



a decade in communicable disease control and child health

# Malaria surveillance efforts in Cambodia

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Joint International Tropical Medicine Meeting

Bangkok, December 2013



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# Challenges in the Mekong Region

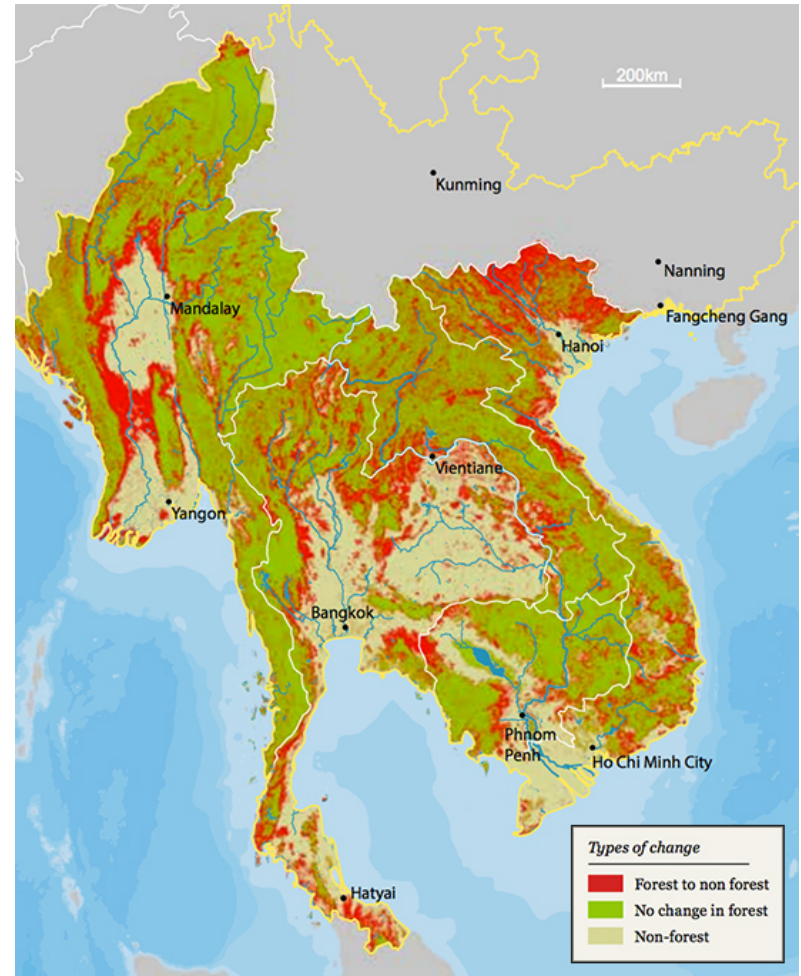
- **Drug resistant *P. falciparum* malaria**



Source: WHO

# Challenges in the Mekong Region

- Drug resistant *P. falciparum* malaria
- **Forest related malaria and potent exophagic vectors**



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# Challenges in the Mekong Region

- Drug resistant *P. falciparum* malaria
- Forest related malaria and potent exophagic vectors
- **Cross border movement, migration of labour force**



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# Challenges in the Mekong Region

- Drug resistant *P. falciparum* malaria

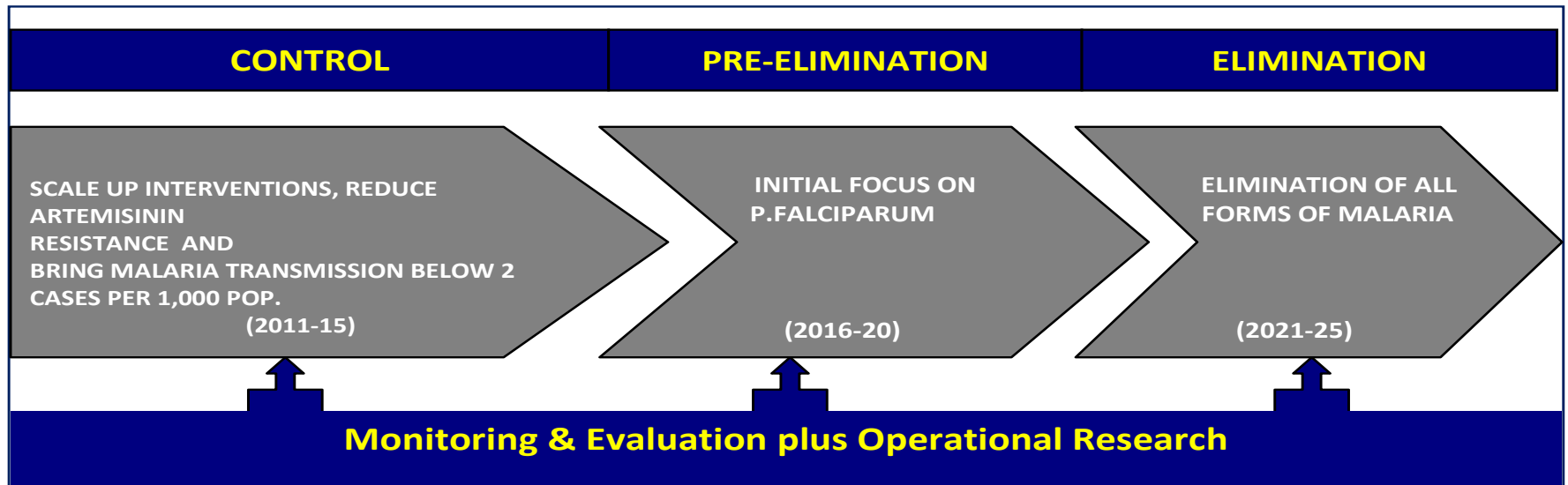
- For **Mobile and Migrant Populations (MMPs)**

- Cross border movement, migration of labor force



Source: WHO

# The Cambodian National Strategic Plan for Elimination of Malaria



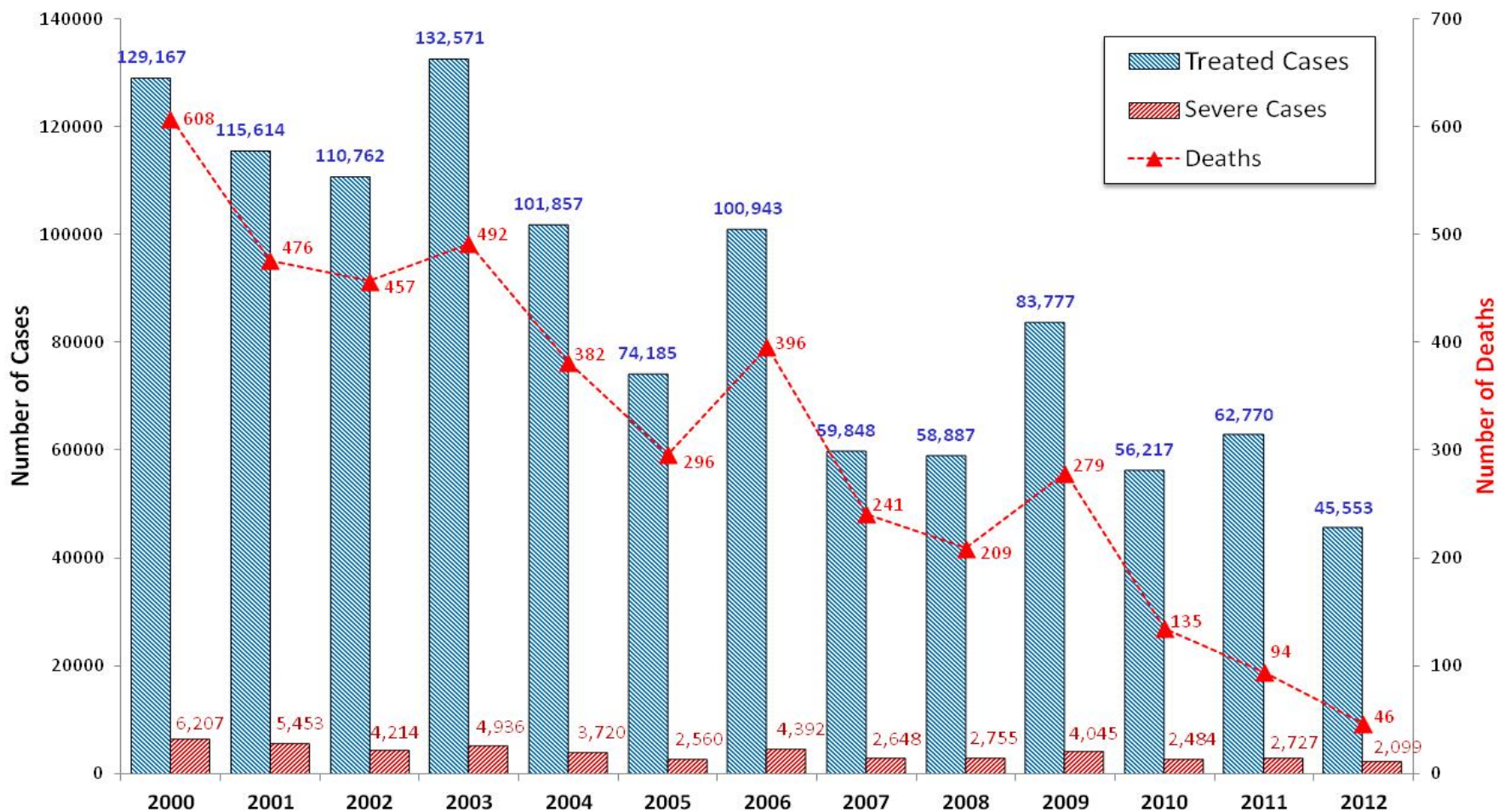
**Short-term (by 2015):** To move towards pre-elimination of malaria across Cambodia, bringing level of transmission below 2 cases per 1,000 population for most parts, with special efforts to contain artemisinin resistant *Plasmodium falciparum* malaria.

**Medium-term (by 2020):** To move towards elimination of malaria across Cambodia with an initial focus on *P.falciparum* malaria and ensure zero deaths from malaria.

**Long-term (by 2025):** To achieve phased elimination of all forms of malaria in Cambodia.

# Malaria trends in Cambodia

# of Malaria Treated Cases, Severe Cases and Deaths, 2000 to 2012 in Cambodia



Source: Epidemiology Unit, CNM

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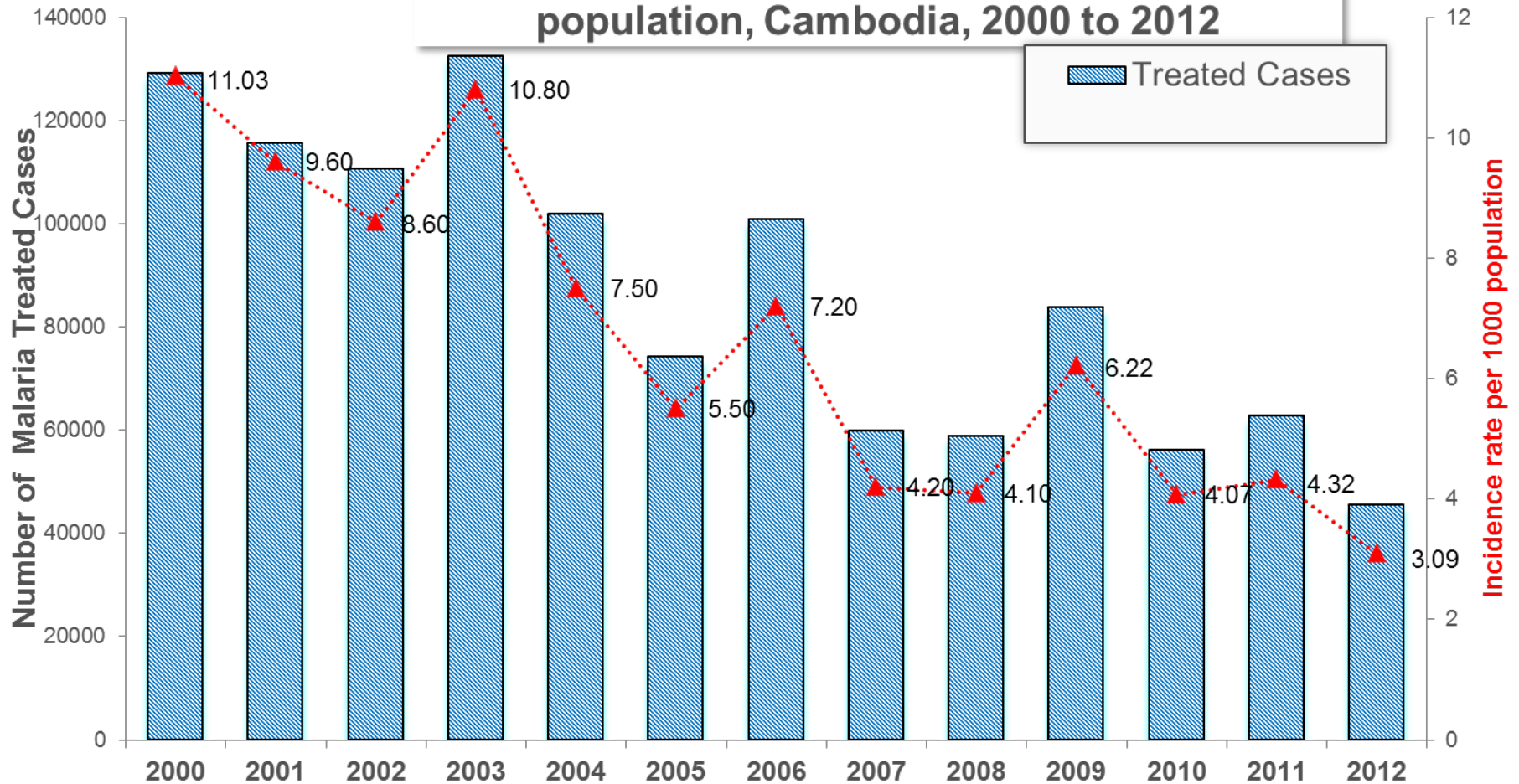
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# Malaria trends in Cambodia

Incidence rate of malaria treated cases per 1000 population, Cambodia, 2000 to 2012



Source: Epidemiology Unit, CNM

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# Malaria surveillance system prior to 2009

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## **Health Information System (HIS):**

- ▶ Malaria data available down to health facility level
- ▶ Lab data not directly linked to the patient

**Limited Day 3 information** from sentinel site surveillance

**Risk stratification based upon distance from the forest**  
using outdated maps (heavy deforestation in areas of the  
containment zone)

# What information was required?

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## 1. Demographic and malaria case data for...

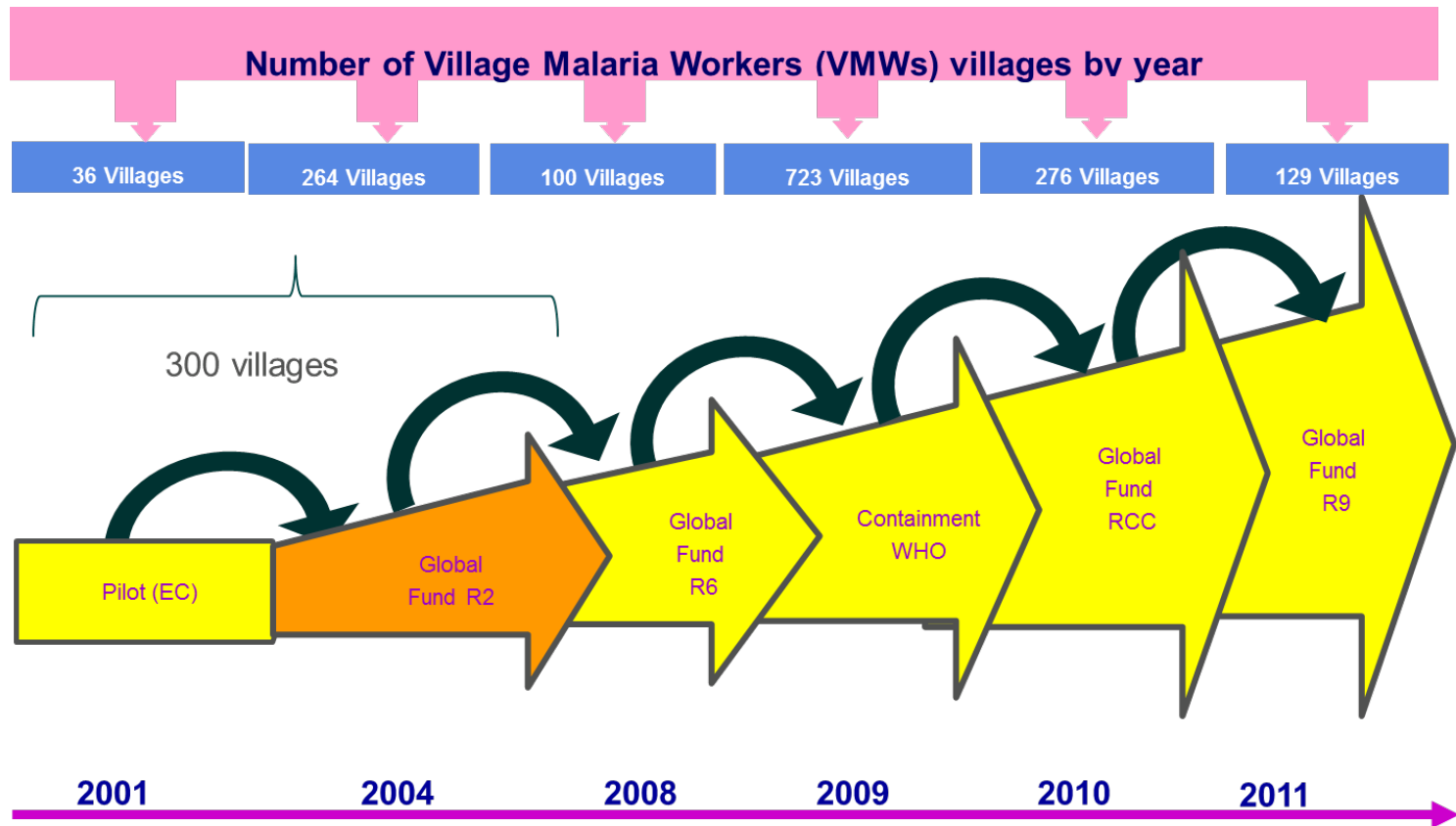
Monthly **village level data** to be used for statistics, planning and village level stratification, including:

- ▶ No. of malaria cases by species (*Pf*, *Pv*), age and sex of the patient
- ▶ No. of severe malaria cases
- ▶ No. of malaria deaths
- ▶ Treatments given

Planning interventions such as mosquito net distribution

# Improvements made since 2009?

**Increased** the number of villages with of **VMWs and MMWs to over 1600**



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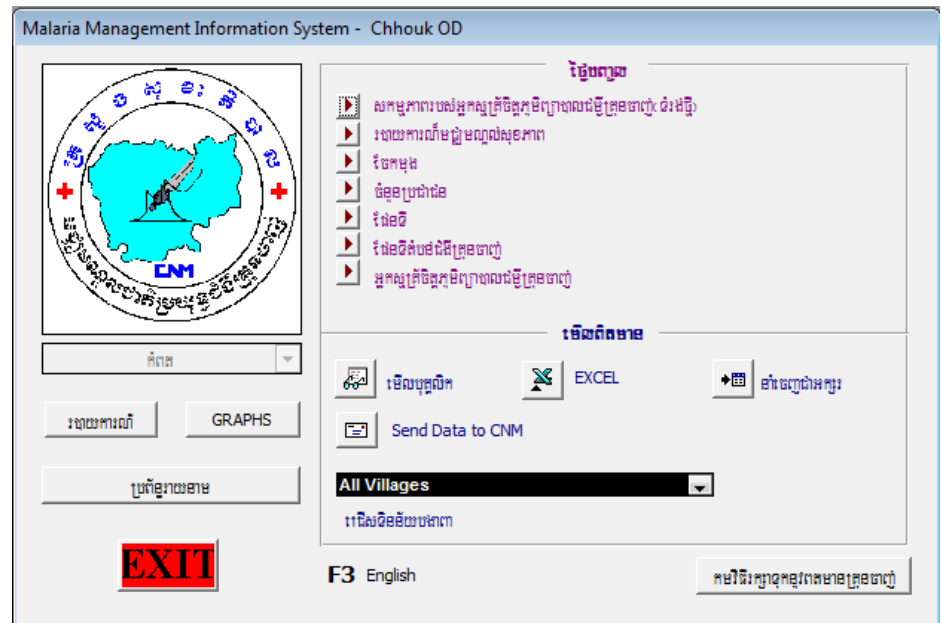
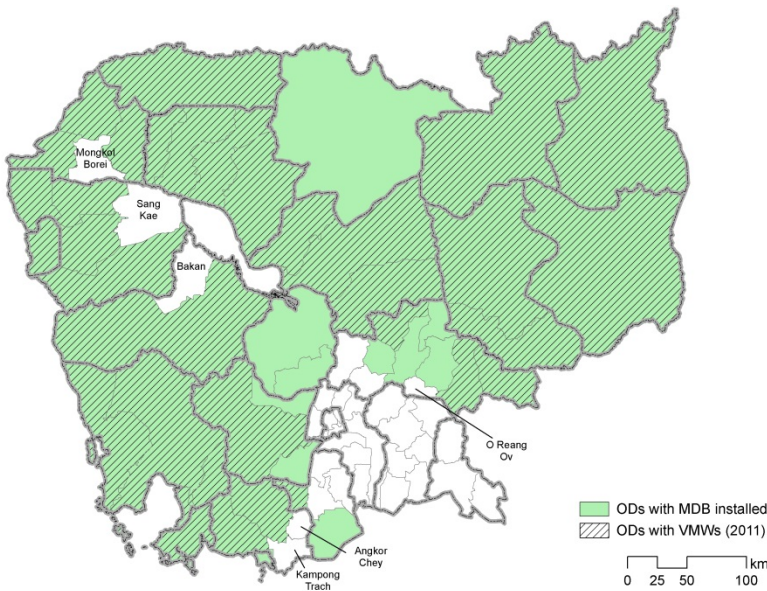
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# Improvements made since 2009?

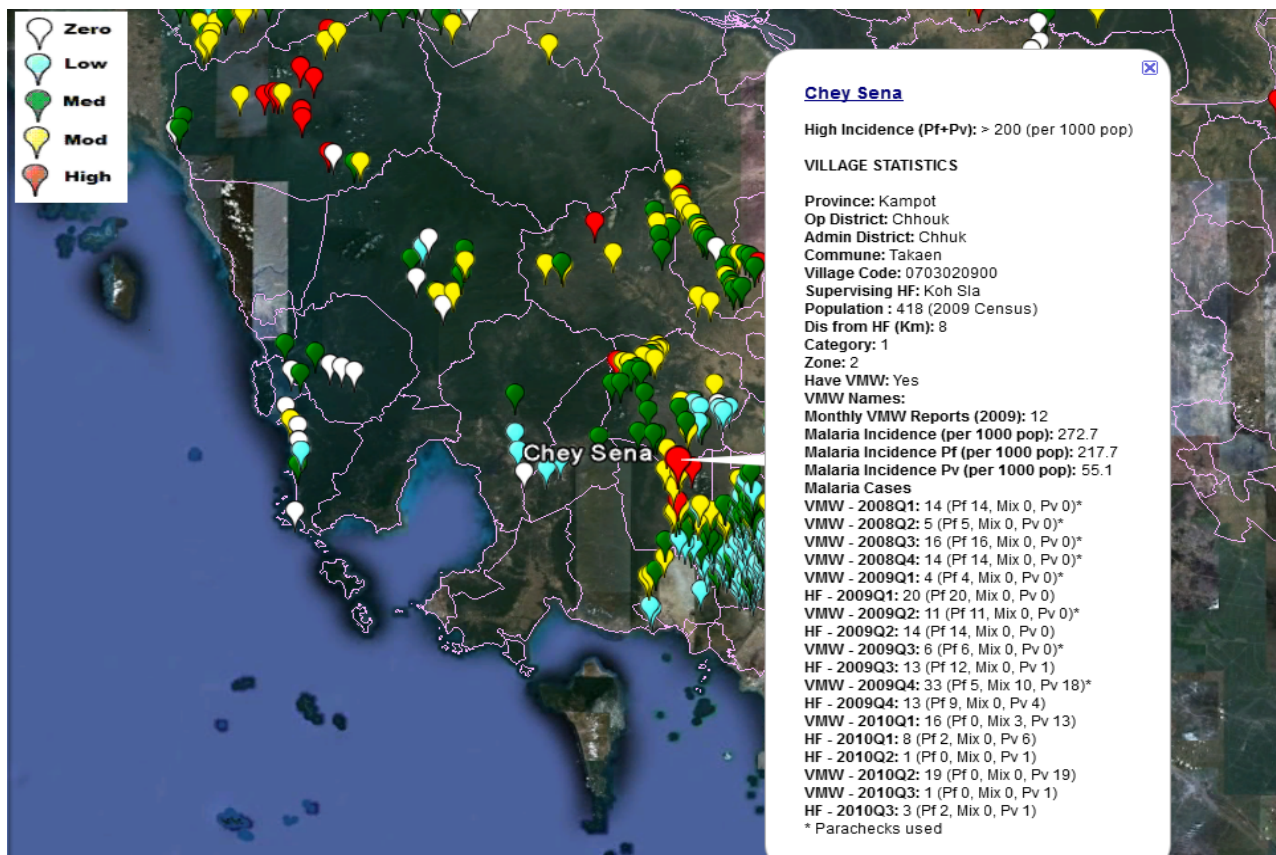
**Developed** a database to process malaria data from VMWs, health facilities and data relating to mosquito net distribution and management (**MIS Database**)

- Installed in all 45 targeted Operational Districts
- Individual case data for all patients seen by VMWs and at public health facilities



# Improvements made since 2009?

**Integration** of facility level malaria data from the new **online HIS** with the **VMW** and bed net data from malaria **MIS** database



# Improvements made since 2009?

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- **Increased** the number of villages with of **VMWs and MMWs to over 1600**
- **Developed** a database to process malaria data from VMWs, health facilities and data relating to bed net distribution and management (**MIS Database**)
  - Installed in all 45 targeted operational districts
  - Individual case data for all patients seen by VMWs and at public health facilities
- **Integration** of facility level malaria data from the new **online HIS with the VMW and bed net data from malaria MIS database**
- **Creation of a “Malaria Bulletin”**

# Cambodia Malaria Bulletin (available at [www.cnm.gov.kh](http://www.cnm.gov.kh))

SEPTEMBER 2013 BULLETIN, DATA TO 3RD QUARTER, CNM, CAMBODIA

Estimated coverage with LLIN or retreated mosquito net	Target <sup>1</sup>	Mobile <sup>2</sup>
No. of persons at risk of malaria	3,348,421	448,273
No. of LLIN distributed YTD	2,072	3,682
No. of LLHN distributed YTD	1,607	467
No. of conventional nets distributed and retreated YTD	30,903	300
No. of long lasting nets distributed in last 3 years	2,959,334	4,149
Estimated coverage with LLIN / treated net (1 net / 1 pers)	89%	1%

<sup>1</sup> Pop of target villages

<sup>2</sup> Mobile pop (est from census)

Indicators	HIS			VMW			Total		
	2012	2013	Change	2012	2013	Change	2012	2013	Change
Malaria cases	35,386	18,023	-49%	22,599	13,270	-41%	57,985	31,293	-46%
Malaria Incidence	2.41	1.20	-50%	19.20	10.88	-43%	3.94	2.08	-47%
Malaria deaths	35	7	-80%	0	0	0%	35	7	-80%
Mortality rate <sup>4</sup>	0.24	0.05	-80%	0.00	0.00	0%	0.24	0.05	-80%

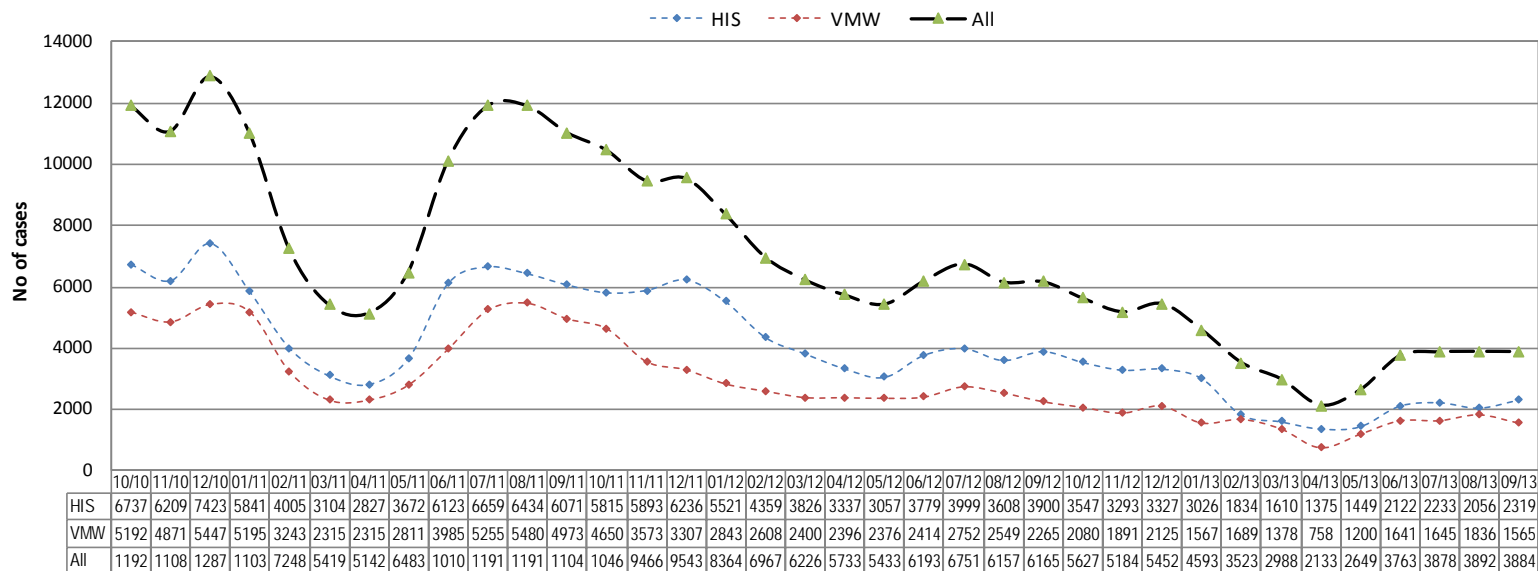
<sup>3</sup> Cases per 1000 pop

<sup>4</sup> Deaths per 100,000 pop

<sup>4,5</sup> VMW rates uses VMW village populations

## TRENDS IN SURVEILLANCE

Treated malaria cases from HIS and VMW by month



Severe malaria cases and deaths from HIS by month

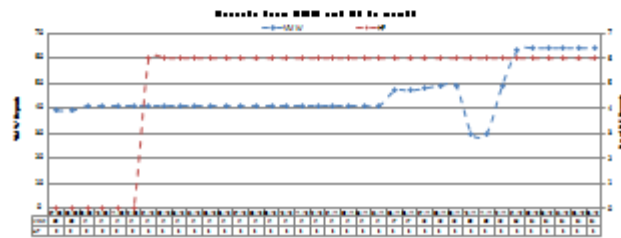
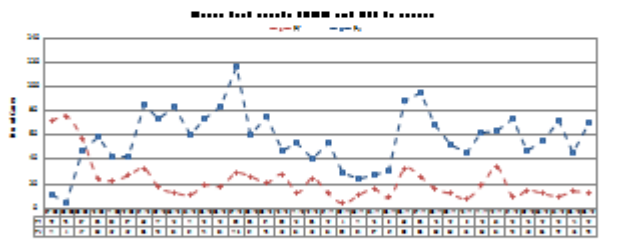
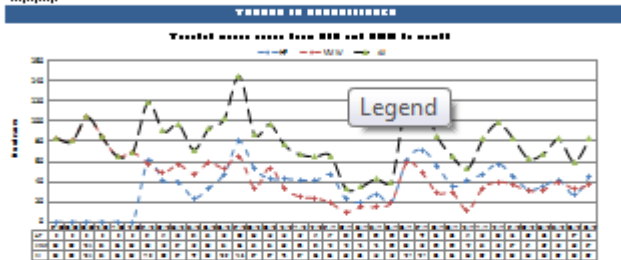
---◆--- Severe    ---■--- Deaths

# Province level surveillance trends – District Malaria Bulletin - Beyond Garki

## DISTRICT MALARIA BULLETIN

2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022

Reported cases with ITN use	Total	Male	Female
2008	1000	500	500
2009	1200	600	600
2010	1500	750	750
2011	1800	900	900
2012	2000	1000	1000
2013	2200	1100	1100
2014	2500	1250	1250
2015	2800	1400	1400
2016	3000	1500	1500
2017	3200	1600	1600
2018	3500	1750	1750
2019	3800	1900	1900
2020	4000	2000	2000
2021	4200	2100	2100
2022	4500	2250	2250



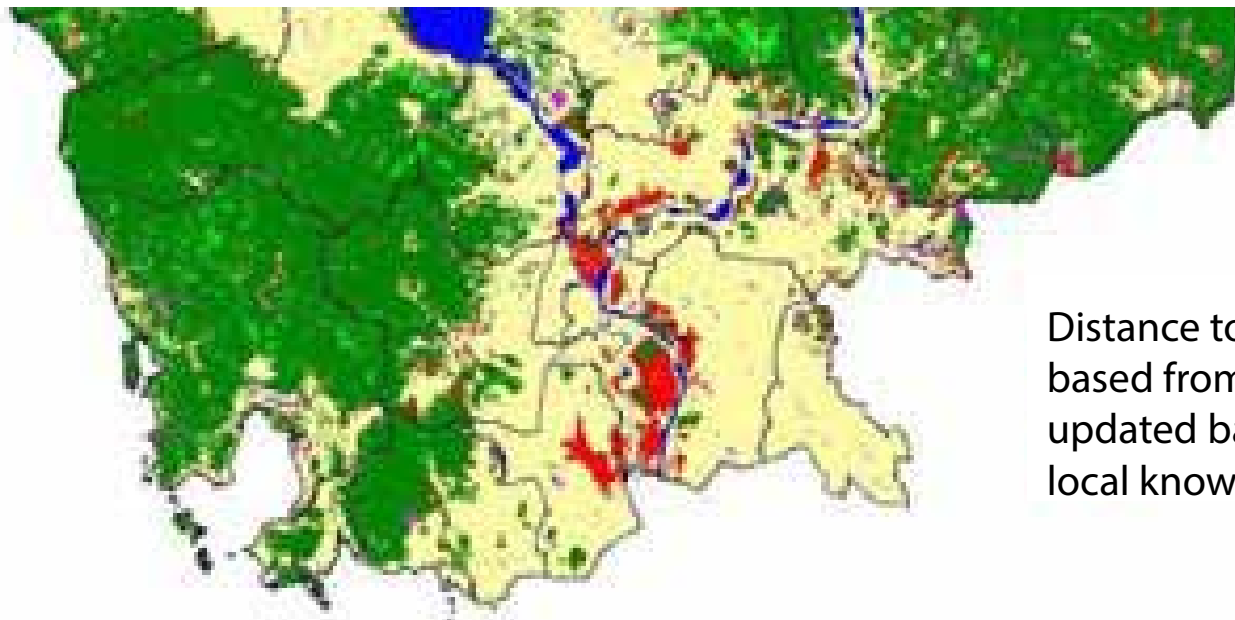
Villages with Highest Incidence of Malaria Pailin, Jan-Jun 2012																	
Village	Population (x1000)	Reported By Health Facility						Reported By Village Malaria									
		All Cases		Treated PF		Treated Pa		All Cases		Treated PF		Treated Pa					
		2011	2012	Change	%	2011	2012	Change	%	2011	2012	Change	%				
01 Chhn Kraem	0.87	0.87	18	15	-17%	3	5	+67%	3	18	+500%	0	0	-0%	2	0	-100%
02 Pong Meang Keul	0.11	0.12	12	18	+50%	0	2	+100%	0	0	0%	0	1	+100%	0	2	+100%
03 Ou Reul	0.28	0.23	24	16	-33%	0	1	+100%	24	15	-38%	0	3	+300%	0	11	+275%
04 Ou Teang Kraem	0.13	0.13	1	1	0%	0	0	0%	0	0	0%	0	1	+100%	0	18	+1800%
05 Kraekh Lea	0.53	0.54	15	15	0%	4	4	0%	0	0	0%	17	28	+65%	2	15	+650%
06 Phnom Dambong	0.73	0.74	3	0	-100%	0	4	+500%	0	0	0%	34	27	-21%	4	2	-50%
07 Phnom Spang	0.15	0.16	1	4	+300%	0	0	0%	1	4	+300%	1	3	+200%	0	1	+100%
08 O T. Teu	0.85	0.85	0	1	+100%	0	0	0%	0	1	+100%	2	1	-50%	0	1	+100%
09 O Kling	0.33	0.48	2	4	+100%	0	0	0%	2	4	+100%	2	1	-50%	2	5	+150%
10 Khvok Measak	0.25	0.26	3	1	-67%	0	1	+100%	0	0	0%	2	0	-100%	2	4	+100%
11 Ou Poon	1.43	1.45	0	2	+100%	0	0	0%	0	2	+100%	14	27	+93%	0	25	+2125%
12 Veal Chveng	0.31	0.32	0	0	0%	0	0	0%	0	0	0%	2	0	-100%	2	4	+100%
13 Piek Kiri	0.67	0.68	1	1	0%	0	0	0%	1	1	0%	3	11	+267%	1	1	0%
14 Dar Haq Khmer Chveng	0.34	0.35	3	4	+33%	0	1	+100%	0	3	+300%	1	2	+100%	0	1	+100%
15 Phnom Svan	0.47	0.48	1	0	-100%	0	0	0%	1	0	-100%	0	0	0%	0	0	0%
16 Daq Sri	0.48	0.48	1	0	-100%	0	0	0%	1	0	-100%	0	0	0%	1	0	-100%
17 Redang Pir	0.67	0.68	0	1	+100%	0	1	+100%	0	0	0%	2	10	+400%	1	9	+800%
18 Redang Thmor	0.58	0.51	0	0	0%	0	0	0%	0	0	0%	0	2	+200%	0	3	+300%
19 Ou Teak Phleng	0.48	0.43	0	4	+400%	0	0	0%	0	4	+400%	0	3	+300%	0	0	0%
20 Keapok	0.38	0.31	2	2	0%	1	0	-100%	1	2	+100%	0	2	+200%	0	2	+200%
21 Teak Phnu	0.61	0.62	0	0	0%	0	0	0%	0	0	0%	0	0	0%	0	7	+700%
22 Dar Haq Khmer Thveng	0.23	0.24	7	2	-71%	1	0	-100%	0	2	+200%	0	1	+100%	0	0	0%
23 Teak Khiron	0.24	0.24	1	3	+200%	0	0	0%	1	3	+200%	0	0	0%	0	0	0%
24 Ou Chva Lea	0.34	0.34	3	4	+33%	0	0	0%	3	4	+33%	0	0	0%	0	0	0%
25 Phnom Chveng	0.18	0.18	0	1	+100%	0	0	0%	0	1	+100%	2	1	-50%	0	2	+200%
26 Ou Svan Svan	0.46	0.47	1	1	0%	0	0	0%	1	1	0%	4	4	0%	1	3	+25%
27 Tamouk	0.48	0.48	3	4	+33%	0	0	0%	3	4	+33%	0	0	0%	0	0	0%
28 Ou Redang	0.56	0.57	0	5	+500%	0	0	0%	0	5	+500%	0	0	0%	0	0	0%
29 Pong Re Lom	1.81	1.82	4	5	+25%	1	0	-100%	3	5	+67%	2	4	+100%	0	2	+200%
30 Dri Kraekum	0.45	0.45	4	1	-75%	0	0	0%	1	0	-100%	2	3	+50%	1	0	-100%
31 Dar Thmor	0.45	0.46	7	4	-43%	1	0	-100%	0	4	+400%	7	0	-100%	0	3	+300%
32 Ou Chva Leak	0.48	0.43	1	4	+300%	0	1	+100%	1	3	+200%	0	0	0%	0	0	0%
33 Teak Khveng	0.58	0.51	2	4	+100%	2	0	-100%	0	4	+400%	0	0	0%	0	0	0%
34 Sil	0.26	0.27	0	2	+200%	0	0	0%	0	2	+200%	0	0	0%	0	0	0%
35 Sankh	0.88	0.82	0	2	+200%	1	0	-100%	0	1	+100%	0	4	+400%	2	2	+0%
36 Phnom Pral	0.28	0.23	1	2	+100%	1	0	-100%	0	2	+200%	0	0	0%	0	0	0%
37 Kraekh Kraem	1.21	1.22	3	7	+233%	0	2	+200%	3	5	+67%	0	1	+100%	0	1	+100%
38 Thmor	0.46	0.47	1	1	0%	0	0	0%	1	1	0%	1	2	+100%	0	1	+100%
39 Pong Pralil	0.78	0.73	0	3	+300%	0	0	0%	0	3	+300%	3	2	-33%	0	2	+200%
40 Koua Phnom	0.33	0.34	2	2	0%	1	1	0%	1	1	0%	0	0	0%	0	0	0%



## Median malaria incidence (all species) by OD

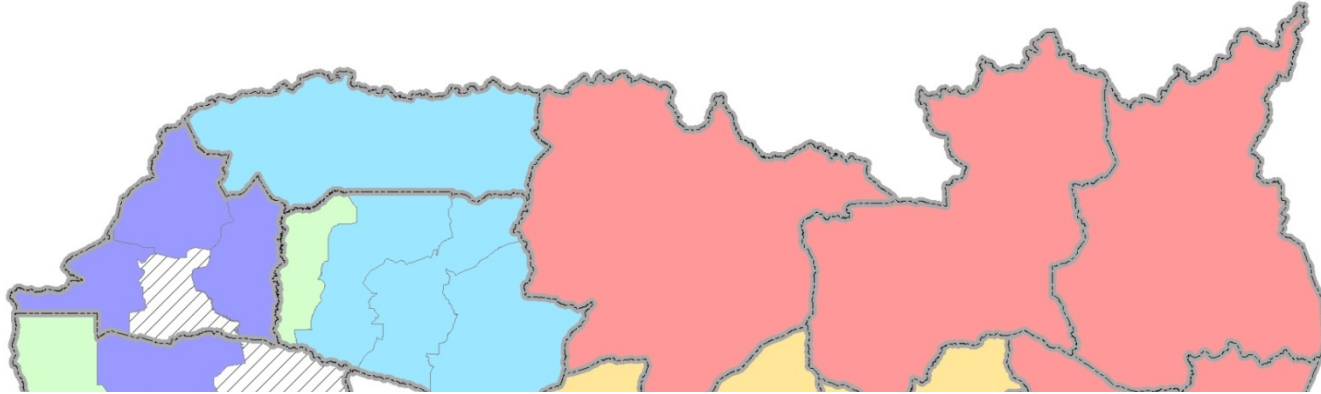


Are the MDB and VMW system focusing on the right places?

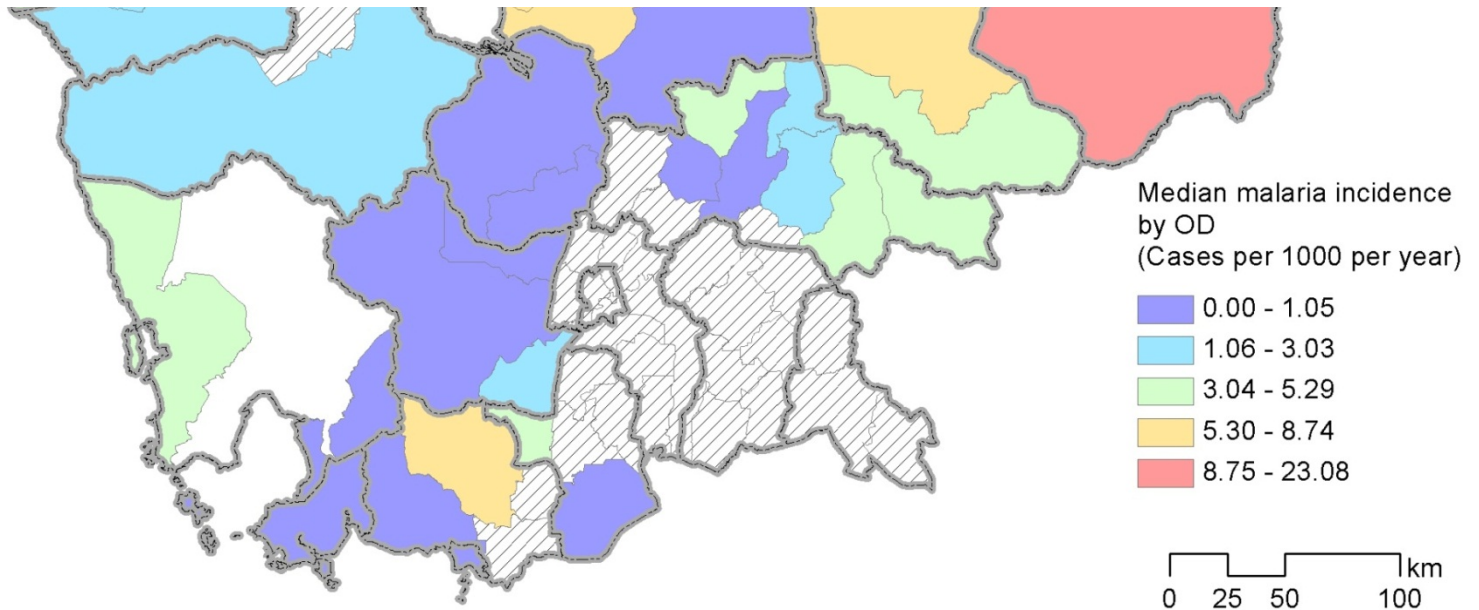


Distance to forest  
based from 2004 and  
updated based on  
local knowledge

## Median malaria incidence (all species) by OD



Are the MDB and VMW system focusing on the right places?



# Using data for planning... Work in progress

**Re stratification of all at risk villages in Cambodia based on village level incidence.** Currently updating village stratifications based on 2011 incidence data

Period

◀ 2011 ▶

Province

Ratanak Kiri

Operational District

Ratanakiri

No. of Categories: 3

No. of HF Reports: 9

No. of Jul-Dec Reports: 4

Set Default

Incidence (per 1000 pop)

Category 1 >= 50

Category 2 >= 10

Category 3 >= 1

Generate New List

Apply Stratification

NOTE: Can only apply stratification in the OD MIS!!!

Code	Village	Health	Pop	Repts	JulDec	VMWCa	HFCases	Inc	Category	Suggest	NewCategory	Excl
1604040400	Kam Bak	Kachanh	465	10	5		1	2.2	2	3	3	<input type="checkbox"/>
1604040500	La En Sre	Kachanh	308	10	5	48		155.8	1	1	1	<input type="checkbox"/>
1604040600	Sre Meunthaing	Kachanh	203	10	5			0	1			<input type="checkbox"/>
1604050100	Phum Muoy (Trapea	Kounmum	1543	12	6		17	11	2	2	2	<input type="checkbox"/>
1604050200	Phum Pir (Trapea	Kounmum	988	12	6		5	5.1	2	3	3	<input type="checkbox"/>
1604050300	O Plong	Kounmum	2158	12	6		56	25.9	2	2	2	<input type="checkbox"/>
1604050400	Kor Hoksib	Kounmum	974	12	6		4	4.1	1	3	3	<input type="checkbox"/>
1604050500	Sangkum	Kounmum	731	12	6		1	1.4	2	3	3	<input type="checkbox"/>
1604060100	Phum Muoy (Trapea	Kounmum	940	12	6		4	4.3	2	3	3	<input type="checkbox"/>
1604060200	Phum Pir (Trapea	Kounmum	555	12	6		2	3.6	3	3	3	<input type="checkbox"/>
1604060300	Phum Bei (Trapea	Kounmum	1012	12	6		6	5.9	2	3	3	<input type="checkbox"/>
1604060400	Phum Boun (Wor	Kounmum	153	12	6			0	2			<input type="checkbox"/>
1604060500	Phum Pram (Wor	Kounmum	153	12	6			0	2			<input type="checkbox"/>
1604060600	Phum Prammouy	Kounmum	153	12	6			0	2			<input type="checkbox"/>
1604060700	Veal Chhke Hot	Kounmum	328	12	6		2	6.1	2	3	3	<input type="checkbox"/>
1605010100	Ou Kan	Lumphat	443	0	0			0	2			<input checked="" type="checkbox"/>
1605010200	Srae Chhuk	Lumphat	588	0	0			0	2			<input checked="" type="checkbox"/>
1605010300	Sam Kha	Lumphat	439	0	0			0	2			<input checked="" type="checkbox"/>
1605010400	Dei Lou	Lumphat	808	0	0			0	2			<input checked="" type="checkbox"/>
1605010500	Thmei (Chey Otd	Lumphat	776	0	0	82		105.7	2	1	1	<input type="checkbox"/>
1605010600	Lumphat	Lumphat	1060	0	0			0	3			<input checked="" type="checkbox"/>
1605020100	Sayas	Lumphat	680	0	0	12		17.6	1	2	2	<input type="checkbox"/>
1605020200	Ka Laeng	Lumphat	203	0	0	13	1	69	1	1	1	<input type="checkbox"/>
1605020300	Ka Nang Ket	Lumphat	447	0	0	13		29.1	1	2	2	<input type="checkbox"/>

Record: 4 of 314

No Filter Search

# What information was required?

## 2. Real time data to facilitate rapid response

### Alert

### Response

Real time data about individual patients still positive after 3 days (an indication of drug tolerance)



Patients to be interviewed to identify possible sites (hotspots) of transmission

Rapid identification of all Pf cases in drug resistant areas



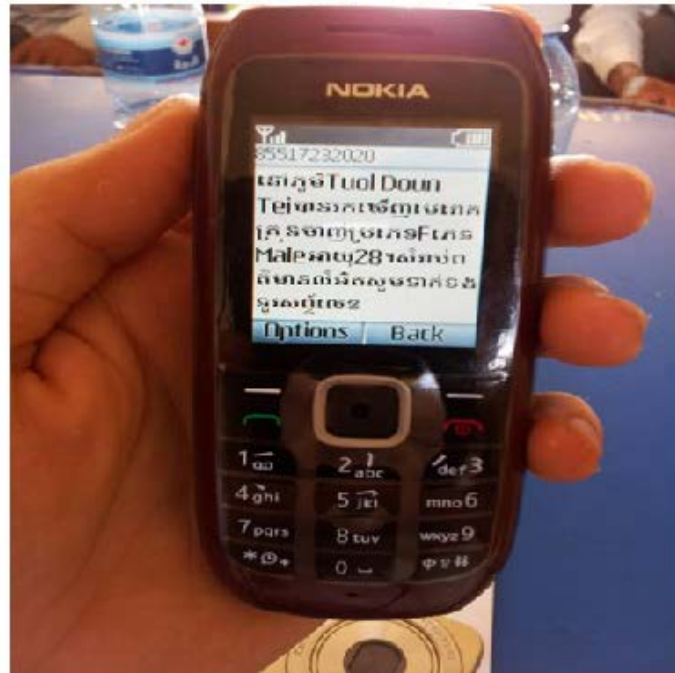
Ensure appropriate testing, DOTS treatment (Malarone) and follow up

Real time data from health facilities about stock levels of malaria drugs



To prevent stock outs and supply drugs on a timely manner

# Use of mHealth technology to report malaria cases



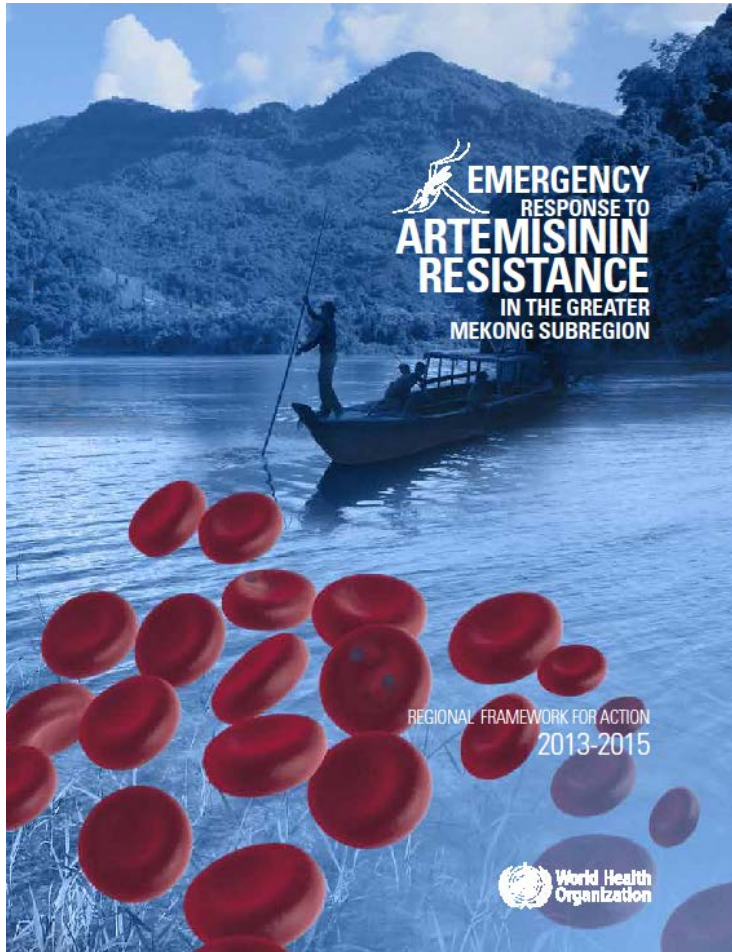
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# Is this enough?



## FULL COVERAGE OF QUALITY INTERVENTIONS IN PRIORITY AREAS

- Action 1. Increase quality and coverage of key interventions in the private and public sector*
- Action 2. Engage health and non-health sectors to reach high risk populations*
- Action 3. Implement measures to ensure continuous and uninterrupted supply of essential commodities*

## TIGHTER COORDINATION AND MANAGEMENT OF FIELD OPERATIONS

- Action 4. Strengthen coordination of field activities*
- Action 5. Monitor staff performance and increase supportive supervision*
- Action 6. Promote the integration of containment, elimination and malaria control while maintaining the focus on resistance*

## BETTER INFORMATION FOR ARTEMISININ RESISTANCE CONTAINMENT

- Action 7. Improve collection and use of data to target operations*
- Action 8. Fast-track priority research and refine tools for containment and elimination*
- Action 9. Increase monitoring of antimalarial therapeutic efficacy and strengthen the therapeutic efficacy networks worldwide*
- Action 10. Increase monitoring of insecticide resistance*

## REGIONAL OVERSIGHT AND SUPPORT

- Action 11. Enhance accountability and exchange of information*
- Action 12. Build political support at all levels*
- Action 13. Facilitate progress and regional cooperation on pharmaceutical regulation, production, export and marketing*
- Action 14. Create regional community of practice on approaches to high-risk populations*
- Action 15. Support cross-border coordination*

# Is this enough?



6 Priority interventions:

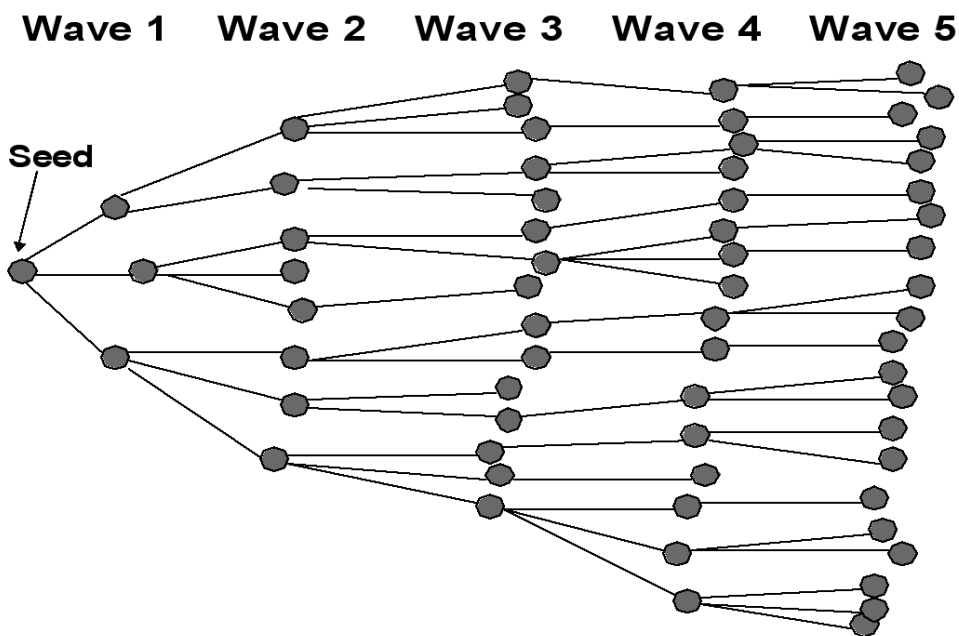
- Insecticide treated nets
- Indoor residual spraying
- Early diagnosis and treatment
- Private sector interventions
- Surveillance
- Behaviour change communication

**Focus on evaluating responses to hotspots/outbreaks/ eventually single *Pf* cases**  
**Focus on reaching/monitoring populations at risk and hard-to-reach populations (e.g MMPs).**

# Current gaps...

...relevant to malaria elimination

- ▶ Integration of routine M&E data focusing on hard-to-reach populations into MIS



Respondent driven sampling on MMPs



Verboice technology



# Current gaps...

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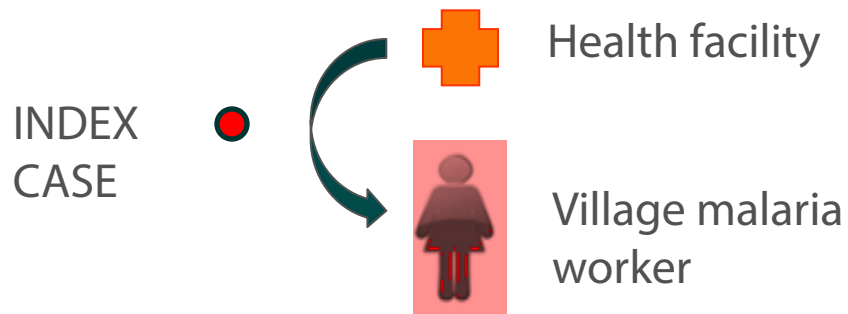
...relevant to malaria elimination

- ▶ Integration of routine M&E data focusing on hard-to-reach populations into MIS (e.g. RDS)
- ▶ Re-active/pro-active case detection including standardised methodologies
- ▶ Exploration of novel deployment strategies (e.g. FSAT) and endorsement of alternative indicators to transmission intensity (e.g. serology)
- ▶ Exploration of the role of subpatent parasitaemias (clustering?)

# Way forward: reactive case detection- Pailin

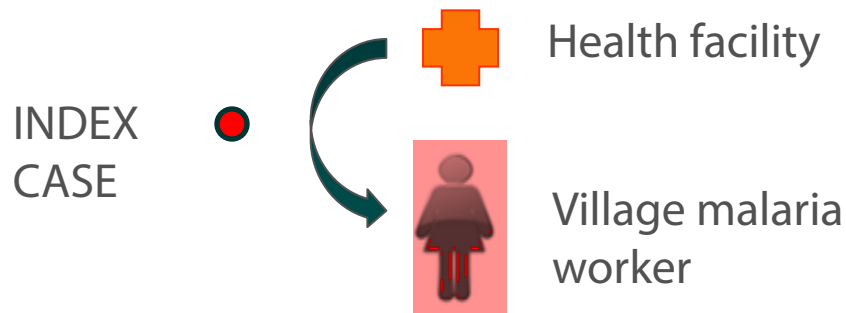
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## Passive case detection

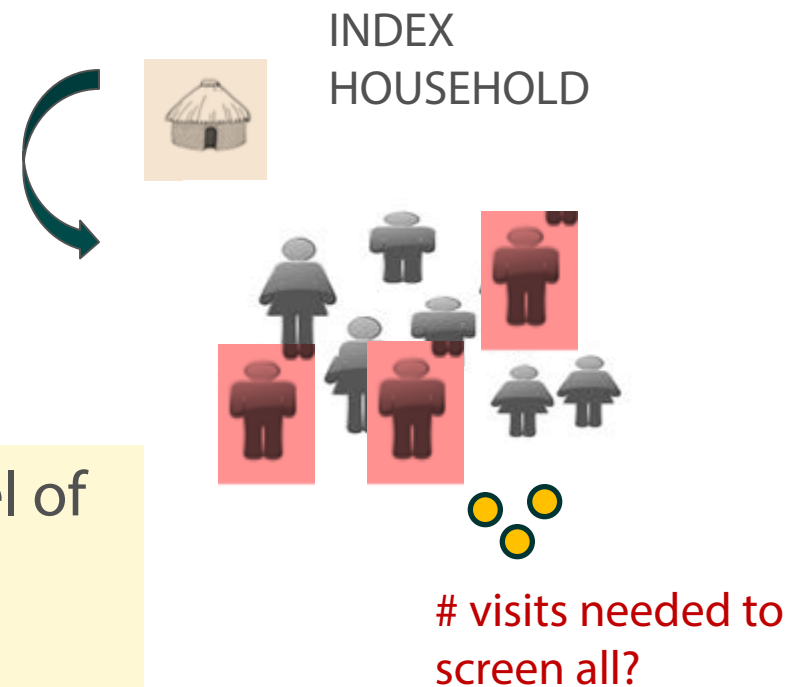


# Way forward: reactive case detection- Pailin

## Passive case detection



## Active case detection



Better understanding on the level of clustering of asymptomatic parasitaemia at household level

# Current gaps...

...relevant to malaria elimination

- ▶ Integration of routine M&E data focusing on hard-to-reach populations into MIS (e.g. RDS)
- ▶ Re-active/Pro-active case detection including standardised methodologies
- ▶ Exploration of novel deployment strategies (e.g. FSAT) and endorsement of alternative indicators to transmission intensity (e.g. serology)
- ▶ Exploration of the role of subpatent parasitaemias (clustering?)
- ▶ Need indicators to evaluate the impact of primaquine regimens. (ACT plus primaquine ==> radical cure, reduced transmission and decrease ArtRes spread)
- ▶ Regional surveillance system/early warning system



a decade in communicable disease control and child health

[www.malariaconsortium.org](http://www.malariaconsortium.org)

Thank you



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