. Use of larvivorous fish in the water bodies such as slow moving streams, lakes, ornamental ponds, is also recommended. Larvicides are used for water bodies unsuitable for larvivorous fish. Awareness campaigns are also undertaken by municipal bodies and urban area authorities.

Urban malaria has seen a fluctuating trend over the last decade. There was a steady decline in cases from 150 917 in 2004 to 102 829 in 2007 followed by an increase in cases from 115 424 in 2008 to 220 062 in 2010. Subsequently, the cases dropped to 65 568 in 2013 followed by another upsurge in 2014 when cases increased to 142 376. The number of deaths due to malaria has been consistently declining from 213 in 2009 to 21 in 2014. *Plasmodium vivax* contributes to a major proportion of malaria reported from urban areas responsible for 85-90% of all cases.

Programme monitoring

Apart from routine monitoring and surveillance operations, a number of programmatic reviews are conducted from time to time to assess progress against milestones and targets and identify gaps in implementation. Common Review Missions and Joint Monitoring Missions are two such pertinent reviews through which teams of experts visit different parts of the country periodically and conduct in-depth analysis of various programmatic aspects.

NVBDCP organized its most recent Joint Monitoring Mission (JMM) in 2014 during which key recommendations regarding programme policy and implementation were suggested, to address the public health impact of major vector borne diseases in India.

The Mission was conducted from March 1 to March 10, 2014 and its key objective was to review the country's progress towards the malaria-related Millennium Development Goals (MDGs) and targets defined in the National Strategic Plan, Result Framework Document and National Health Policy 2002. It also aimed to provide inputs on strategic approaches and innovative mechanisms for achieving the key targets of the 12th Five Year Plan. The outcome of the JMM aims to provide high-level advice to the Government of India and partners on strategic issues and for improving integration of vector borne diseases with the general health system in the country.

The action points of the JMM 2014 re-emphasized some of the recommendations made in the previous review held in 2007. Additionally, new action points were proposed on both the strategies and policies and on delivery mechanisms to help improve access by marginalized populations to the best available disease control options. Action points are meant to stimulate leadership in the states that have not been performing well, to consolidate the achievements in states that are on track and to help the best performing states go beyond the current targets.

Some key recommendations for malaria from the JMM 2014 include initiation of replacement of ACT to minimize risk of emergence of or importation of artemisinin resistance, strengthening of quality assurance mechanisms, collaboration with the private sector, strengthening of and systematic use of vector control measures, strengthening of surveillance and data analysis and formulating a plan for elimination. The next JMM can take place in 2016 in articulation with the National 13th five year planning exercise expected to start in 2016.

Governance and coordination

Under the overarching umbrella of the National Health Mission (NHM), a Technical Advisory Committee (TAC) on Vector Borne Diseases (VBDs) has been constituted with experts from various government and private institutions as members and Directorate General of Health Services (DGHS) as Chairman. The key functions of this committee include: review of entomological and epidemiological data on VBDs and suggest alternative methodologies; periodic review of the drug policy and suggestion of alternative drugs for the treatment of malaria and other VBDs; review and suggest diagnostics and case management practices for all VBDs; and review of preventive measures, and suggestions on mid-course changes in strategy as per evidence.

An Expert Committee on Malaria Diagnostics and Chemotherapy and Prospects of Malaria Elimination in the country is also in place with former Special DGHS as chairman and representatives from prominent research and academic institutions and private medical colleges as members. The key functions of the committee are deliberation on new developments in the field of antimalarials and diagnostic tools; assessment of feasibility of introducing these new drugs and diagnostics in the programme; review of current status of malaria in the country; control strategies and advice regarding clinical management of severe malaria in the light of latest scientific developments.

Apart from these committees, an Expert Committee on Vector Control has also been constituted for decisions and advice regarding use of various vector control tools and strategies in the national programme.

For decisions governing the use of DDT under the programme, a DDT Mandate Committee has been constituted with Secretary, Department of Health, Ministry of Health & Family Welfare as chairman and members from other government ministries and departments, such as planning commission, agriculture and biotechnology. This committee is responsible for specifying the parameters for use of DDT on the basis of annual review and identifying specific areas every year for the targeted use of DDT in the public health programme.

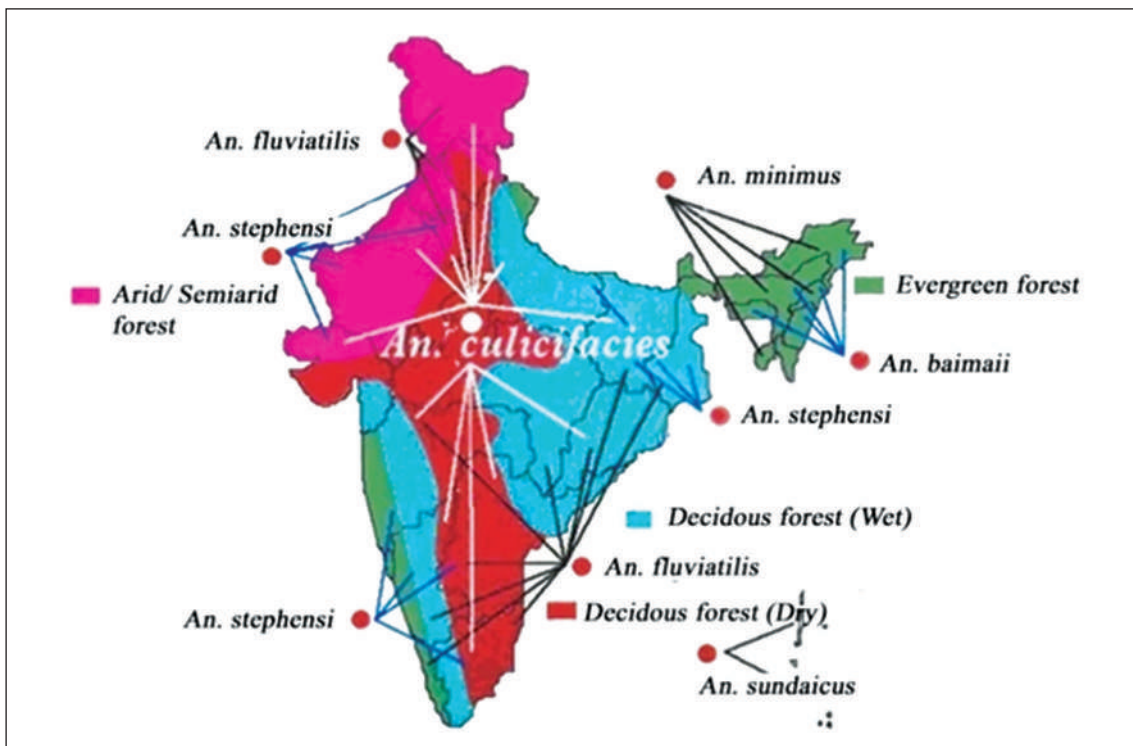
Annex 4

Current trends and epidemiological profile of malaria in India

Epidemiology

Malaria in India is mainly caused by two major malaria parasites namely *Plasmodium falciparum* and *Plasmodium vivax* (though cases of malaria from *Plasmodium ovale* and *Plasmodium malariae* have also been reported from some parts of the country). *P. falciparum* (Pf) and *P. vivax* (Pv) are the most common species causing malaria in the country. While *P. vivax* is more prevalent in the plains, *P. falciparum* predominates in forested and peripheral areas. The disease is transmitted by nine *Anopheline* species out of which the six primary vectors are *Anopheles culicifacies*, *Anopheles stephensi*, *Anopheles dirus*, *Anopheles fluviatilis*, *Anopheles minimus* and *Anopheles epiroticus* (previously known as *Anopheles sundaicus*).

Figure 1: Distribution of main malaria vectors in India



Source: National Vector Borne Disease Control Programme

Key characteristics of these vectors are summarized below.

- *An. culicifacies* is widespread in peninsular India. It is the main vector of malaria in rural plains areas and peri-urban areas. It is found in a variety of natural and man-made breeding sites. It is highly zoophilic as a result of which the presence of a high density of cattle relative to that of humans limits its vectorial capacity.
- *An. stephensi*, which often shares breeding sites with *An. culicifacies* has developed a strong propensity for artificial containers, and is responsible for malaria in urban and industrial areas.
- *An. fluviatilis* is the main vector of malaria occurring in hilly areas, forests and forest fringe areas in many states, especially in the eastern part of the country.
- *An. minimus* is the vector responsible for malaria occurring in foothills of north-eastern states of the country.
- *An. dirus*, an important forest vector in the North-East, is well known for its exophilic behaviour.
- *An. epiroticus*, a brackish-water breeder, is restricted to causing malaria in the UT of Andaman & Nicobar Islands.

At present, malaria affects all population groups in the country, regardless of gender or age, although children and pregnant women are at higher risk. The majority of malaria in India is reported from the eastern and central part of the country and from states which have large forest, hilly and tribal areas. These states include Odisha, Chhattisgarh, Jharkhand, Madhya Pradesh, Maharashtra and some north-eastern states like Tripura, Meghalaya and Mizoram. These states have more or less perennial transmission of malaria due to a number of factors, such as presence of large conflict-affected, hilly and forest areas with poor access and inadequate health infrastructure. Additionally, there is low community awareness on malaria prevention and control among the tribal population in these areas which makes the task of transmission reduction even more challenging.

On the other hand, in states and UTs with low levels of malaria transmission, the majority of the malaria occurs as a result of continuous influx of mobile and migrant populations from neighbouring moderate or highly endemic states and bordering countries.

During the months from June to September, the country experiences the monsoon season characterized by heavy rains across different states of the country. It is during these months that maximum transmission of malaria takes place. In the immediate post-monsoon period from October to December, collection of rainwater in pits and puddles promotes mosquito breeding and subsequently the transmission of malaria.

In India, DDT and hexachlorocyclohexane (HCH) were introduced for public health use (vector control) during the 1950s, and malathion was brought in for vector control during the

1960s. In 1997, HCH was banned from public health use and this insecticide is not used for vector control any more. Use of DDT and malathion continues in the NVBDCP, primarily for indoor residual spraying (IRS) and space spraying, respectively. Synthetic pyrethroids (SP) have been introduced during the last one and a half decades for IRS and impregnation of mosquito nets. This is the only insecticide group recommended for net treatment.

Currently, insecticides of the organochlorine (DDT), organophosphate (malathion) and synthetic pyrethroid (deltamethrin, cyfluthrin, lambdacyhalothrin, alphacypermethrin, permethrin, bifenthrin) groups are used for the control of vectors in India. Carbamates are not used as they are expensive and possess high mammalian toxicity..

Current trends

As per the World Malaria Report 2015¹, India accounts for 70% of the total malaria incidence in the South-East Asia Region. However, with 46% reduction in malaria-related morbidity and 40% reduction in malaria-related mortality between 2000 and 2014, the country could be well on its way to achieving Goal 6 of the Millennium Development Goals (MDGs) through a 50–75% reduction in malaria cases by 2015.

Data from 2014 shows the incidence of malaria is 0.89 per 1000 population at risk per year with 1.1 million cases and 562 deaths in a population of nearly 1.25 billion. In the last 10 years, total malaria cases declined by 42% from 1 915 363 in 2004 to 1 102 205 in 2014, combined with a 41% decline in malaria-related deaths from 949 to 562 (see Table 7 and Figure 3).

The geographic distribution of malaria is shown in Figure 4. In 2014, 26 states/UTs reported an API of less than or equal to one per 1000 population at risk in 2014, as compared to 23 states in 2013 and 21 states in 2012. Similarly, the number of districts with API less than or equal to one per 1000 population at risk has increased from 370 in 2000 to 492 in 2012, 516 in 2013 and 527 in 2014. There are a total of 660 reporting districts in the country and 17 other reporting units, making a total of 677 reporting units.

From 1999 to 2013, malaria cases were caused in almost equal proportions by *P. falciparum* and *P. vivax* (see Figure 2). The proportion of cases due to *P. falciparum* increased from 53% in 2013 to 66% in 2014. Out of 36 states/UTs, 24 reported an increase in the number of *P. falciparum* cases in 2014 compared to the previous year. At the same time, 28 out of 36 states/UTs reported a decrease in the total number of *P. vivax* cases in the same period.

The upsurge in malaria incidence in the country in 2014 can be attributed to a number of factors. Surveillance has risen by 10% in 2014 compared to 2013 because of greater involvement of ASHAs in community level diagnosis and treatment of malaria.

The use of bi-valent RDTs has also increased since their introduction in 2013. Outbreaks and focal upsurges have been reported from some parts of the country as a result of a number of factors including sub-optimal functioning of health systems, poor supply chain management and inadequate vector control.

The likely reason for the increase in *Pf* contribution to malaria is the overall increase in positive cases of malaria in high-endemic states such as Odisha, Chhattisgarh and Tripura, in which more than 80% malaria is due to *P. falciparum* cases. The highest proportions of *Pf* cases were in Odisha (45%), Chhattisgarh (19%) and Jharkhand (8%) in 2013, and Odisha (47%), Chhattisgarh (15%) and Tripura (7%) in 2014, respectively. Moreover, a large number of states with predominantly *P. vivax* infections have reported a decline in malaria incidence in 2014.

Additionally, there was an outbreak of malaria in the north-eastern state of Tripura in 2014. The state was in a transition phase of replacement of ACT-SP with ACT-AL, after reports of late treatment failures with ACT-SP. During this period, poor supply chain management leading to inadequate delivery of supplies to the peripheral areas, coupled with sub-optimal involvement of ASHAs, led to the upsurge in positive cases of malaria from this state.

Table 7: Epidemiological situation and indicators for malaria in India (2000–2014)

Year	Population (in thousands)	BSE	Positive Cases	Pf Cases	Pf %	ABER	API	SPR/ TPR	Deaths
2000	970 275	86 790 375	2 031 790	1 047 218	51.54	8.94	2.09	2.34	932
2001	984 579	90 389 019	2 085 484	1 005 236	48.20	9.18	2.12	2.31	1005
2002	1 013 942	91 617 725	1 841 229	897 446	48.74	9.04	1.82	2.01	973
2003	1 027 157	99 136 143	1 869 403	857 101	45.85	9.65	1.82	1.89	1006
2004	1 040 939	97 111 526	1 915 363	890 152	46.47	9.33	1.84	1.97	949
2005	1 082 882	104 143 806	1 816 569	805 077	44.32	9.62	1.68	1.74	963
2006	1 072 713	106 725 851	1 785 129	840 360	47.08	9.95	1.66	1.67	1707
2007	1 087 582	94 928 090	1 508 927	741 076	49.11	8.73	1.39	1.59	1311
2008	1 119 624	97 316 158	1 526 210	775 523	50.81	8.69	1.36	1.57	1055
2009	1 150 113	103 396 076	1 563 574	839 877	53.72	8.99	1.36	1.51	1144
2010	1 167 360	108 679 429	1 599 986	834 364	52.15	9.31	1.37	1.47	1018
2011	1 167 360	108 969 660	1 310 656	665 004	50.30	8.88	1.10	1.23	754
2012	1 210 913	109 031 706	1 067 824	534 695	49.98	9.00	0.88	0.98	519
2013	1 221 640	113 109 094	881 730	468 346	52.61	9.26	0.72	0.78	440
2014	1 234 995	124 066 331	1 102 205	722 546	65.55	10.05	0.89	0.89	562

BSE: Blood Smears Examined

ABER: Annual Blood Examination Rate

TPR: Test Positivity Rate

Figure 2: Distribution of malaria cases by parasite species (2000–2014)

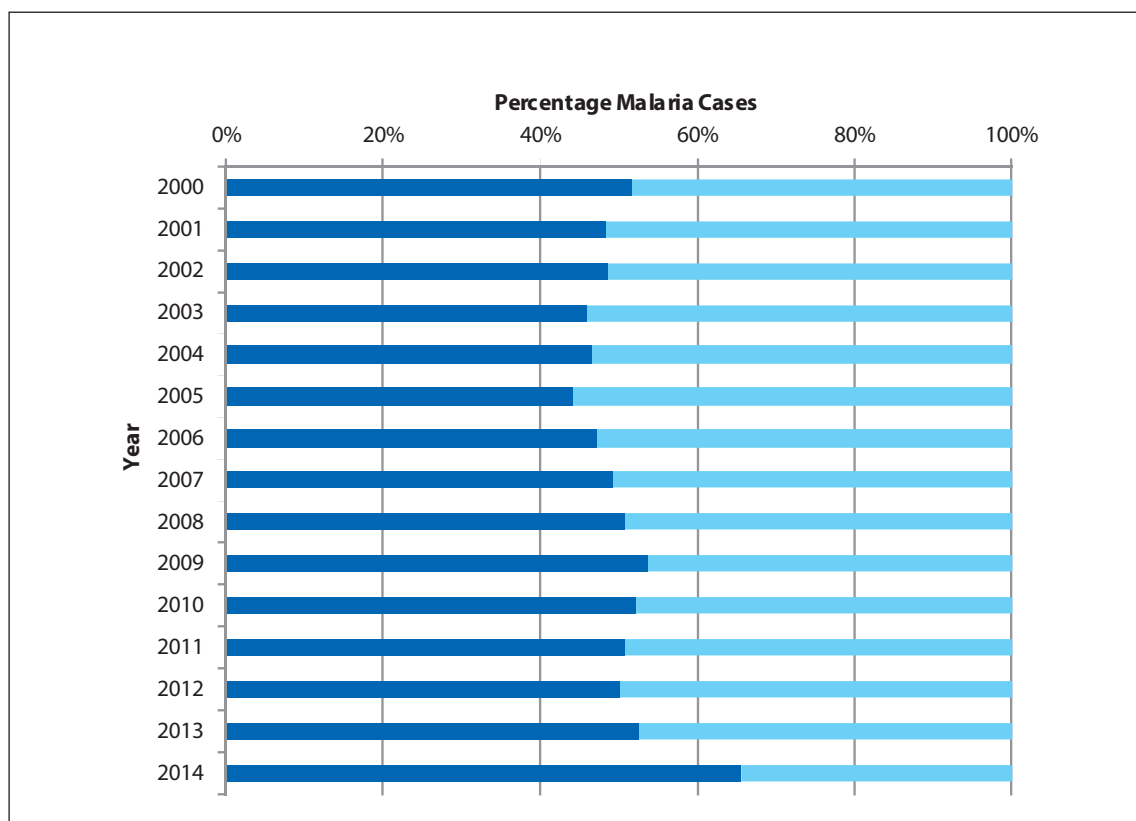


Figure 3: Trend of total malaria cases, *Pf* and *Pv* cases and deaths (2000–2014)

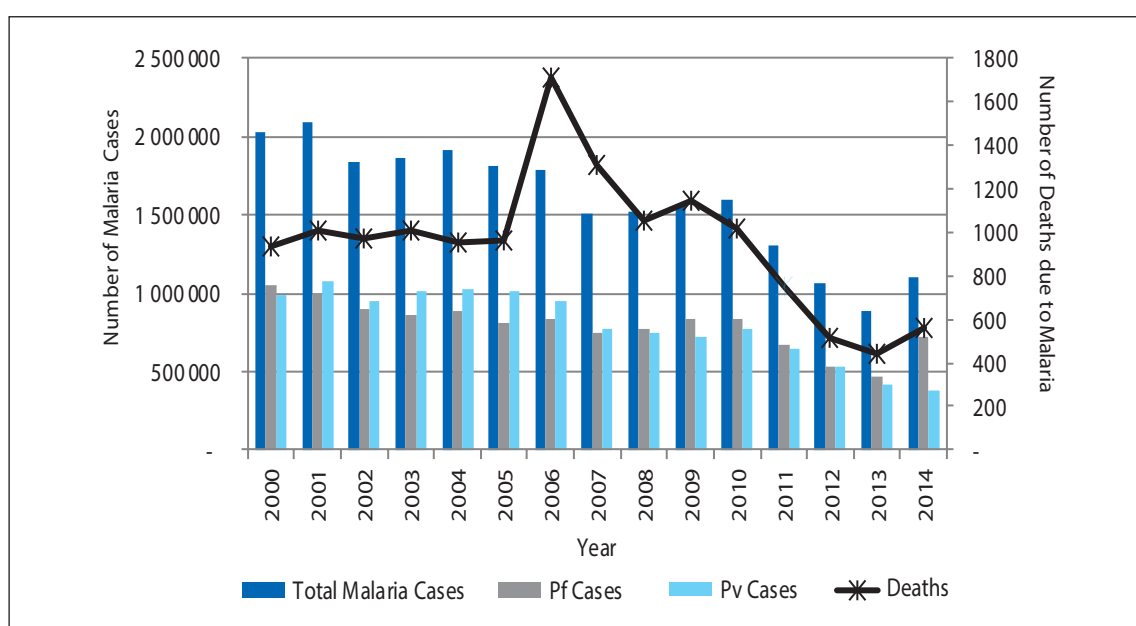
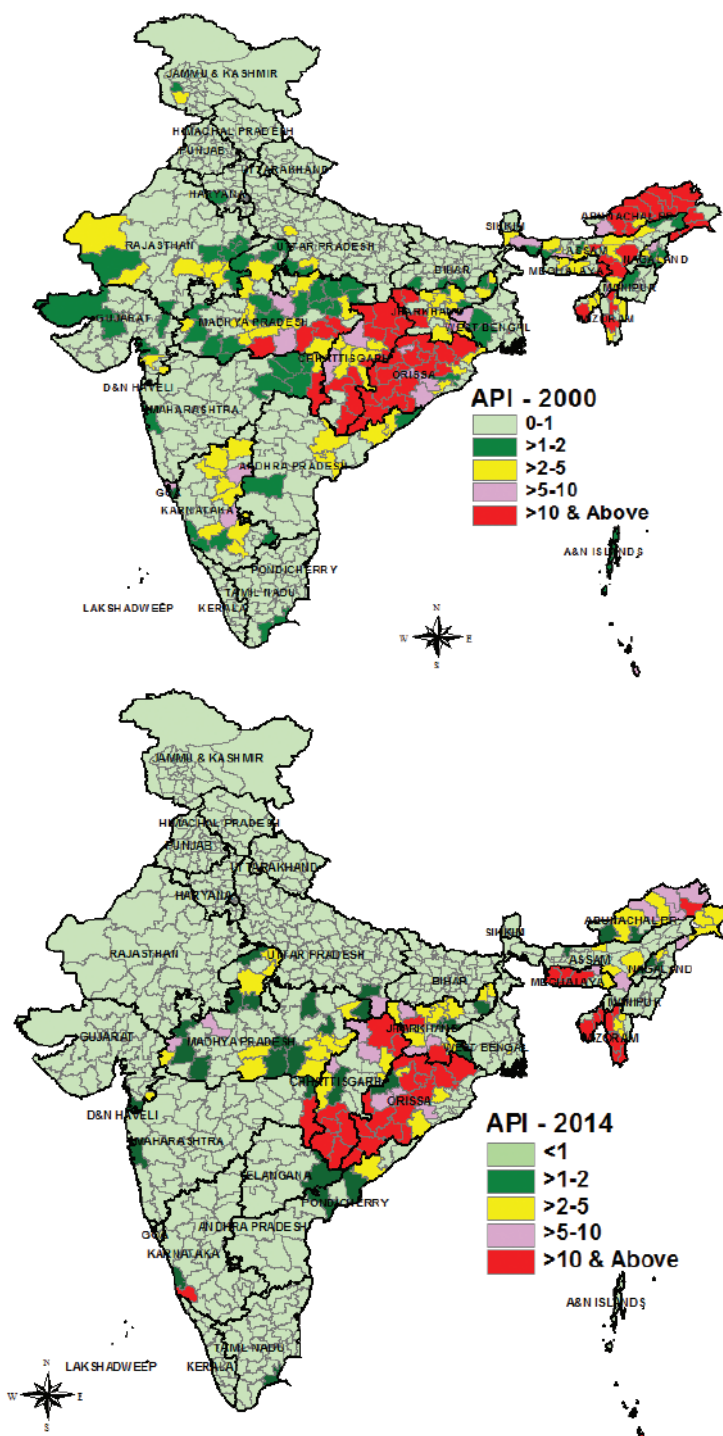


Figure 4: Geographic distribution of malaria incidence (API) in India (2000 and 2014)



Annex 5

Challenges in malaria control

The key challenges in malaria control can be summarized as follows.

1. Population movements, often uncontrolled across states/UTs, and sharing of large international borders with neighbouring malaria endemic countries

There are 36 states and union territories in India, most of which share large borders with each other. This often leads to the spread of malaria from one state to another due to movement of populations. With different administrative structures and variable functioning of health systems in each state, management of malaria in such mobile and migrant populations becomes difficult. Additionally, some of the high-endemic states including north-eastern states share their border with neighbouring countries such as Myanmar and Bangladesh where malaria is still prevalent and there is a persistent threat of influx of malaria cases from these countries. There is also a growing threat of the spread of malaria multi-drug resistance including ACT resistance as a result of sharing these international borders.

2. Shortage of skilled human resources

The programme is adversely affected by an insufficient number of sanctioned posts of health workers and other programme staff in different parts of the country. For instance, there are about 40 000 multipurpose health workers (MPWs) against approximately 80 000 sanctioned posts for nearly 150 000 sub-centres (SCs) across the country. Additionally, there is a shortage of qualified entomologists in the country leading to poor vector surveillance and a lack of robust data on entomological aspects of malaria.

3. Insecticide resistance

The extensive use of insecticides, particularly DDT, under the vector control programme controlled malaria to a great extent but exerted high selection pressure on the vector population to develop resistance. Among the six primary vectors of malaria in India, resistance to DDT has been widespread in *An. culicifacies* (district level), but malathion resistance in this species is localized and except for a few reports of reduced susceptibility this species remains largely susceptible to synthetic pyrethroids (see Table 8).

ANNEX 6

Malaria epidemiological situation by state/UT (2000, 2013 and 2014)

S. No.	State/UT	2000			2013			2014		
		Total malaria cases	Total Pf Cases	Deaths	Total malaria cases	Total Pf Cases	Deaths	Total malaria cases	Total Pf cases	Deaths
1	Andhra Pradesh	80 557	46 685	6	19 787	13 385	0	21 077	15 511	0
2	Arunachal Pradesh	46 165	6966	0	6398	2181	21	6082	2338	9
3	Assam	84 915	52 116	43	19 542	14 969	7	14 540	11 210	11
4	Bihar	9509	2084	2	2693	715	1	2043	699	0
5	Chhattisgarh	359 155	246 129	63	110 145	89 418	43	128 993	108 874	53
6	Goa	9164	2598	11	1530	131	0	824	42	0
7	Gujarat	36 712	6672	2	58 513	9122	38	41 608	6253	16
8	Haryana	1050	157	0	14 471	247	3	4485	45	1
9	Himachal Pradesh	491	0	0	141	0	0	102	1	0
10	Jammu & Kashmir	3045	23	0	698	24	0	291	21	0
11	Jharkhand	133 453	68 744	16	97 786	38 263	8	103 735	46 448	8
12	Karnataka	109 118	28 303	14	13 302	967	0	14 794	1329	2
13	Kerala	2940	373	9	1634	243	0	1751	305	6
14	Madhya Pradesh	194 689	62 850	93	78 260	28 775	49	96 879	41 638	26
15	Maharashtra	81 406	25 694	40	43 677	9198	80	53 385	25 770	68
16	Manipur	1064	380	0	120	42	0	145	72	0
17	Meghalaya	13 699	9238	11	24 727	22 885	62	39 168	37 149	73
18	Mizoram	9059	5358	33	11 747	10 340	21	23 145	21 083	31
19	Nagaland	3443	264	0	2285	519	1	1936	647	2
20	Odisha	509 497	428 032	467	228 858	208 488	67	395 035	342 280	89
21	Punjab	493	25	1	1760	31	0	1036	14	0
22	Rajasthan	35 973	3 425	10	33 139	1086	15	15 118	603	4
23	Sikkim	16	1	0	39	13	0	35	18	0
24	Tamil Nadu	43 053	1738	1	15 081	539	0	8729	339	0

S. No.	State/UT	2000			2013			2014		
		Total malaria cases	Total Pf Cases	Deaths	Total malaria cases	Total Pf Cases	Deaths	Total malaria cases	Total Pf cases	Deaths
25	Telangana	0			0	0	0	5189	4602	0
26	Tripura	12 245	9480	6	7396	6998	7	51 240	49 653	96
27	Uttarakhand	2008	424	0	1426	108	0	1171	89	0
28	Uttar Pradesh	96 971	6 214	0	48 346	590	0	41 612	326	0
29	West Bengal	145 322	32 465	103	34 717	3705	17	26 484	4981	66
30	A.N.Islands	1002	236	1	1005	334	0	557	109	0
31	Chandigarh	256	6	0	150	2	0	114	-	0
32	D & N Haveli	2415	282	0	1778	513	0	669	90	1
33	Daman & Diu	132	5	0	91	5	0	56	4	0
34	Delhi	2631	249	0	353	8	0	98	-	0
35	Lakshadweep	5	0	0	8	0	0	-	-	0
36	Puducherry	137	2	0	127	2	0	79	3	0
All India Total		2 031 790	1 047 218	932	881 730	463 846	440	1 102 205	722 546	562

ANNEX 7

Malaria epidemiological situation for elimination planning by category

Category (Base year 2014)	State/ UT	Population at risk (in thousands)	Total districts	Total positive cases	Pf%	ABER	API	SPR	Deaths
Category 1- states/UTs with API less than one, and all the districts in the state with API less than one (15)	Chandigarh	1080	1	114	0%	4.17	0.11	0.25	0
	Daman & Diu	274	2	56	7%	12.51	0.20	0.16	0
	Delhi	16 753	1	98	0%	1.07	0.01	0.05	0
	Goa	1506	2	824	5%	28.67	0.55	0.19	0
	Haryana	26 695	21	4485	1%	9.46	0.17	0.18	1
	Himachal Pradesh	5721	10	102	1%	8.60	0.02	0.02	0
	Jammu & Kashmir	5626	12	291	7%	8.04	0.05	0.06	0
	Kerala	33 901	14	1,751	17%	7.89	0.05	0.07	6
	Lakshadweep	65	1	-	0%	0.20	0.00	0.00	0
	Manipur	2856	12	145	50%	2.32	0.05	0.22	0
	Puducherry	1245	4	79	4%	14.53	0.06	0.04	0
	Punjab	28 677	22	1036	1%	10.78	0.04	0.03	0
	Rajasthan	77 057	33	15 118	4%	11.43	0.20	0.17	4
	Sikkim	203	4	35	51%	3.93	0.17	0.44	0
	Uttarakhand	10 112	13	1171	8%	3.84	0.12	0.30	0
Category 2- states/ UTs with API less than one and one or more districts reporting API more than one (11)	Andhra Pradesh	51 171	13	21 077	74%	19.26	0.41	0.21	0
	Assam	33 226	27	14 540	77%	11.09	0.44	0.39	11
	Bihar	105 664	38	2043	34%	0.17	0.02	1.11	0
	Gujarat	62 878	41	41 608	15%	21.38	0.66	0.31	16
	Karnataka	54 681	34	14 794	9%	17.93	0.27	0.15	2
	Maharashtra	114 973	34	53 385	48%	15.31	0.46	0.30	68
	Nagaland	2008	12	1936	33%	11.69	0.96	0.83	2
	Tamil Nadu	73 104	43	8729	4%	12.31	0.12	0.10	0
	Telangana	34 324	10	5189	89%	10.49	0.15	0.14	0
	Uttar Pradesh	203 980	75	41 612	1%	2.37	0.20	0.86	0
	West Bengal	93 675	21	26 484	19%	7.28	0.28	0.39	66

Category (Base year 2014)	State/ UT	Population at risk (in thousands)	Total districts	Total positive cases	Pf%	ABER	API	SPR	Deaths
Category 3- states/ UTs with API more than one (10)	Andaman & Nicobar Islands	466	3	557	20%	16.07	1.20	0.74	0
	Arunachal Pradesh	1415	16	6082	38%	8.73	4.30	4.92	9
	Chhattisgarh	27 349	27	128 993	84%	14.42	4.72	3.27	53
	Dadra & Nagar Haveli	409	1	669	13%	17.54	1.64	0.93	1
	Jharkhand	35 253	24	103 735	45%	9.63	2.94	3.06	8
	Madhya Pradesh	77 041	50	96 879	43%	13.35	1.26	0.94	26
	Meghalaya	3128	7	39 168	95%	13.99	12.52	8.95	73
	Mizoram	1116	9	23 145	91%	29.65	20.74	6.99	31
	Odisha	43 501	30	395 035	87%	14.60	9.08	6.22	89
	Tripura	3862	8	51 240	97%	15.71	13.27	8.44	96