Kingdom of Cambodia
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Cambodia Malaria Survey 2007 Report

Report prepared by

The National Institute of Public Health, Cambodia

Malaria Consortium

Supported by

Report of the Cambodia Malaria Survey 2007

Authors

National Institute of Public Health, Cambodia (NIPH)
Dr. Ung Sam An
Dr. Bunsoth Mao
Dr. Vonthanak Saphonn

Malaria Consortium
Ms. Jane Bruce
Dr. Sylvia Meek
Dr. Jo Lines, London School of Hygiene & Tropical Medicine (LSHTM) for Malaria Consortium,
Dr. Jonathan Cox, LSHTM for Malaria Consortium

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List of Acronyms

A+M	Artesunate + Mefloquine
AFRIMS	US Armed Forces Research Institute of Medical Sciences
AMT	Artesunate monotherapies
BCC	Behaviour Change Communication
C1……C6	Core Indicator
CI	Confidence Interval
CMAA	Cambodia Mine Action Authority
CMBS 2004	Cambodian Malaria Baseline Survey 2004
CMS 2007	Cambodia Malaria Survey 2007
CNM	National Centre for Parasitology, Entomology and Malaria Control
ELISA	Enzyme-linked Immunosorbent assay
GFATM	Global Fund to Fight AIDS, Tuberculosis and Malaria
GIS	Geographic Information System
GPS	Global Positioning System
HH	Household
HIS	Health Information System
HU	Health Unlimited
IEC	Information, Education and Communication
IMCI	Integrated Management of Childhood Illness
IPC	Institut Pasteur Cambodia
ITN	Insecticide treated net
LLIN	Long Lasting Insectide Treated Net
LSHTM	London School of Hygiene and Tropical Medicine
JICA	Japanese International Cooperation Agency
KABP	Knowledge, Attitude, Behaviour and Practice
MC	Malaria Consortium
MDG	Millennium Development Goals
MODIS	Moderate Resolution Imaging Spectroradiometer
NAMRU-2	U.S. Naval Medical Research Unit No. 2
NGO	Non-governmental Organisation
NIPH	National Institute of Public Health
NMCP	National Malaria Control Programme
OD	Operational District
PCR	Polymerase Chain Reaction
Pf	*Plasmodium falciparum*
PFD	Partners for Development
PHD	Provincial Health Department
PSI	Population Services International
Pv	*Plasmodium vivax*
RBM	Roll Back Malaria
RDT	Rapid Diagnostic Test
S1……S11	Supplementary Indicator
SES	Socioeconomic status
SPOT	Système pour l'Observation de la Terre
TORs	Terms of Reference
VCF	Vegetation Continuous Fields
WHO	World Health Organization
WRAIR	Walter Reed Army Institute of Research

Executive Summary

The Cambodia Malaria Survey 2007 was conducted in November to December 2007 (during high transmission season) by a partnership of organisations supporting the National Centre for Parasitology, Entomology and Malaria Control (CNM). The purpose of the survey was both to assess progress of the national malaria control programme in achieving its targets and to provide data required by the Global Fund to fight AIDS, Tuberculosis and Malaria (GFATM) for monitoring the Round 2 malaria grant to Cambodia. The survey followed three years after a baseline survey in 2004. While every attempt was made to ensure comparability of the two surveys, a number of changes were introduced to maximise the useful information from the follow up survey. This was largely in response to observations in the baseline on areas of malaria risk, so one domain of negligible risk was omitted, whilst an additional risk zone from 2 to 5 kilometres from forest was added to determine more precisely the limits to risk of transmission. Some questions were adapted on the basis of lessons learnt in 2004, and a number of new questions were added at the request of the World Health Organisation (WHO) for the GFATM five-year evaluation.

The support of the Global Fund through Rounds 2 and 4 significantly expanded the distribution of insecticide-treated nets (ITNs), provided training for bed net management and re-impregnation, and intensified behaviour change communications (BCC) in 20 malarious provinces.   The impregnated bednet programme contributed to the restratification and mapping of malaria risk based on distance from the forest fringe – upon which this survey and the national malaria programme currently relies.

This survey is not nationwide, as malaria transmission rates are very heterogeneous, so the survey focused on populations at highest risk stratifying first by higher risk provinces and then by distance from forest. A total of 2923 households in 76 clusters, 76 mosquito net outlets, 152 drug outlets and 91 health facilities were surveyed. The household survey included collection of blood for malariometric assessment in addition to interviews. Blood samples were kept for serology and PCR. Distance of sampled households from forest was measured.

Key findings according to the required indicators are shown in Tables 1 (Core Indicators) and Table 2 (Supplementary Indicators), and are summarised as follows[1]:

Core Indicators
1. The percentage of people seeking treatment from a trained provider within 48 hours of symptom onset increased slightly but significantly from 2004 to 2007.
2. Knowledge of malaria transmission and prevention remained high.
3. Disappointingly, although the percentage of people with sufficient mosquito nets (person to net ratio less than 2) increased more than 3 times, the percentage with sufficient insecticide treated nets remained very low (6.4%) showing little progress.
4. The population at risk sleeping under a net the previous night remained around 80%, while the population sleeping under an ITN also changed little and was around 25%.
5. Measurement of correct prescribing practices at public health facilities through a short cross-sectional survey proved difficult as anticipated, because of the low numbers of patients. Knowledge of treatment by health facility staff was good for

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[1] It is important to note that, for the main analyses, only the 2,270 households within 2 kilometres of forest are included, so that results can be compared with the 2004 survey. The 653 households 2 to 5 km from the forest are included in the spatial analysis.

simple malaria and malaria in children, but was only 72% for severe malaria and 47% for correct treatment of pregnant women. New methodologies for assessing quality of treatment, probably through longer visits to health facilities, are needed.
6. The percentage of health facilities with adequate stock levels of antimalarials and diagnostics were quite high, except the level of 86% for drugs for simple malaria could be improved.

Supplementary Indicators

S1. Percentage of respondents able to recognise signs and symptoms of malaria remained similar to 2004 at around 76%, whereas ability to recognise severe fever achieved 100%.
S2. There was an encouraging and significant increase in percentage seeking treatment from a trained provider from 67% to 74%.
S3. Where ITNs are sufficient the rate of use by children under five is high at 93%.
S4. Percentage of public health facilities able to confirm diagnosis was only 42% by microscopy and 36% by RDTs.
S5. There was a very high 88% availability in the market of antimalarials other than those recommended. This is clearly of great concern in the light of current concerns on existence of artemisinin resistance in the region.
S6. There has been considerable increase in awareness of correct antimalarials from 47 to 72%.
S7. Similarly, awareness of where to obtain testing and treatment remains high at 93%.
S8. Awareness of the importance of taking full courses increased from 10 to 39%.
S9. Stockouts of drugs and diagnostics remain a problem with only 46 to 66% of facilities having no stockouts greater than a week in the past 3 months.
S10. Percentage of private providers recommending appropriate treatment for malaria was worryingly low at less than 30%.
S11. The percentage of forest workers or mobile populations in highly endemic areas sleeping under a net has declined since 2004 to 66% for any net and only 35% for treated nets, showing the need to make treated nets more available and to increase demand in these populations.

Recommendations
- *Improve targeted BCC/IEC strategies and messages*. Since the survey in 2004, knowledge about malaria transmission and prevention has remained generally high among respondents. However, there is a great need for improvement of treatment-seeking knowledge and behaviour. Knowledge of Malarine for the treatment of malaria has increased since the 2004 survey, but more effective strategies for BCC/IEC regarding full treatment courses may still needed. Regarding mosquito net use, improved BCC/IEC strategies and messages targeted for people going to the forest should be considered – as mosquito net use among these at risk populations is low.

- *Promote training and refresher trainings for health facility providers and private drug outlet prescribers, particularly on the diagnosis and treatment for P. vivax*. Prescriber knowledge about treatment for *P. vivax* is low, and more information for the treatment of *P. vivax* should be included in the training modules for case management of malaria. As the case load for P. falciparum is decreasing in favour of P. vivax, it will be important to ensure that health staff in public, private, and communities, are better equipped to diagnosis and treat malaria, including increasingly non-malaria fevers.

- ***Increase sufficient ITN coverage and use is needed.*** Efforts by the national malaria programme to increase coverage of mosquito nets have largely been successful due to the intensive distribution programme supported by the Global Fund, World Bank, and other key stakeholders. However, the programme should now focus on ensuring sufficient ITN coverage (at least one ITN for every two persons), particularly among larger households. Besides ownership of ITNs, it will be important to strengthen strategies to increase the regular *use of ITNs*.

- ***Maintain efficacy of ITNs.*** Increased frequency of washing mosquito nets will undoubtedly reduce the residual insecticidal efficacy of ITNs. A significant proportion (40%) of mosquito nets was reported to be washed at least once per month. The national programme should develop targeted BCC/IEC communications to reduce the frequency of washing of mosquito nets.

- ***Consider more emphasis on mosquito net retreatment.*** According to the 2007 survey, the availability of insecticides for the retreatment of mosquito nets was found to be low. Nearly one-quarter of mosquito nets were more than 3 years old, and the majority were at least 12 months old. Despite increased distribution and use of LLINs, mosquito nets (including conventional nets) are used for several years and with the frequent washing of these nets, it would seem advantageous to increase the availability of mosquito net retreatment.

- ***Ensure availability of antimalarial and RDTs.*** The issue of stock-outs of antimalarial drugs and RDTS in health facilities of more than 1 week within the past 3 months should be addressed. It is especially important to ensure that effective antimalarials, supplies and regents are available and adequately stocked at point of care, particularly for health facilities offering in-patient care where more severe cases would likely be seen.

- ***Promote further operational research addressing the changing epidemiology of malaria.*** The epidemiology of malaria will likely change as the incidence of malaria continues to decline in the region. More research may be needed to evaluate the impact of changing species distributions (i.e., increasing *P. vivax* burden) on disease transmission dynamics. There is also a need for more information on the effect of the rapidly changing environment on malaria vector behaviour and possible secondary malaria species.

- ***Develop and test innovative strategies to improve data collection for M&E indicators.*** As the malaria burden continues to decline it is important to ensure that M&E systems adequately reflect and can address the changing epidemiology. Due to the few numbers of malaria patients, the health core indicator of malaria patients receiving appropriate treatment according to national guidelines could not be adequately addressed. It is recommended that new strategies should be developed and tested in the upcoming CMS 2010 survey (e.g., conducting exit interviews with patients receiving treatment for fever not only malaria cases).

Table 1. Summary of main indicators: Core Indicators

Indicator	CMBS 2004			CMS 2007			P-value
	N	%	95% CI	N	%	95% CI	
C1. % people seeking treatment from *trained providers* within 48 hours of developing a fever	1440	**39.2**	34.7,44.0	1212	**46.7**	42.0,51.4	0.03
C2. % target population who can explain how malaria is transmitted and prevented:							
• Transmission (know mosquito bite/go to forest)	2259	**94.4**	92.1,96.0	2270[2]	**97.5**	96.4,98.3	0.001
• Prevention1 (use of mosquito net)	2259	**94.7**	92.6,96.2	2270	**94.1**	92.3,95.5	0.6
• Prevention2 (use of net + 1 other prevention)	2259	**37.5**	31.2,44.1	2270	**67.5**	63.7,71.0	<0.001
• Prevention3 (use of ITN)	2259	**14.0**	9.5,20.1	2270	**53.0**	47.5,58.5	<0.001
C3. % families living in endemic areas that have *sufficient* ITNs (person:net ratio < 2)	2259	**5.0**	3.5,7.0	2270	**6.4**	4.5,8.9	0.3
• % families living in endemic areas that have sufficient mosquito nets (person:net ratio< 2)	2259	**17.5**	14.7,20.7	2270	**58.6**	54.1,62.9	<0.001
C4. % population at risk sleeping under ITNs the previous night measured in *peak malaria season*	1362	**29.3**	20.4,40.0	11242	**25.3**	21.0,30.0	0.5
• % population at risk sleeping under mosquito nets the previous night measured in *peak malaria season*	10461	**81.1**	74.9,87.1	11342	**79.6**	75.8,82.9	0.5
C5. % patients with malaria in public health facilities prescribed correctly according to national guidelines[3]							
% health workers who have correct knowledge of treatment for: (see below for related indicator) • simple malaria				145	**89.7**	84.6, 94.7	
• severe malaria				60	**71.7**	59.9, 83.4	
• pregnant women				100	**47.0**	37.0, 57.0	
• child with fever				146	**93.2**	94.1, 100.0	
C6. % public health facilities which maintain stocks of antimalarials / rapid tests with no out of date stock for:							
• simple malaria (A+M2,3,4)				86	**86.1**	78.6,93.5	
• severe malaria (artemether, HF with bed only)				29	**100.0**	-	
• RDTs (only if use RDTs)				51	**92.2**	84.5,99.7	
• Slides & Giemsa (only if use microscopy)				22	**95.5**	86.0,100.0	

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[2] Excludes 653 households greater than 2 km. from forest. See Section 3.
[3] Core Indicator C5 could not be measured directly, as malaria was not common at health facilities. Knowledge was used as a contribution to this indicator.

Table 2. Summary of main indicators: Supplementary Indicators

Indicator	CMBS 2004			CMS 2007			P-value
	N	%	95% CI	N	%	95% CI	
S1. % 'households' able to recognize signs & symptoms of malaria	2259	**76.1**	71.6, 80.1	0	**75.5**	73.0, 77.8	0.8
% 'households' able to recognize signs & symptoms of a serious fever[4]	2259	**94.2**	92.5, 95.6	2270	**100.0**	-	<0.001
S2. % seeking treatment from trained provider / total cases febrile illness	1442	**66.6**		1414	**74.2**		<0.001
S3. % children under-5 sleeping under treated mosquito nets the previous night in households that have sufficient treated mosquito nets	26	**100**	-	60	**93.0**	81.8, 97.5	0.1
S4. % public health facilities able to confirm malaria diagnosis acc. national guidelines • microscopy &/or RDT[5]				91	**41.8**	31.4, 52.1	
• microscopy only				91	**36.3**	26.1, 46.3	
S5. % availability of antimalarial regimens other than A+M and Malarine in the market				131	**87.8**	82.1, 93.5	
S6. % awareness of Malarine (Malarine and/or A+M for 2004) among the targeted populations	2238	**47.3**	38.3, 56.4	2266	**72.0**	66.4, 76.9	[6]
S7. % of target groups who know where to obtain testing and treatment for malaria	2259	**91.8**	87.9, 94.5	2202	**93.3**	88.2, 96.3	0.6
S8. % of target groups who know that Malarine (Malarine & A+M for 2004) treatment is effective only if entire course is taken	2259	**10.3**	6.9, 15.1	2270	**38.92**	34.2, 43.9	[7]
S9. % of public health facilities reporting no disruption of stock of antimalarials for >1 week during the previous 3 months (or no disruption of stock on the day of survey)[8] • simple malaria (A+M2,3,4)				91	**61.5**	51.4, 71.7	
• severe malaria (artemether injection, HF with bed only)				38	**65.8**	50.0, 81.6	
• RDTs (only if use RDTs)				50	**58.0**	43.8, 72.1	
• slides & Giemsa				48	**45.8**	81.2, 60.5	
S10. % of private sector providers in target provinces recommending appropriate treatment for malaria • *P.vivax* (chloroquine)				131	**27.5**	19.7, 35.2	
• *P.falciparum* (Malarine)				131	**24.4**	17.0, 31.9	
• *P.falciparum* (A+M)				131	**2.3**	0, 4.9	
S11. % temporary forest workers/ mobile populations in high endemic areas < 2 km from forest who slept under a net last time the person spent the night in the forest • any net	551	**74.1**	59.5, 84.9	1693	**65.5**	59.9, 70.8	<0.001
• treated net (2007 only)				1685	**34.8**	28.2, 42.1	

[4] Original definition was: % mothers and care takers able to recognize signs and symptoms of danger of a febrile illness in a child <5 years, but respondent was not necessarily mother or carer and question was not asked specifically for children under 5

[5] Only 3 cases with only RDT in numerator

[6] In 2004 only asked for awareness of Malarine and/or A+M

[7] Those who do not know Malarine are included in the denominator

[8] Numerator includes Health facilities who had drugs in stock on the day of survey and no disruption of stock for more than 7 days in the past 3 months

1   Background

The Cambodian malaria component proposal was approved by the Global Fund in the Second Round for an initial period of two years (total budget of US $5,013,262 including a 5.9% contribution to the Principal Recipient office). The total budget needed for five years of implementation of the programme has been estimated to be US $9,998,371. The National Centre for Parasitology, Entomology and Malaria Control (CNM) gave critical importance to the conduct of a baseline survey, since the improvement of monitoring and evaluation (M&E) systems based on a rigorously conducted Baseline Survey could be of particular relevance in view of results-based disbursement of future GFATM tranches. For this purpose, the four GFATM sub recipients (CNM, Health Unlimited, Partners for Development and Population Services International) requested the services of the UK-based Malaria Consortium (MC) through support of the World Health Organisation (WHO) to provide overall technical assistance in carrying out a follow-up survey to the 2004 baseline study, and selected The National Institute of Public Health (NIPH) to manage data collection and assist with data analysis and report writing. The US Armed Forces Research Institute of Medical Science (AFRIMS), Thailand provided technical support for the parasite prevalence survey. Detailed Terms of Reference for the survey are in Annex 1.

2   Purpose of the Survey

The Cambodia Malaria Survey 2007 studied a sample of individuals in high-risk areas of Cambodia in order to measure their Knowledge, Attitude, Behaviour and Practice (KABP) towards malaria and obtain a malaria prevalence estimate. In addition, health facilities and providers were surveyed to obtain a measure of coverage of both public and private distribution of antimalarial drugs and mosquito nets. Most indicators were the same as in the baseline survey and the report compares the changes from the 2004 survey to the 2007 survey.

The data gathered through the survey will serve several important purposes:
-   To document the characteristics of the target areas of the malaria programme as a baseline for malaria situation analysis in Cambodia
-   To track changes in key knowledge, attitude, behaviour and practice indicators in order to evaluate programme impact
-   To use findings to improve delivery of malaria control interventions (training, supervision, communications), review current NMCP policies, strategies and programmatic priorities and make mid-course corrections if required

Although not part of the original survey purpose, the opportunity has been taken to extract data from those clusters, which were in the region, which subsequently became Zone 1 of the artemisinin resistance containment project, to contribute to the baseline of containment activities.

3   Methods

Overview

Given the range of required indicators, the survey includes several components, as shown in Figure 3.1. In addition, filter paper samples were collected for serological analysis using enzyme-linked immunosorbent assay (ELISA) and for polymerase chain reaction (PCR) assays at the time of taking blood samples for microscopic diagnosis. The serology will be performed at a later date, and the PCR has been completed, and will be reported separately.

The data collection was undertaken in November to December 2007 towards the end of rainy season, as this is the time of peak malaria transmission, and matches the season of the baseline survey. The questionnaires used for the surveys were similar to those in the baseline and were refined on the basis of observations in the baseline. They are attached as Annex 2.

Figure 3.1   Components of the Cambodia Malaria Survey (CMS) 2007
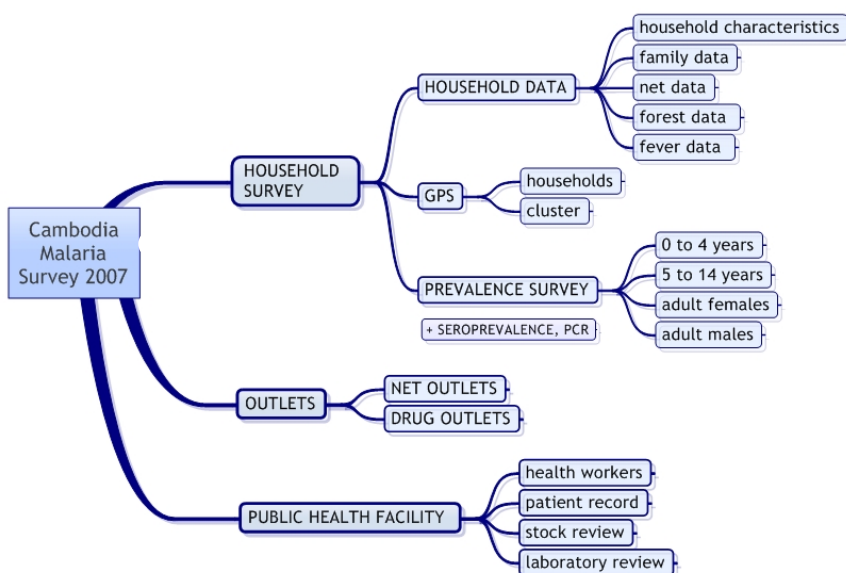
Defining risk zones and sampling domains for baseline survey

The sampling universe for the End of Project Evaluation survey was updated from that used in the baseline survey. It involved combining updated GIS maps of village positions with maps of malaria risk zones and defined sampling domains to provide a list of potential villages to be sampled.

From a total of 13,748 currently mapped villages in Cambodia, 4,816 villages were located in the domains included in the current survey.

Geographical domains

As for the baseline, it was not feasible in this End of Project Evaluation survey to gain precise estimates for each Province. Nevertheless it was useful to have some idea of environmental, geographical and cultural variations in coverage/epidemiology. Domains 1 and 2 of the baseline were maintained, but domain 3 was excluded, as prevalence in these areas was extremely low. The selection of provinces for each domain was made by reviewing maps of predominant land use and particularly forest type by geographical location during baseline planning. The rationale for this was the dependence of the main malaria vectors on being near to or in particular types of forest.

Table 3.2 Distribution of Provinces by Domain

1. Northeast + Koh Kong	2. North West and Central
Koh Kong	Banteay Meanchey
MondulKiri	Battambang
Ottar Meanchey	Kampong Thom
Preah Vihear	Kratie
Rattanakiri	Pailin
Stung Treng	Pursat
	Siemreap

In each domain, sampling was restricted to villages within 5 km from a forest.

Figure 3.2 Selected clusters by domain
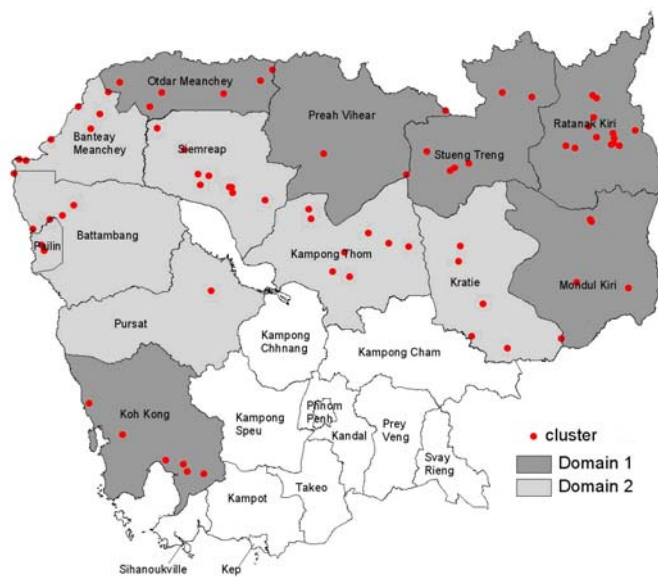
Figure 3.3 Selected clusters by forest coverage
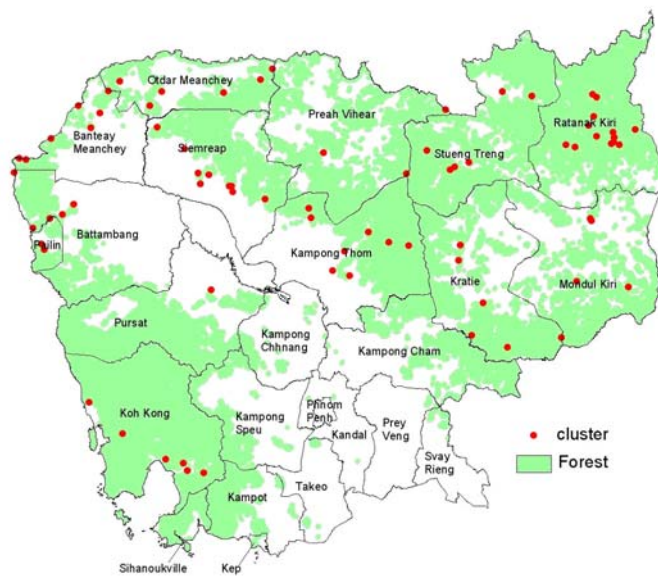
Redefined Risk Zones

Following analysis of the baseline survey it was agreed that an additional risk zone (2 to 5 km from forest) would be added to the three zones used in the baseline. The outer limit of 5

4

kilometres did not set a new control strategy zone, but allowed collection of more information on the distance from forest at which transmission was likely to be absent.

Table 2 Risk zone definitions

CNM Risk Zones	CMBS 2004 Risk Zones	CMS 2007 Risk Zones
1) In forest	1) In forest and up to 250 m from forest	1) In forest and up to 250m from forest
2) Less than 200m from forest		
3) 200-500 m from forest	2) 250m to1 km from forest	2) 250m to 1 km from forest
4) 500 m- 1 km from forest		
5) Greater than 1 km	3) 1 to 2 km from forest	3) 1 to 2 km from forest
		4) 2 to 5 km from forest

Villages per risk zone

Of the 4,816 villages in Domains 1 and 2, 2440 (51%) were located within 5 km of forest, according to available GIS data. Of these, 433 villages were located in Risk Zone 1 (see definitions of new risk zones below); 667 villages were located in Risk Zone 2; 482 villages were located in Risk Zone 3; and 858 villages were located in Risk Zone 4. Across all risk zones there were 1471 villages in Domain 1 and 969 villages in Domain 2.

Main household survey

The household survey design was multi-stage, sampling clusters at the first stage, households within each cluster at the second stage, and then individuals within households (for the subsample for blood collection). The proposed sample size was 1,520 households per domain (for details of the calculations of the sample size and assumptions made see Annex 3). The most desirable design to obtain this was to take **38 clusters of 40 households in each of the 2 domains**. As most villages have at least 40 households it was possible for each cluster to consist of a single village.

In the baseline survey there were a total of 90 clusters: 30 clusters per domain, with 14 in risk zone 1 (<250 m) and 8 each in the two other zones. In the End of Project Evaluation survey there was a total of 76 clusters: 38 clusters per domain, with 14 in risk zone 1 (<250 m) and 8 each in the three other zones (250m to 1km, 1 to 2km, 2 to 5km).

Within each cluster households to be sampled were selected from the current village list. This list was obtained from the village chief on arrival in the cluster.

A questionnaire was administered in each selected household. The person interviewed was the head female where possible. A finger prick blood sample was taken from a sub-sample of four individuals in the household, one from each of the following groups: one aged 0 to 4 years, one aged 5-14 years, one adult female and one adult male (except where not all occur). This selection was made to compare malaria risk in these classes. If there were more than 1 person in any of these groups one was sampled randomly from all individuals falling in that group. The individuals for whom blood samples were taken were recorded in the household schedule in the household questionnaire. A household survey blood sample

sheet was used to record samples taken (and finally results). If there were not anybody in any group (i.e. a blood sample cannot be taken) "NONE" was noted in the blood sample sheet for that group. Blood slides and one filter-paper containing 4 bloodspots were prepared from the blood samples. If there were a pregnant woman in the house who was not included in the blood taking sample for adult woman, her blood was also taken. If there were any persons in the household who appeared to be symptomatic for malaria those persons were given a rapid diagnostic test (RDT) and those with a positive result given the appropriate treatment.

Microscopic examination of Giemsa stained blood smears was performed in order to determine the presence of malaria parasites in survey participants. An extensive training and quality assurance programme was implemented in order to ensure accuracy of prevalence data. Blood takers were trained in smear preparation and smear staining procedures and microscopists required to pass a blinded practical qualifying examination before reading smears obtained from the survey. All smears judged positive by these readers were re-read by a second, senior microscopist who was blinded to the results of the first reader. Additionally, 10% of all smears judged negative by the first microscopist were overread by a senior microscopist. In both cases, the senior microscopist reading was used in the event of non-concordance with the first reader.

Figure 3.4 Cambodia Malaria Survey Sample Design
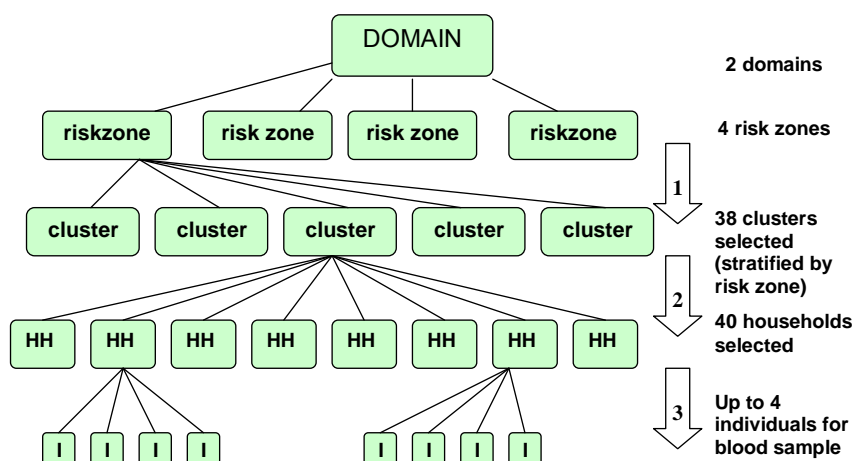
Provider and Outlet Survey

During the household survey, there was a provider (of health care) and outlet (for mosquito nets and anti-malarial drugs) survey with a limited number of questions at three levels of treatment provider (note: private prescribers can be private doctors, medical assistants or nurses and level of qualification was noted). The number of facilities / providers is shown below:

Table 3.3 Number of provider and outlets surveyed per domain

Type of Provider	Total Number
1. Referral Hospital	15
2. Health Centre with bed (MPA)	23
3. Health Centre without bed (MPA)	43
4. Health Centre (not MPA)	1
5. Health Post	9
6. Drug shop/ pharmacy/market	131
7. Net outlet	72

For selected villages, the field staff walked around the market to find mosquito net and anti-malarial drug outlets. They assessed which was the largest outlet for both mosquito nets and anti malarial drugs and where possible noted any brands in other smaller outlets that were not available in the surveyed outlets.

Fieldwork process

This section describes how the fieldwork was organised based on the study design.

The sample size was 38 clusters in 2 domains = **76 clusters**. The intended number of households for the household survey was 76 clusters x 40 households / cluster = **3,040 households**. As some clusters had less than 40 households only 2974 households were visited. A total of 2924 interviews were undertaken, as one householder refused and 49 were absent even after 3 visits. In addition 72 net outlets, 131 drug outlets and 91 health facilities were surveyed.

A team visited each cluster for one day and one night to wait for inhabitants returning from their farms to avoid bias from missing people absent in the day time.   Field work was undertaken from 12 November to 10 December 2007, one week less than planned, as the teams decided to work long and continuous days.

The fieldwork was about 2 weeks later than in 2004, but review of rainfall patterns for the two years shows that the 2007 rainy season continued later in both domains than in 2004, so that climate-related variation in mosquito and human behaviour is likely to be very limited (see Annex 3 for rainfall patterns).

Five teams were required and the composition of each team consisted of:

- 1 survey supervisor
- 1 supervisory technician
- 5 household interviewers
- 3 bloodtakers
- 2 outlet/ facility interviewer
- 2 drivers

The 5 household interviewers covered 8 households per day (total 40 households), and the outlet/ facility interviewer visited one village outlet, one mosquito net and one drug outlet in the nearest market in each cluster and one health centre and health post for each cluster together with a referral hospital where these were near to the cluster.

The bloodtakers covered:

1) household prevalence survey in the village where the household questionnaire survey took place (blood slide and filter paper samples on one aged 0 to 4 years, one aged 5-14 years, one adult female and one adult male.
2) The team also took GPS readings for a central point in the village and 4 readings for the edge of the nearest forest.

Data management

Data from the household survey, health facilities, drug and mosquito net outlets were entered into a database using Epidata (3.1).

Data analysis

Data processing and analysis was carried out using Stata (9.2). Analysis of household survey data accounted for the survey design adjusting for sample weights, risk zone strata and clusters. The survey design allowed comparisons between estimates from the two surveys. ***Weighted estimates are presented in this report***. The frequencies presented are the number of observations in the sample. In order to examine the relationship between key outcomes and socioeconomic status, an index of socioeconomic status was constructed for each household using principal components analysis. The same approach was used in both the baseline survey and the CMS 2007 survey. The indicators included in the index were a mixture of household ownership of assets and housing conditions. The resulting index score was divided into 5 equal sized groups (quintiles) to produce a wealth index.

The sample design for the household survey was non self-weighting, and analysis accounts for sample weights for households and individuals respectively. Therefore the estimates presented are not simple percentages of the observed data shown.

The sources of information for each indicator are shown in Annex 4.

4   Results and Interpretation

Basic characteristics of the respondents in the surveys, including the numbers of health facilities and outlets surveyed are presented in Table 4.

Table 4. Summary of respondent data

	CMBS 2004	CMS 2007	
	N (%)	within 2km of forest N (%)	2km to 5km from forest N (%)
Households	2259	2270	653
People in households	10461	11342	3357
Under 5's	1359 (13.0)	1399 (12.3)	371 (10.9)
5 to 14 year olds	3214 (30.7)	3046 (26.9)	858 (25.1)
Male adults 15+years	2698 (25.8)	3310 (29.2)	1000 (29.2)
Female adults 15+ years	3190 (30.5)	3587 (31.6)	1128 (33.0)
Currently pregnant (% of all eligible women)	202 (7.6)	301 (7.8)	62 (1.8)
Household nets:	4571	5011	1567
ITNs[9]	1468	1790	408
Long lasting nets[10]	-	992	146
People who go to the forest	2063	1696	350
People who had fever in the past 2 weeks	1316	1214	352
People with blood slide	5696	6273	1794
People with positive blood slides	255	212	9
Net outlets	49	72	
Drug outlets	123	131	
Health facilities	24	91	

4.1   Malaria and Fever Prevalence

The overall malaria prevalence decreased from 4.4% in 2004 to 2.9% in 2007, which was not statistically significant (Table 4.1.1.). The distribution of *Plasmodium falciparum*, *P. vivax*, mixed infections, and other species was similar between the two study periods, with approximately two-thirds of infections due to *P. falciparum* and a third from *P. vivax*.

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[9] ITN includes recently treated and LLINs. Recently treated refers to nets that have been pre-treated and less than 1 year old or treated with insecticide in the past year.
[10] LLINs include White Olyset (n=218), blue Olyset (n=697) or Malanet (n=77) nets

Although the numbers are relatively small, it is worth noting that the overall proportion of *P. falciparum* among all positive cases decreased from 68% (2004) to 59% (2007) while *P. vivax* increased from 27% (2004) to 33% (2007). Interestingly, the proportion of mixed infections (Pf and Pv) significantly increased from 2.3% (2004) to 8% (2007) although the small numbers do not allow for meaningful interpretations. For comparison, it was noted that Health Information System (HIS) data from public health facilities showed that 74% of the positive cases were Pf and 23% Pv in 2007.

Table 4.1.1 Malaria prevalence and species, 2004 and 2007 in households located 0-2 km from forest

	CMBS 2004			CMS 2007		
	%	95% CI	N (=5696)	%	95% CI	N (=6273)
Total	4.4[11]	2.8, 6.8	255	2.6	1.6, 4.1	212
P.falciparium	2.9	1.7, 5.1	173	1.6	0.9, 2.7	125
P.vivax	1.3	0.8, 2.1	70	0.9	0.6, 1.6	69
Pf & Pv	0.1	0.04, 0.3	6	0.3	0.1, 0.9	17
Other	0.05	0.02, 0.1	6	0.01	0, 0.08	1
	%	95% CI	N (=10461)	%	95% CI	N (=11342)
Fever reported in last 2 weeks	12.9	11.6, 14.3	1316	10.8	9.8, 12.0	1214

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[11] Estimates presented in this report are weighted.

Table 4.1.2 Species by age/sex, risk zone and domain

	N	Total positive N (%)	*P.falciparum* N (%)	*P.vivax* N (%)	Pf & Pv N (%)	Other N (%)
Age and Sex						
CMBS 2004						
<5yr	830	32 (4.2)	22 (2.5)	9 (1.7)	1 (0.4)	0
5 to <15 yr	1297	73 (4.9)	39 (3.0)	29 (1.5)	4 (0.3)	1 (0.5)
male 15+ yr	1521	93 (6.7)	68 (4.8)	23 (1.9)	1 (0.01)	1 (0.2)
female 15+ yr	2048	57 (2.4)	44 (1.7)	9 (0.6)	0	4 (0.1)
CMS 2007						
<5yr	940	39 (3.1)	24 (2.0)	10 (0.7)	5 (0.4)	0
5 to <15 yr	1361	64 (3.2)	25 (1.7)	20 (1.0)	9 (0.4)	0
male 15+ yr	1781	63 (3.2)	39 (2.0)	21 (1.1)	2 (0.1)	1 (0.04)
female 15+ yr	2191	46 (1.5)	27 (0.8)	18 (0.7)	1 (0.03)	0
Risk zone strata						
CMBS 2004						
<250m	2590	140 (5.0)	87 (3.1)	46 (1.7)	3 (0.1)	4 (0.1)
250m to <1km	1526	75 (5.7)	54 (3.7)	18 (1.9)	2 (0.1)	1 (0.03)
1km to <2km	1580	40 (2.5)	32 (2.0)	6 (0.4)	1 (0.1)	1 (0.1)
CMS 2007						
<250m	2110	68 (2.3)	48 (1.3)	20 (1.0)	0	0
250m to <1km	2343	87 (2.9)	49 (1.8)	30 (1.0)	8 (0.2)	0
1km to <2km	1820	57 (2.3)	28 (1.2)	19 (0.7)	9 (0.4)	1 (0.04)
2km to <5km[12]	1794	9 (0.5)	3 (0.1)	5 (0.2)	1 (0.1)	0
Domain						
CMBS 2004						
1	2885	167 (6.9)	128 (5.4)	31 (1.2)	4 (0.2)	4 (0.1)
2	2811	88 (2.8)	45 (1.3)	39 (1.4)	2 (0.04)	2 (0.03)
CMS 2007						
1	3330	189 (5.4)	114 (3.3)	57 (1.6)	17 (0.5)	1 (0.03)
2	2943	23 (0.7)	11 (0.3)	12 (0.4)	0	0

It was notable that the greatest drop in positivity rates from 2004 to 2007 was in adult males, which may reflect changing patterns of travel and forest use between the time of the two surveys. The data from the 2 to 5 kilometre zone were of considerable interest, as this zone was not included in the national target area for ITN distribution. It was clear that the risk of infection was considerably lower in this zone. It would be interesting to investigate the travel history of the small number of positive cases to determine if there could be local transmission, but this was beyond the scope of this report. There was also a higher proportion of *P. vivax*, which had been expected, because relapses of *P. vivax* do not require mosquito-borne transmission.

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[12] The results for the clusters 2 to 5 km from forest are not included in the age/sex and domain breakdown.

Figure 4.1.1 Distribution of malaria species by age/sex groups
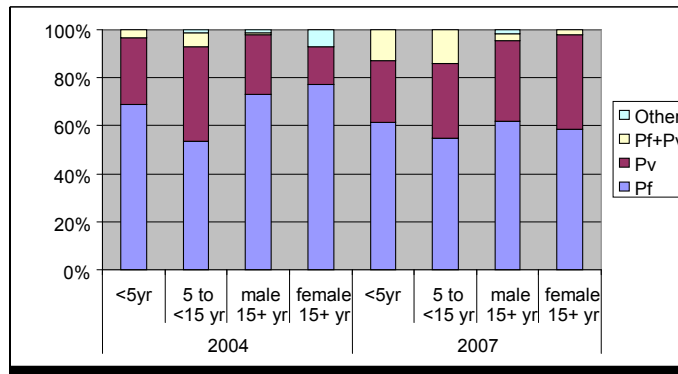
The distribution of Pf vs Pv appears to be similar between the two survey periods, with a slight trend of decreasing Pf and increasing Pv species. Interestingly, there was an increase of mixed Pf and Pv infections, particularly among under 5s and those between 5 and 14 years. There was no difference in the distribution by species between males and females 15 years and above.

Based on the 2004 survey results, it appeared that there was a significant increase in risk of infection among those inhabitants who lived < 250m and 250m to <1km from the forest compared to those who lived more than 1km. The CMS 2007 survey sought to confirm this relationship by including a fourth category for those who lived between 2 and 5 km from the forest. Data from both surveys suggest there to be a higher risk associated with proximity to the forest (Figure 4.1.2), with a slightly higher risk among those who lived in the periphery of the forest (250km to 1km). PCR and serological analyses should provide more data to evaluate this association.

In both surveys of 2004 and 2007, domain 1 had a significantly higher number and proportion of positive cases than in Domain 2.

Table 4.1.3 Prevalence by Province, 2007

Province	Number of blood slides	Total positive N (%)	Pf N (%)	Pv N (%)	Pf & Pv N (%)	Other N (%)
Banteay Meancheay	545	**1 (0.3)**	1 (0.3)	0	0	0
Battambang	412	**0**	0	0	0	0
Kampong Thom	680	**9 (1.1)**	3 (0.4)	6 (0.7)	0	0
Koh Kong	616	**11 (1.4)**	4 (0.5)	6 (0.8)	1 (0.1)	0
Kratie	553	**10 (1.6)**	5 (0.4)	5 (1.2)	0	0
Mondul Kiri	432	**54 (11.8)**	29 (6.7)	14 (2.8)	10 (2.1)	1 (0.2)
Preah Vihear	106	**0**	0	0	0	0
Rattanakiri	1291	**75 (6.7)**	42 (4.3)	27 (2.3)	6 (0.2)	0
Siem Reap	490	**2 (0.4)**	2 (0.4)	0	0	0
Steung Treng	495	**44 (5.7)**	37 (4.5)	7 (1.2)	0	0
Oddar Meancheay	394	**5 (0.4)**	2 (0.2)	3 (0.2)	0	0
Pailin	259	**1 (0.3)**	0	1 (0.3)	0	0

The table excludes people from the risk zone 2km to <5km from forest. There were a total of 9 positives in this stratum: 4 in Siem Reap, 2 in Preah Vihear, 2 in Oddar Meancheay and 1 in Mondul Kiri.   Interestingly, the number of positives in this zone in Siem Reap was double the number in the three risk zones closer to the forest. The absence of any positive slides in Preah Vihear was surprising, given that it had the highest prevalence in 2004.

Malaria prevalence by province revealed a varied geographical distribution from 0% in Battambang and Preah Vihear to 6.7% and 11.8% in Rattanakiri and Mondul Kiri along the borders with Lao PDR and Vietnam. It is interesting that all mixed infections (Pf + Pv) were found in Domain 1, and nearly all of these were from Rattanakiri and Mondul Kiri. It will be important to ensure that the treatment guidelines are followed closely in these areas.

Figure 4.1.2 Percent positive by risk zone (2004 compared to 2007)
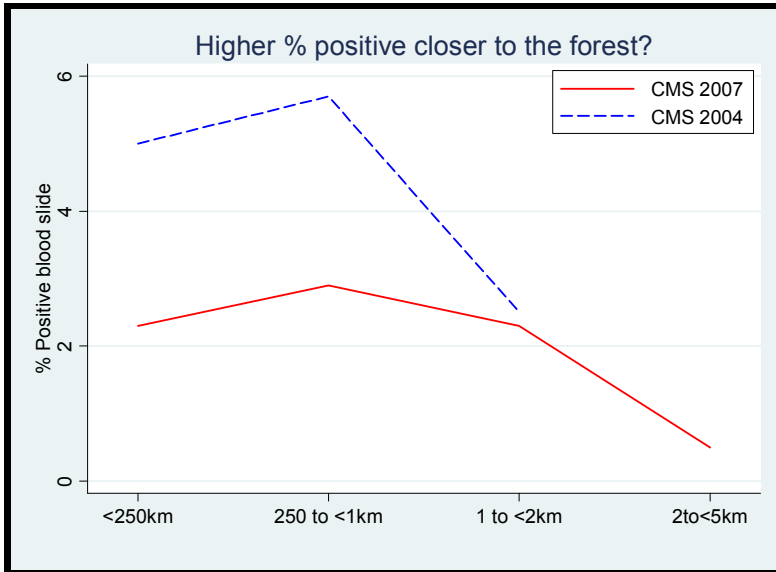
Figure 4.1.3 Percent positive by socio-economic group (2004 compared to 2007)
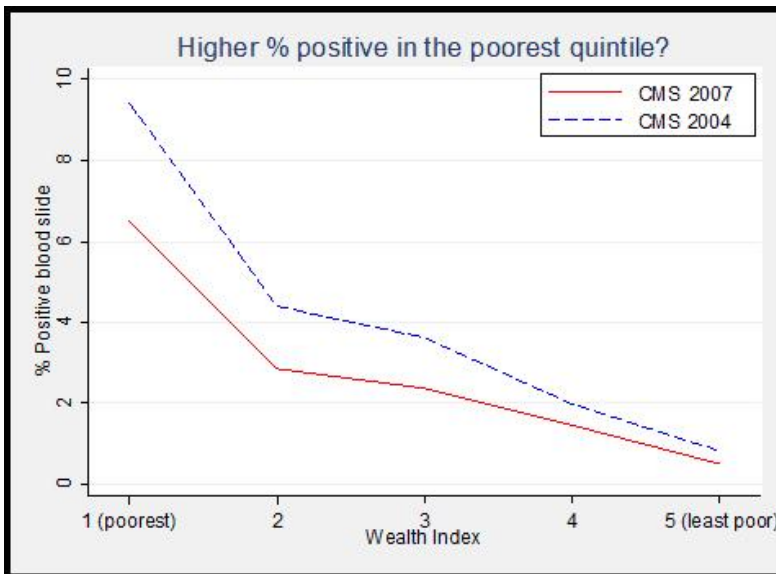
Using the same wealth index for both 2004 and 2007 surveys, the association between poverty and malaria is evident – malaria prevalence is highest among those with the lowest wealth index (Figure 4.1.3). When we look at net use by socio-economic group, we also see that wealthier households report higher levels of both any mosquito net and ITN use than their poorer counterparts in the 2004 survey. In 2007, this trend of wealthier households reporting more use held true with regards to any mosquito net, but not with ITNs (see Table 4.3.8).

Table 4.1.4 Associations of multiple factors with a positive blood slide (2-5 km zone excluded)

	CMBS 2004			CMS 2007		
	N	%	p-value	N	%	p-value
Total Positive	5696	4.4		6273	2.6	
Domain						
1	2885	6.9	<0.001	3330	5.4	<0.001
2	2811	2.8		2943	0.7	
Risk zone						
<250m	2590	5.0	0.3	2110	2.3	0.8
250m to <1km	1526	5.7		2343	2.9	
1km to <2km	1580	2.5		1820	2.3	
Socio economic group						
Q1 (poorest)	1360	9.4	<0.001	1382	5.9	<0.001
Q2	1318	4.3		1264	2.7	
Q3	1161	5.3		1258	2.1	
Q4	1008	2.0		1326	1.7	
Q5 (least poor)	849	1.1		1043	0.6	
Age/ Sex						
<5yr	830	4.2	<0.001	940	3.1	0.01
5 to <15 yr	1297	4.9		1361	3.2	
male 15+ yr	1521	6.7		1781	3.2	
female 15+ yr	2048	2.4		2191	1.5	
Had fever						
Yes	921	8.1	0.001	828	4.3	0.001
No	4775	3.7		5445	2.3	
Net use last night						
Any net						
Yes	4764	3.4	0.001	5372	2.6	0.9
No	932	8.9		901	2.6	
Ever treated						
Yes	2946	4.2	0.8	3459	3.0	0.2
No	2750	4.6		2758	2.1	
ITN						
Yes	1558	3.3	0.2	1804	3.1	0.4
No	4088	4.9		4413	2.4	
Went to forest						
Yes	1102	8.2	0.002	1100	4.6	0.01
No	4594	3.7		5173	2.2	
Women 15 to 49						
Pregnant	196	6.8	<0.001	217	3.3	0.02
Not pregnant	1563	1.9		1974	1.3	

ITN includes recently treated and LLIN. Note that some nets were not recorded as treated from the respondent but were classified as LLIN from net type. P values comparing years are not included, as they would need a more advanced analysis that adjusts for multiple variables at the same time. Although not significant it is unexpected that treated net use correlates with higher prevalence in 2007; this is the reverse of what was found in 2004. The lack of evidence of a protective association with net use may be due to the lower overall proportion of positives. The significantly higher positivity rate in pregnant than non-pregnant women highlights the importance of intervention for this group.

Univariate analysis of selected variables revealed significant positive associations between having a positive malaria blood slide and residence in Domain 1, low socio-economic status, fever, and going to the forest. The higher risk of malaria associated with males >15 years of age from the 2004 survey, was not observed in the recent survey, possibly due to changes in the types of and reasons for population movement.. In the 2007 survey, children <5, adolescents between 5 and 14 years, and males 15 years and above all were twice more likely to have a positive malaria blood slide compared to females 15 years and above.

In both surveys, going to the forest more than doubled the risk of a positive blood slide compared to those who did not report going in the forest.

4.1.1 Fever

Table 4.1.5 Associations of multiple factors with fever in the last 2 weeks

	CMBS 2004			CMS 2007		
	Number of people	% with fever	p-value	Number of people	% with fever	p-value
Overall fever	10461	12.9		11342	10.8	
Domain						
1	5906	11.5	0.2	5629	12.1	0.06
2	6059	12.7		5713	10.1	
Riskzone						
<250m	4470	12.4	0.9	3809	11.6	0.2
250m to <1km	2884	13.1		4196	11.5	
1km to <2km	3107	12.9		3337	9.5	
Socio economic group						
Q1 (poorest)	2567	15.7	<0.0001	2300	13.0	0.07
Q2	2676	12.8		2195	11.6	
Q3	2616	12.2		2334	10.2	
Q4	2177	11.7		2479	10.6	
Q5 (least poor)	1925	8.5		2034	9.1	
Age/sex						
< 5 years	1482	24.5	<0.0001	1399	21.1	<0.001
5 to <15 years	3544	12.4		3046	12.2	
male 15+ years	3344	10.5		3310	8.8	
female 15+ years	3595	8.7		3587	7.7	
Under 5 years						
No	10483	10.6	<0.0001	1399	9.4	<0.001
Yes	1482	24.5		9943	21.1	
Pregnant women						
No	11746	12.2	0.9	11103	10.8	0.5
Yes	219	12.5		239	12.3	
Go to forest						
No	9902	11.8	0.005	9646	10.6	0.1
Yes	2063	14.7		1696	12.4	

Fevers in the last two weeks do not seem to be associated with domain or risk zones. In areas of low transmission of malaria, fevers are generally not indicative of malaria infection. Although the data do suggest that fevers are more likely among children under 5 years and those from lower socio-

economic status than their wealthier counterparts, these fevers could be due to other causes such as pneumonia or other infections not directly related to malaria.

Table 4.1.6 Distribution of fever by age and sex for each risk zone and domain

	N	Total with fever N (%)		Total with fever Age / Sex group		
			0 to 4 years N (%)	5 to 14 years N (%)	15+ years males N (%)	15+ years females N (%)
CMBS 2004						
Total with fever	10461	1316 (12.9)	335 (24.8)	399 (12.6)	285 (11.6)	298 (9.2)
Risk zone strata						
<250m	4470	567 (12.4)	161 (26.0)	171 (12.2)	101 (8.1)	134 (9.8)
250m to <1km	2884	386 (13.1)	97 (25.1)	116 (12.9)	90 (11.4)	83 (9.1)
1km to <2km	3107	363 (12.9)	76 (23.5)	112 (12.5)	94 (13.9)	81 (8.8)
Domain						
1	5198	587 (11.9)	167 (25.3)	189 (12.3)	110 (9.2)	121 (7.8)
2	5263	729 (13.5)	167 (24.6)	210 (12.9)	100 (13.1)	177 (10.0)
CMS 2007						
Total with fever (excl. 2 to <5km)	11342	1214 (10.8)	296 (21.1)	341 (12.2)	286 (8.8)	291 (7.7)
Risk zone strata						
<250m	3809	418 (11.6)	107 (21.1)	110 (12.9)	100 (10.5)	99 (7.8)
250m to <1km	4196	471 (11.5)	107 (20.3)	145 (14.4)	99 (8.5)	120 (8.3)
1km to <2km	3337	325 (9.5)	82 (22.3)	86 (8.9)	85 (8.2)	72 (6.8)
>= 2km	3357	352 (10.2)	82 (23.9)	85 (8.7)	90 (9.2)	95 (8.1)
Domain						
1	5629	661 (12.1)	159 (20.6)	201 (14.1)	141 (9.5)	160 (9.3)
2	5713	553 (10.1)	137 (21.4)	145 (8.4)	131 (6.8)	553 (10.1)

Generally, from the CMS 2007 survey, those who lived closest to the forest (<250m and 250m to <1km from the forest) were more likely to have fevers within the past two weeks compared to those who lived between 1km to <2km from the forest. This was particularly evident among males 15 years old and above who were 1.2 times more likely to suffer from a fever within the past two weeks if they lived <250m from the forest compared to those who lived 1km to <2km from the forest.

Table 4.1.7 Distribution of type of fever

Type of fever	CMBS 2004		CMS 2007	
	N	%	N	%
Krun chanh	167	13.0	236	16.5
Krun kdao	1214	83.1	871	76.4
Krun loap	6	0.3	10	0.6
Krun chhiem	2	0.02	11	0.8
Krun yop	18	1.1	9	0.7
Other	29	2.6	60	4.9

Note: frequencies appear inconsistent with percentages because of data weights.

There are many different types of fevers that are identified by local inhabitants. In the 2004 survey, 83% of fevers were associated with *krun kdao* followed by *krun chanh*. Interestingly, there appeared to be a shift in the type of fevers reported in the 2007 survey, with numbers reporting *krun chanh* increasing and numbers reporting *krun kdao* decreasing. More qualitative research may be needed to understand the symptoms associated with these different types of fevers and whether these differences are good predictors for malaria versus non-malaria fevers. *Krun chanh* is usually translated as malaria, while *kdao* means hot, *krun chhiem* means dengue, and *yop* means night.

4.2   Spatial Patterns of Malaria

4.2.1   Spatial patterns of malaria at national level

Mapped survey results are shown in Figure 4.2.1, which indicates that highest malaria prevalences were recorded in clusters located in north-central, north-western and western parts of the country (including, principally, Rattanakiri, Mondulkiri, Stung Treng, Kratie and Kampong Thom). This is reflected in prevalence calculations by domain (see Table 4.1.2), which indicate that mean prevalence in domains 1 and 2 were 5.4% and 0.7% respectively (corresponding values in 2004 were 6.9% and 2.8%). The prevalence of *P. vivax* was 1.6% in domain 1 and 0.4% in domain 2 (corresponding estimates in 2004 were 1.2% and 1.4%).

Figure 4.2.1 Malaria prevalence by cluster, with risk zones for each cluster indicated by the numbers next to the coloured circles.
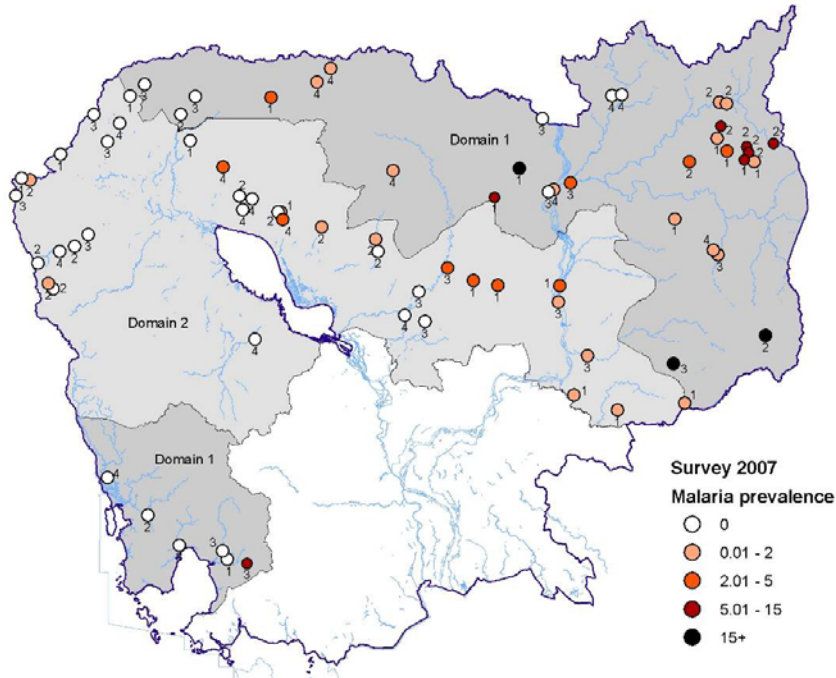
4.2.2 Analysis of prevalence by risk zone

Geographic Position System (GPS) records for 2,874 households with validated location data were imported into a Geographic Information System (GIS) and overlaid with available estimates of forest distribution to determine minimum straight-line distances between households and the forest boundary. Points lying within areas of forest were assigned a distance of zero. As, previously carried out for the CMBS 2004, spatial analysis of forest/prevalence relationships was carried out using four alternative estimates of forest distribution:

A. Forest to household distances measured by GIS, using available land use data from the Cambodia Reconnaissance Survey Digital Database (referred to as 'JICA' (Japanese International Cooperation Agency) land cover maps in this document)
B. Forest to household distances calculated from rapid GPS surveys of forest carried out during the malaria survey
C. Forest to household distances measured by GIS, using estimates of forest cover from remotely sensed vegetation index data. These data are derived from MODIS sensor data at 250 m spatial resolution (see 2005 CMBS report, Annex 5, for a full description of this data source)
D. Existing CNM expert opinion estimates of cluster-level distance to forest (CNM risk zones)

Graphs showing variation in cluster-level malaria prevalence with distance to forest (risk zones 1-4), as estimated using the above methods, are presented in Figure 4.2.2. Data from the CMBS 2004 are included for reference (note, these are not available for CNM risk estimates, panel D).

Figure 4.2.2 Variation in malaria prevalence with distance to forest (indicated by risk zone) based on four alternative indicators of forest distribution
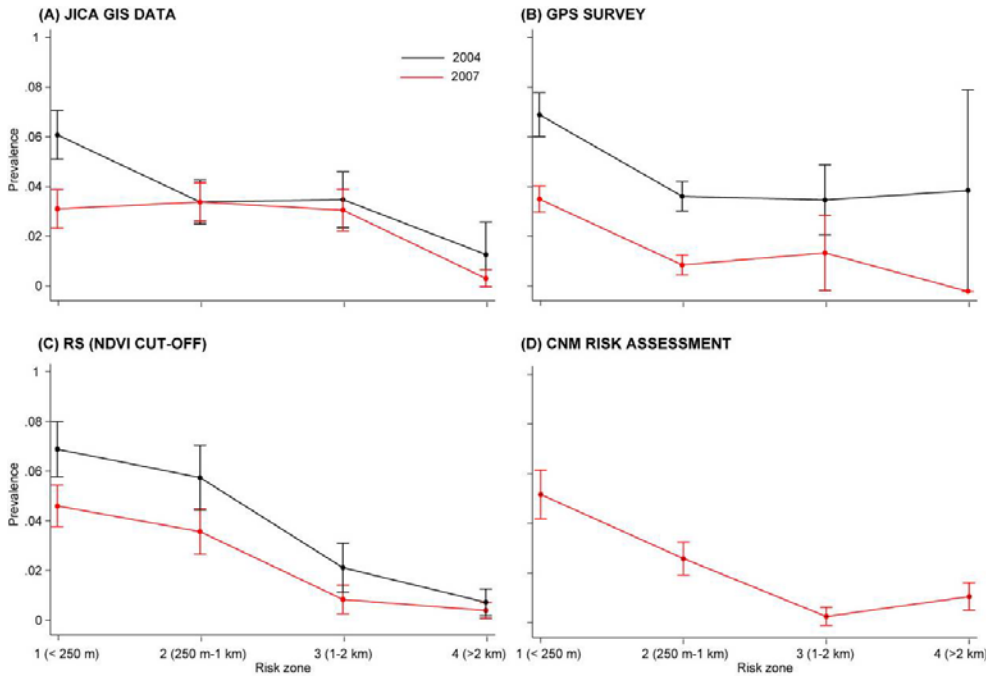
The graphs in Figure 4.2.2 indicate a general decline in prevalence as anticipated risk of infection (on the basis of risk zone) declines. However, spatial patterns of prevalence appear to vary considerably depending on which method is used to map forest. Using GIS data from JICA land cover maps (Figure 4.2.2a), malaria data for 2004 suggest a monotonic decline in prevalence with increasing distance from forest and a subsequent marked reduction in prevalence within risk zone 1 in 2007. However, this effect is less evident when other indicators of forest are used. In the case of GPS-measured forest (Figure 4.2.2b), reductions in prevalence occur across all risk zones, with the largest reductions (in percentage terms) appearing to have taken place outside risk zone 1. RS-based estimates of distance to forest (Figure 4.2.2c) show an intermediate picture: the percentage reduction in prevalence appears to be fairly similar across all risk zones.

It is unclear which of the indicators used in this analysis provides the most accurate estimate of forest distribution. This lack of a 'gold standard' estimate of forest distribution remains a problem when planning and interpreting malaria survey results. In practice such a gold standard can only be provided by recent, high-resolution satellite data such as the SPOT5 images for 2005-6 (available through JICA). These images allow direct mapping of forest (see Figure 4.2.3a), but unfortunately are only available for selected areas of Cambodia (see footprints of available imagery in Figure 4.2.3d).

Figure 4.2.3 An illustration of the limitation of existing land use data for forest mapping.
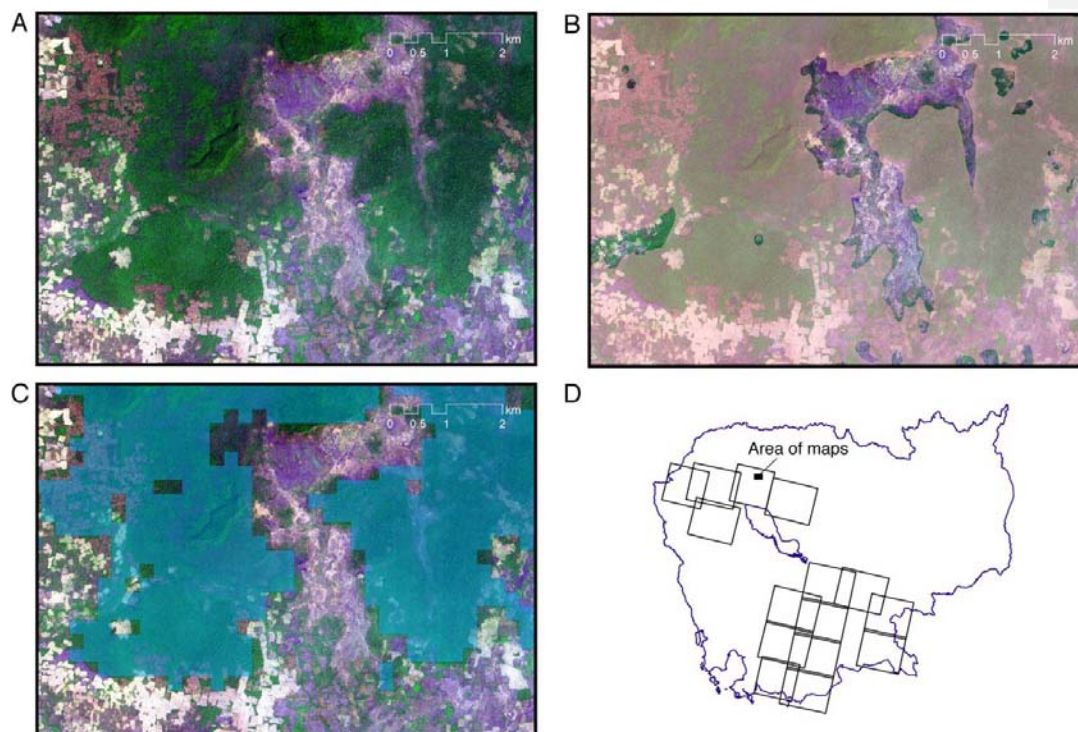
Panel A shows an approximately 10 × 6 km subset of a SPOT5 image (spatial resolution 5 m). Areas of forest (green areas) and fields (white areas) are clearly visible. Panel B indicates (using pink shading) areas classified as forest in the JICA land cover map. Large portions of the SPOT5 image are incorrectly classified by the JICA map. Forest cover maps derived using vegetation index data from MODIS satellite sensor data (Panel C, blue shading) would appear to provide a more accurate estimate of forest distribution. Panel D indicates the availability of SPOT5 data (each polygon represents an individual SPOT5 image).

In areas where direct comparisons between SPOT images, JICA land cover data and RS-derived vegetation index data are possible, major limitations in the JICA land cover dataset become apparent. This is illustrated in Figure 4.2.3, in which the JICA land cover maps clearly overestimate the distribution of forest (see Figure caption). From this example it seems likely that better estimates of forest distribution can be obtained using freely available RS data (such as, in this case, MODIS data); but such products would need rigorous validation before they could be advocated as a tool for malaria risk stratification.

4.3   Malaria prevention

Indicators of knowledge of transmission, knowledge of prevention and of prevention behaviour are shown below:

Core Indicators - prevention

C2   % of target population who can explain how malaria is transmitted and prevented

C3   % of families living in endemic areas that have sufficient treated mosquito nets

C4   % of population at risk sleeping under insecticide treated nets the previous night, measured during peak malaria transmission season

Supplementary Indicators

S5   % of children under-5 sleeping under treated mosquito nets that have sufficient treated mosquito nets the previous night

4.3.1   Knowledge of malaria transmission:

Core indicator C2:   % of target population who can explain how malaria is transmitted

Table 4.3.1: Knowledge of transmission and prevention

	CMBS 2004			CMS 2007			
Components of C2	**N**	**%**	**95% CI**	**N**	**%**	**95%CI**	
Transmission (know a mosquito bite or going to the forest)	2259	94.4	92.1,96.0	2270	97.5	96.4,98.3	0.001
Prevention1 (use of mosquito net)	2259	94.7	92.6,96.2	2270	94.1	92.3,95.5	0.6
Prevention2 (use of mosquito net plus 1 other type of prevention)	2259	37.5	31.2,44.1	2270	67.5	63.7,71.0	<0.001
Prevention3 (use of ITN)	2259	14.0	9.5,20.1	2270	53.0	47.5,58.5	<0.001

Knowledge of how malaria is transmitted is generally quite high as observed in both 2004 and 2007 surveys. In fact, the percentage of respondents who reported that malaria can be transmitted via mosquito bites increased from 94.4% in 2004 to 97.5% in 2007 – a statistically significant increase (p<0.001). The other common responses were drinking dirty water and drinking unboiled water (Figure 4.3.1). The distribution of these and "other" responses was similar between the two surveys periods. The BCC/IEC communications activities of the national programme have contributed to the increase in knowledge of how malaria is transmitted between the survey periods, but the national programme should also look at ways to address the other common responses such as "drinking dirty water" and "drinking unboiled water."

Figure 4.3.1 Respondent knowledge of malaria transmission
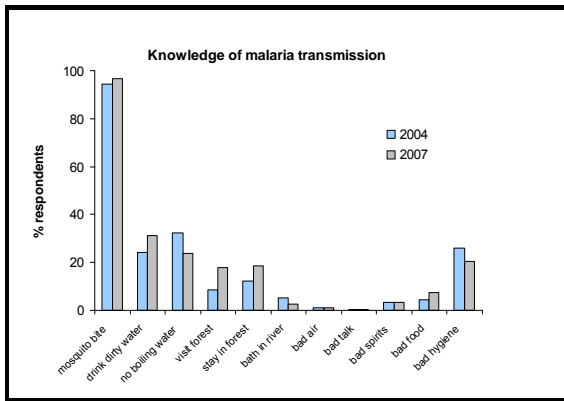
Figure 4.3.2. Respondent knowledge of malaria prevention
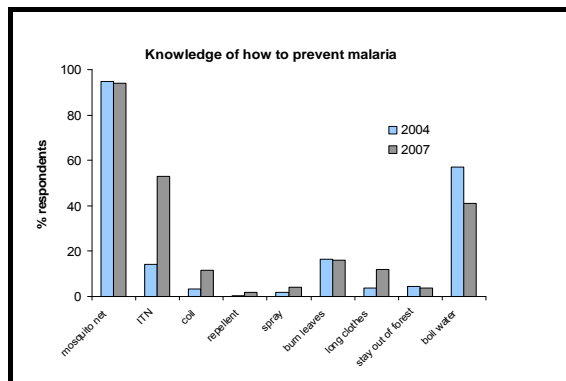
Knowledge of using mosquito nets to prevent malaria remained consistently high between the two surveys. However, a significant increase in the number of respondents (14% in 2004 to 53% in 2007, p<0.001) reported that malaria could be prevented by the use of ITNs. This result is encouraging because it suggests that respondents knew the difference between a mosquito net and an ITN, the latter being a more effective tool in prevention of malaria. Generally compared to the results from 2004, it appeared that respondents were more knowledgeable of other appropriate prevention measures, including use of coils, repellents and sprays, and wearing long clothes. At the same time, despite nearly all respondents knowing that mosquito nets can be used to prevent malaria, a significant proportion of these respondents also cited "boiling water" as a preventive measure.

Table 4.3.2 Knowledge of where to buy nets

	CMBS 2004		CMS 2007	
	N	%	N	%[13]
nearest market	1504	67.8	1586	73.5
near place (2004)/ village shop (2007)	454	23.9	145	7.3
place further away	142	6.5		
would not buy	1	0.1	93	3.8
wait for project			234	9.6
other	13	0.3	202	5.4
don't know	23	1.2	10	0.4
TOTAL	2137	100.0	2270	100.0

In both 2004 and 2007 surveys, the majority of respondents knew that they could purchase a mosquito net from the nearest market. A significant decrease of respondents from 23.9% in 2004 to 7.3% in 2007 indicated that they could purchase mosquito nets from a near place (2004) or village shop (2007).

Figure 4.3.3 Knowledge of benefits of a treated net
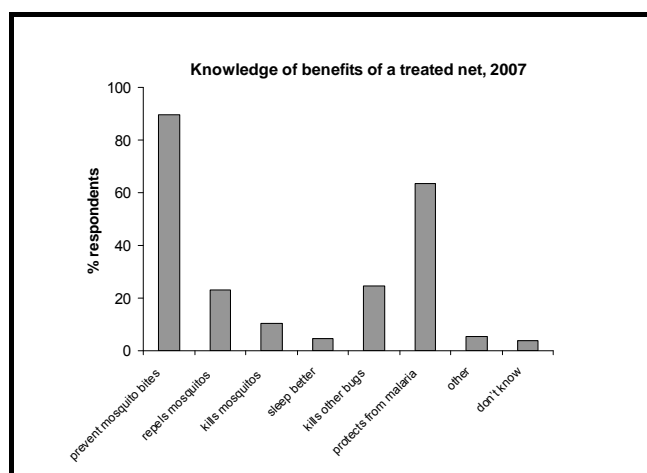
The benefits of using an insecticide-treated bednet are well understood. More people noted the benefit of preventing mosquito bites than protecting against malaria, but this does not mean they do not know both reasons.

4.3.2 Prevention indicators: levels and patterns of ITN coverage

Core Indicator C3 % of families living in endemic areas that have sufficient treated mosquito nets[14]

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[13] Data are weighted
[14] **Definitions:**
"**Net**" = a mosquito net or a hammock net, whether treated or not;
"**Never-treated net**" = a net that has never been treated with insecticide;

Table 4.3.3: Summary of household ownership of mosquito nets

	CMBS 2004		CMS 2007		p-value
	N	% (95% CI)	N	% (95% CI)	
At least 1 net:					
Any net	2259	94.9 (91.0,97.2)	2270	100.0 (-)	0.004
Ever treated	2259	66.2 (56.6,74.6)	2270	66.4 (58.0,73.8)	0.9
ITN	2259	35.8 (26.3,46.7)	2270	42.6 (35.9,49.7)	0.3
Sufficient nets (at least 1 net for 2 people)					
Sufficient nets	2259	17.5 (14.7,20.7)	2270	58.6 (54.1,62.9)	<0.001
Sufficient ITNs	2259	5.0 (3.5,7.0)	2270	6.4 (4.5,8.9)	0.3

Southeast Asia has a long tradition of using mosquito nets. This is also the case in Cambodia where all respondents (100%) in 2007 reported having at least one mosquito net in the household compared to 95% in 2004. Although coverage of at least one mosquito net is high, only two-thirds reported their net ever having been treated (consistent in both surveys), and even fewer respondents had at least one ITN.

Household ownership of treated nets has not changed since 2004, and this is both surprising and very disappointing. Household ownership of nets, on the other hand, has improved significantly, measured both as the proportion of households with at least one net, or as the proportion with more than one net for every 2 people. Actually, it is remarkable that we saw more than 2,200 households and every single one of them had a net – the writers are not aware of any careful large-scale representative survey that has reported anything close to this.

The proportion of respondents with sufficient nets (at least one net for every two people) significantly increased from 18% in 2004 to 59% in 2007, which suggests that efforts by the NMCP to increase coverage of mosquito nets has dramatically improved since the last survey. However, more work needs to be focused on ensuring that these nets are ITNs and/or retreatment of net strategies.

Table 4.3.4 Household ownership of at least 1 ITN by province, 2007

	No. houses visited	ITN % (95% CI)
Banteay Meancheay	214	32.4 (18.5, 50.2)
Battambang	160	29.2 (15.7, 47.7)
Kampong Thom	248	57.9 (40.5, 73.5)
Koh Kong	200	60.9 (32.5, 83.4)
Kratie	192	30.3 (16.3, 49.3)
Mondul Kiri	152	62.1 (36.5, 82.4)
Preah Vihear	40	100.0
Ratna Kiri	461	39.4 (27.8, 52.4)
Siem Reap	193	24.7 (11.2, 46.2)
Steung Treng	170	64.6 (40.0, 83.3)
Oddar Meancheay	144	9.9 (5.4, 17.3)
Pailin	96	38.0 (27.4, 49.8)

"**Ever-treated net**" = a net that has been treated with insecticide or a long lasting net;
"**ITN**" or "**Insecticide-treated net**" = a net that has been treated or retreated with insecticide within the last 12 months, or a net that has been obtained within the last 12 months from a project (Govt or NGO) source (and is therefore assumed to be pre-treated) or a long lasting net

According to this most recent survey, household ownership of at least one ITN varies significantly by province, from 10% in Oddar Meancheay province to nearly 65% in Steung Treng province (both provinces are in Domain 1). Since fewer than 10% of all households in both 2004 and 2007 surveys have sufficient ITNs, this trend has remained consistently low and should be an area for improvement.

It is worth considering with care the definition of "sufficient nets" used in Cambodia. With the simple criterion that at least one net per two people is sufficient, there does appear to be a sharp drop-off in percentage of sufficient nets and ITNs, as household size increases (figure 4.3.4a and b):

Figure 4.3.4a Percent of sufficient mosquito nets by household size
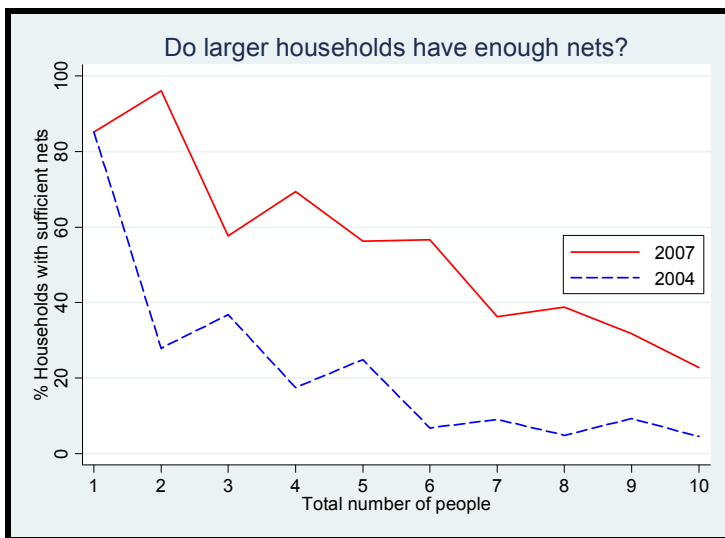
Figure 4.3.4b Percent of sufficient ITNs by household size
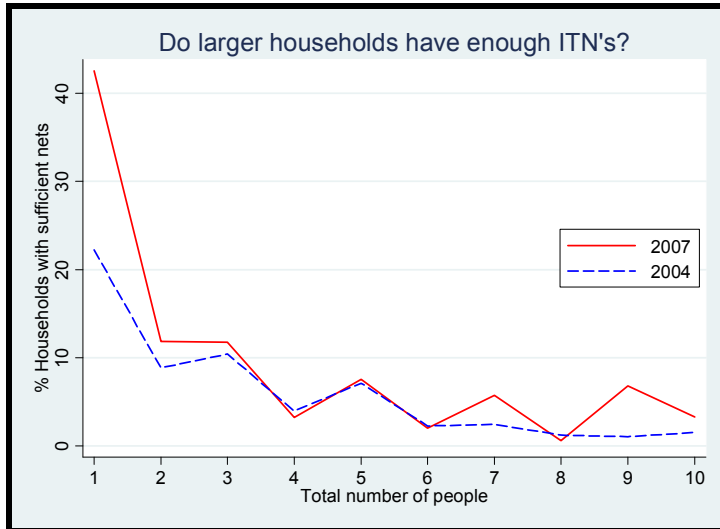
This, however, assumes that *no more than two individuals would share a mosquito net*. Therefore, it appears that as household size increases, the likelihood of enough nets for everyone in the family will decrease. However, further analysis of percentage of people actually sleeping under a net in different sizes of household shows a very different situation (Figure 4.3.5a and b):

Figure 4.3.5a Household (HH) level ownership versus usage of nets - 2004
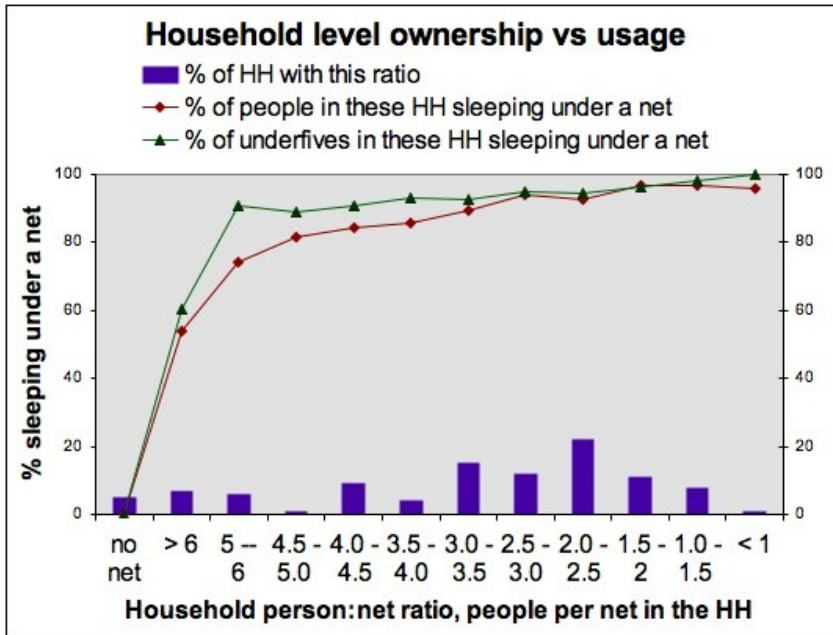
Figure 4.3.5b Household (HH) level ownership versus usage of nets – 2007
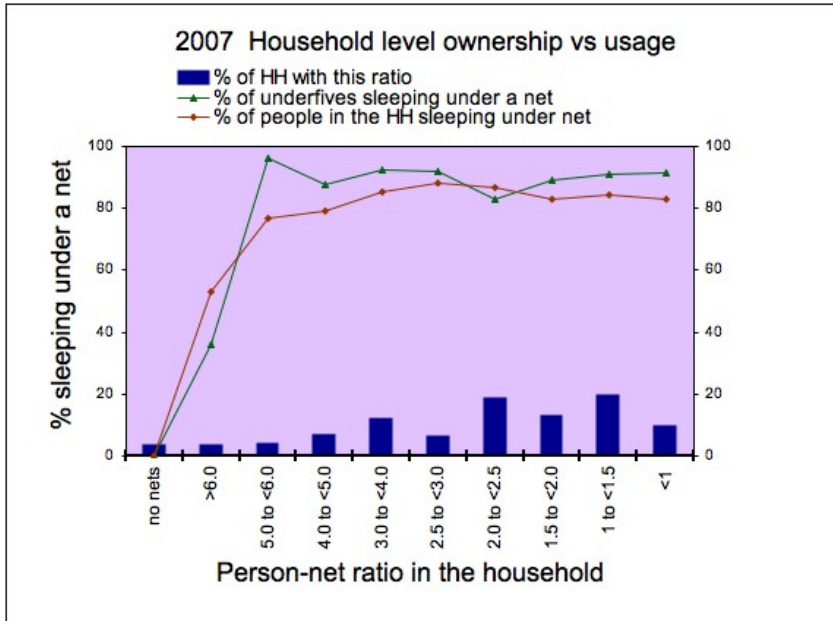
It is clear from these graphs for both 2004 and 2007 that Cambodia has almost achieved saturation with untreated mosquito nets. Even when there is only one net per 4-5 people in a single household most people are sleeping under it. Only when the number of people reaches more than 6 does the

number of people sleeping under a net fall much below 100%. It is unlikely that adding more nets to move from around 80% to 100% of people sleeping under a net will provide as much protection than dealing with the much bigger concern over low coverage and use of *treated* mosquito nets. More qualitative research should be conducted into net usage, particularly how larger families utilize their limited mosquito nets.

Table 4.3.5 Household ownership of mosquito nets, 2007

	Number of households	At least 1 net		Sufficient ITNs % (95% CI)
		Ever treated % (95% CI)	ITN % (95% CI)	
Total	2270	66.4 (58.0, 73.9)	42.6 (35.8, 49.7)	6.4 (4.5, 8.9)
Domain				
1	1166	73.4 (61.0, 82.9)	49.5 (37.9, 61.2)	11.1 (7.2, 16.7)
2	1104	62.0 (50.5, 72.3)	38.3 (30.1, 47.3)	3.4 (2.1, 5.5)
Risk zone				
<250m	770	66.6 (52.2, 78.5)	45.1 (32.7, 58.2)	5.3 (3.0, 9.1)
250m to <1km	861	71.2 (58.0, 81.5)	44.5 (33.9, 55.7)	6.4 (3.5, 11.6)
1km to <2km	639	59.6 (44.5, 73.1)	38.4 (27.6, 50.5)	7.0 (4.3, 11.1)
2km to <5km[15]	653	30.7 (19.3, 45.0)	21.2 (13.3, 31.9)	1.9 (0.9, 4.0)
Socio economic status (SES)				
Q1 (poorest)	499	73.8 (62.8,82.4)	44.5 (34.5,54.9)	6.1 (3.2,11.2)
Q2	471	69.1 (57.3,78.9)	47.9 (37.9,58.0)	7.7 (4.3,13.2)
Q3	450	64.6 (54.1,73.9)	45.5 (36.7,54.6)	5.3 (3.3,8.4)
Q4	470	61.5 (50.5,71.3)	39.3 (30.8,48.6)	5.7 (3.1,10.1)
Q5 (least poor)	380	63.1 (49.3,75.1)	35.9 (27.2,45.8)	7.0 (3.4,13.8)

100% of households have at least 1 mosquito net for all strata. Households in Domain 1 are nearly three times more likely to have sufficient ITNs compared to their counterparts in Domain 2. This difference, statistically significant with non-overlapping confidence intervals, may be due to the increased distribution and coverage of households in one domain than the other. The considerably lower proportion of the population with "sufficient" ITNs in risk zone 4 reflects the strategy of NMCP to provide ITNs to people living less than 1km from forest. There is little difference among the other three risk zones. Interestingly, socio-economic status of a household did not seem to be associated with an increased likelihood of owning more nets. Perhaps this is a reflection of more donated project nets among lower socio-economic status (SES) groups and the wealthier households purchasing their nets on their own.

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[15] Data for the 2 to 5 km risk zone are shown here, but not included in the domain and SES breakdown.

Table 4.3.6 Characteristics of household mosquito nets

	CMBS 2004		CMS 2007		p-value
	N	**mean**	**N**	**mean**	
Number of mosquito nets	4571	2.7	5011	2.6	0.6
	N	**%**	**N**	**%**	
Age of net					
<6mth	558	10.5	826	17.8	<0.001
6m to <12mth	561	13.2	1174	22.7	
12mth to <3yr[16]	3296	76.3	1951	37.0	
3yr or more			1041	22.5	
Source of mosquito net					
Gift	208	5.1	1492	29.4	<0.001
Govt/NGO/	2083	44.9	1290	22.6	
Health Project					
Market stall	1570	35.6	1854	40.5	
Shop by market	31	0.7	31	0.6	
Itinerant seller	531	13.4	330	6.7	
Other	13	0.2	7	0.2	
Price of mosquito net (Riel)					
No cost	1063	23.6	602	12.3	0.01
<4000	1219	24.8	910	17.3	
4000 to <12000	591	13.6	614	16.1	
12000 or more	1698	38.0	2446	54.1	
Type of mosquito net					
Siamdutch	17	0.4	3	0.1	<0.001
Siamdutch no label	952	19.4	27	0.6	
B52	152	2.9	751	17.3	
GF logo	0	0	1219	19.6	
white Olyset	0	0	218	2.7	
dark green	502	12.1	1587	33.4	
white	183	4.4	138	2.5	
Malanet	0	0	77	2.3	
blue Olyset	0	0	697	15.4	
other	2562	59.1	96	1.8	
Commercial hammock net	30	0.8	155	3.1	
Commercial with hammock	30	0.8	34	0.9	
Malanet hammock	0	0	9	0.2	
Holes in net					
No	1424	30.4	2641	52.4	<0.001
Yes	3147	69.6	2370	47.6	
Frequency of washing					
at least once a month			2154	41.2	
at least once every 6 months			1439	30.7	
at least once every year			240	5.4	
less than once a year			151	3.1	
never			989	19.5	
Used last night					
Yes	3724	84.5	3794	76.0	<0.001
No	682	15.5	1201	24.0	

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[16] in CMBS 2004 3rd category was 12 months or more

According to the 2007 survey, nearly one-quarter of mosquito nets were more than 3 years old, and the majority were at least 12 months. The source of mosquito nets appeared to have shifted from nearly half of all nets were government/project donated in 2004 to individually purchased from market stall in 2007. The proportion of nets distributed free of charge from the programme or NGO projects decreased from 25% in 2004 to 7% in 2007. The increase in Global Fund activities since 2004 has resulted in more than a quarter of nets procured through the GFATM.

If we merge Gift + Govt/NGO/Project (since nets distributed by the government were also considered gifts), the proportion of nets from these sources was surprisingly unchanged from 2004 (51.7%) to 2007 (51.4%). Similarly, the proportion purchased from markets, shops and sellers was also remarkably unchanged from 49.1% in 2004 to 47.5% in 2007. It seems that the market has not been replaced as a source of net.

It is well understood that washing of mosquito nets will dramatically decrease the effectiveness of the residual insecticides imbedded in the nets. According to the 2007 survey, 41% of the nets had been washed at least once a month, and 31% washed at least once every six months. This frequent washing of nets will significantly reduce any insecticidal benefit over time, and it will be important to disseminate appropriate and targeted messages through BCC approaches to address this behaviour.

Mosquito Net Use

C4	% of population at risk sleeping under insecticide treated nets the previous night, measured during peak malaria transmission season
S5	% of children under-5 sleeping under treated mosquito nets that have sufficient treated mosquito nets the previous night

Table 4.3.7 Summary of use of mosquito nets by population at risk

	CMBS 2004		CMS 2007	
	N	% (95% CI)	N	% (95% CI)
Any net				
All people	10461	81.1 (74.9,87.1)	11342	79.6 (75.8,82.9)
Under 5 year olds	1362	84.9 (78.4,89.7)	1399	83.5 (79.4,87.0)
Pregnant women	202	79.6 (71.4,85.9)	239	88.4 (81.9,92.7)
Ever Treated				
All people	10461	51.2 (41.8,60.5)	11242	48.2 (41.3,55.3)
Under 5's	1362	50.2 (40.8,59.7)	1386	51.7 (43.4,59.8)
Pregnant women	202	50.4 (40.3,60.6)	237	54.2 (42.4,65.6)
ITN				
All people	10369	29.3 (20.4,40.0)	11242	25.3 (21.0,30.0)
Under 5's	1345	26.4 (18.6,36.1)	1386	28.0 (22.4,34.4)
Pregnant women	200	23.0 (15.0,33.6)	237	28.1 (21.2,36.1)

Use of mosquito nets by target populations including children under five years and pregnant women remains relatively high when compared between the two study periods. There were no significant differences in mosquito net use from 2004 to 2007. Although 100% of all households surveyed now have at least one net, overall use of any net has not gone up since 2004, suggesting that household ownership of at least one mosquito net may have reached saturation.

The proportion of target populations using ITNs was substantially lower - only around 28% of under fives and pregnant women slept under an ITN the previous night. It is worth noting that the deficit of pregnant women using ITNs (compared to other population groups) has disappeared. In the 2007 data, use of ITNs by pregnant women was no different from that by other age-sex groups.

Table 4.3.8 Use of mosquito nets by total population

	CMBS 2004				CMS 2007			
	N	Any net % (95% CI)	Ever treated % (95% CI)	ITN % (95% CI)	N	Any net % (95% CI)	Ever treated % (95% CI)	ITN % (95% CI)
Total	10461	81.8 (74.9,87.1)	51.2 (41.8,60.5)	29.3 (20.4,40.0)	11342	79.6 (75.8,82.9)	48.3 (41.3,55.3)	25.3 (21.0,30.0)
Domain								
1	5204	82.3 (74.1,88.3)	46.3 (35.0,58.1)	21.7 (12.6,34.9)	5629	81.4 (76.5,85.6)	54.9 (44.3,65.1)	33.9 (25.5,43.3)
2	5257	81.5 (70.8,88.8)	54.4 (40.7,67.4)	34.1 (21.4,49.6)	5713	78.4 (73.0,83.0)	44.3 (35.2,53.9)	20.1 (15.9,25.2)
Riskzone								
<250m	4487	86.0 (78.5,91.2)	53.8 (42.9,64.3)	28.9 (16.7,45.1)	3809	77.8 (72.4,82.4)	45.7 (35.2,56.5)	26.0 (19.1,34.4)
250m to <1km	2860	86.4 (78.8,91.6)	62.7 (48.8,74.8)	38.0 (24.5,53.6)	4196	78.8 (70.9,85.0)	53.6 (41.9,64.8)	27.3 (20.5,35.4)
1km to <2km	3114	73.8 (57.4,85.5)	36.3 (20.5,55.6)	19.5 (6.9,44.4)	3337	81.7 (77.4,85.3)	42.8 (31.4,55.0)	22.0 (15.3,30.5)
2km to <5km					3357	78.4 (69.8,85.1)	20.3 (11.7, 32.9)	11.4 (6.8, 18.6)
Socio economic status (SES)								
Q1 (poorest)	2048	76.6 (66.7,84.2)	50.2 (39.8,60.6)	21.5 (13.1,33.1)	2300	71.8 (63.0,79.2)	54.3 (42.9,65.3)	30.2 (22.3,39.3)
Q2	2337	82.3 (75.4,87.6)	55.4 (45.9,64.6)	30.4 (22.7,39.2)	2195	75.9 (69.6,81.2)	50.5 (41.1,58.9)	30.8 (23.9,38.7)
Q3	2343	81.2 (73.3,87.2)	54.6 (43.6,65.2)	33.3 (22.4,46.)	2334	78.8 (73.6,83.2)	47.0 (38.2,55.9)	27.4 (20.8,35.1)
Q4	1964	79.4 (68.2,87.4)	44.7 (33.1,56.9)	24.6 (14.6,38.4)	2479	81.9 (78.5,84.9)	42.1 (34.3,50.4)	21.8 (17.5,26.9)
Q5 (least poor)	1769	89.8 (80.4,95.0)	50.2 (33.1,67.2)	35.9 (21.4,53.6)	2034	87.9 (83.3,91.4)	49.1 (36.7,61.6)	17.3 (13.1,22.6)

The overall picture is again of little change, but within this there are some important contrasts between 2004 and 2007 in some specific parts of the data. Firstly, in 2004 ITN use was better in domain 2 than domain 1; now the reverse is true. This could be due to the increased targeting of ITNs in Domain 1. Secondly, in 2004, the SES gradient in ITN use was the same as that in any net use: not strong, but clearly showing worse coverage in the poorer groups. In 2007, the same SES differentials are again seen in any net use (somewhat higher coverage in richer groups) but the gradient is reversed for ITNs: the poorest quintiles are more likely to use ITNs than the less poor. This is good news, and a clear mark of successful targeting, since the poorest are also the most at risk.

Figure 4.3.6 Reported use of mosquito net types stratified by distance to forest (2004 vs 2007)
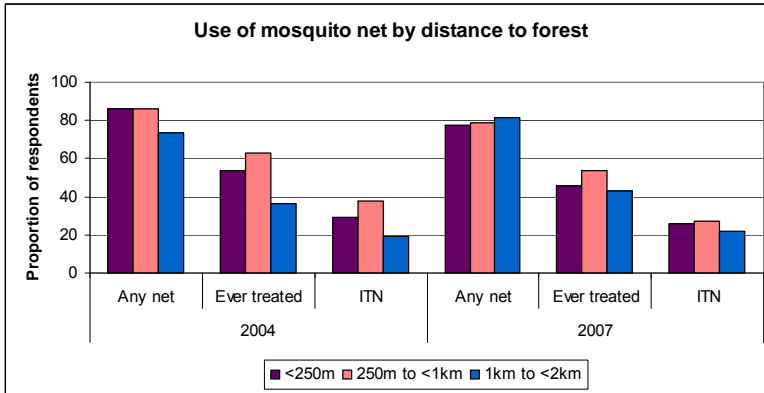
Pattern of mosquito net use (any net and ITN) between 2004 and 2007 was generally similar among total population regardless of distance to forest (i.e., risk strata).

Figure 4.3.7 Reported use of mosquito net by socio-economic status (2004 vs 2007)
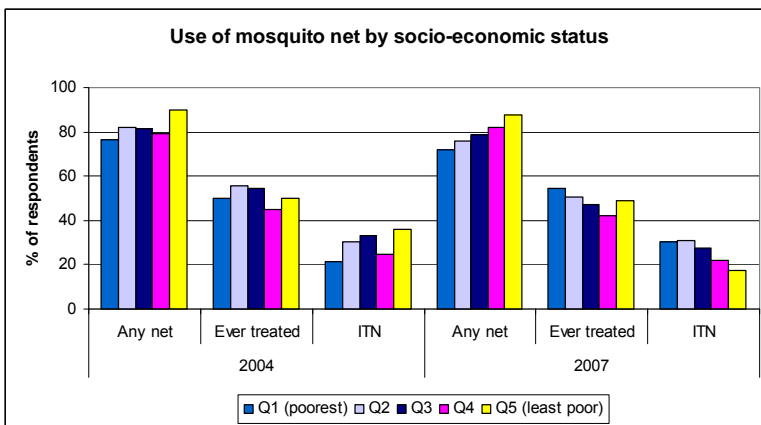
Wealthier respondents report higher mosquito net use than poorer counterparts. However, fewer wealthier respondents reported using an ITN. Even though more mosquito nets are being purchased privately, many of these nets may not be ITNs, or respondents may not realize that they are ITNs.

Table 4.3.9 Use of mosquito nets by children under 5 years

	CMBS 2004				CMS 2007		
	N	Any net % (95% CI)	Ever treated % (95% CI)	ITN % (95% CI)	N	Any net % (95% CI)	Ever treated % (95% CI)	ITN % (95% CI)
Total	1362	84.9 (78.4,89.7)	50.2 (40.8,59.7)	26.4 (18.6,36.1)	1399	83.5 (79.4,87.0)	51.7 (43.4,59.8)	28.0 (22.4,34.4)
Domain								
1	695	85.2 (77.5,90.6)	49.0 (36.4,61.8)	21.5 (12.2,35.1)	743	85.4 (79.4,89.9)	59.4 (48.5,69.4)	36.9 (26.7,48.5)
2	667	84.7 (74.1,91.4)	51.1 (37.7,64.4)	29.9 (18.8,44.1)	656	82.3 (76.4,86.9)	46.6 (34.9,58.6)	22.1 (15.9,29.8)
Risk zone								
<250m	635	88.6 (83.1,92.5)	54.6 (43.7,65.1)	28.4 (16.1,44.9)	495	80.7 (72.6,86.9)	42.5 (31.0,54.9)	25.9 (16.9,37.4)
250m to <1km	392	90.0 (83.1,94.3)	60.0 (42.7,75.2)	33.0 (19.7,49.7)	525	83.7 (76.2,89.1)	59.7 (45.4,72.5)	33.0 (23.6,43.9)
1km to <2km	335	75.0 (57.2,87.0)	33.4 (20.5,49.4)	16.0 (6.3,35.0)	379	85.4 (78.5,90.4)	46.1 (33.7,58.9)	21.8 (14.0,32.3)
Socio economic status								
Q1 (poorest)	363	83.3 (75.3,89.1)	53.9 (41.8,65.4)	23.3 (13.6,37.0)	385	74.3 (66.9,80.5)	55.1 (43.3,66.3)	30.7 (21.9,41.2)
Q2	339	87.3 (80.2,92.2)	55.7 (43.9,66.9)	27.5 (19.9,36.6)	316	82.3 (79.9,89.3)	54.2 (41.9,65.9)	34.3 (24.7,45.)
Q3	300	82.9 (71.7,90.2)	49.9 (38.7,61.2)	28.8 (18.7,41.7)	278	84.6 (78.2,89.3)	48.3 (37.9,58.8)	28.0 (18.9,39.4)
Q4	224	84.3 (72.3,91.7)	42.5 (31.1,54.8)	23.9 (14.7,36.3)	263	87.6 (80.6,92.2)	48.1 (38.9,57.5)	24.3 (17.4,32.9)
Q5 (least poor)	136	87.4 (75.7,93.9)	42.1 (25.8,60.3)	30.6 (16.1,50.2)	157	94.3 (87.9,97.4)	50.9 (32.5,69.1)	17.9 (11.9,26.1)

Table 4.3.10 People who go to the forest

	CMBS 2004		CMS 2007		
	N	%	N	%	P
Total	2063		1696		
Age/Sex					
< 5 years	82	3.3	67	2.8	0.4
5 to <15 years	191	7.4	110	5.8	
male 15+ years	1420	72.2	1179	70.7	
female 15+ years	370	17.1	340	20.7	
Domain					
1	911	35.6	952	43.4	0.4
2	1152	64.4	744	56.6	
Risk zone					
<250m	1006	25.0	561	20.2	0.8
250m to <1km	589	44.6	641	47.0	
1km to <2km	468	30.4	494	32.8	
Socio economic group					
Q1 (poorest)	616	23.3	447	23.7	0.5
Q2	478	23.2	340	20.3	
Q3	414	21.5	333	19.8	
Q4	361	20.4	319	18.8	
Q5 (least poor)	194	11.6	257	17.4	
In forest last night					
No	1491	76.1	1266	75.4	0.8
Yes	570	23.9	430	24.6	
When last in forest					
< 1 week	546	28.3	277	23.2	0.3
1 to < 4 weeks	496	23.3	286	24.5	
4 or more weeks	996	48.4	667	52.5	
Used net last night/time[17]					
Yes	425	74.1	1164	34.8	0.3
No	126	25.9	529	65.2	
Used treated net last night / time					
Yes	-	-	676	65.2	
No			1009	34.8	
Length of time in forest					
< 1 week	1123	54.5	952	59.6	0.4
1 to <2 weeks	437	22.5	273	17.9	
2 to < 4 weeks	239	12.3	180	10.1	
4 or more weeks	199	10.7	267	12.3	

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[17] In CMBS 2004, respondents who where in the forest the previous night were asked about mosquito net use, no questions were asked on previous visits to forest.

The majority of those who reported going into the forest was the males 15 years and above group. Interestingly, nearly half of the respondents who reported going to the forest did not live closest to the forest (<250m), but rather lived more than 250m but less than 1km from the forest. This pattern was observed in both survey periods. It is well-documented that individuals go into the forest as a means of finding alternative food sources or to supplement their incomes. The data from both survey periods show a clear correlation between more reports of going to the forest and lower socio-economic status. Wealthier households rely less on going into the forest.

Half of respondents who reported going to the forest previously spent more than 4 weeks there, and one-third of these reported using a mosquito net.

Table 4.3.11 Summary details of mosquito net outlet, 2007

	CMBS 2004	CMS 2007
	N (%)	N (%)
Total number of outlets	49	72
Respondent's sex		
Male	5 (10.2)	13 (18.1)
Female	44 (89.8)	59 (81.9)
Place of outlet		
Village	6 (12.8)	12 (16.7)
Town	41 (87.2)	60 (83.3)
Type of outlet		
General store / shop out of market	16 (32.7)	10 (13.9)
Net seller in market	33 (67.3)	62 (86.1)

Table 4.3.12 Number of outlets selling the different types of mosquito nets

	CMS 2007
Type of mosquito net	Number of outlets N (%)
Siamdutch	6 (8.3)
Siamdutch no label	1 (1.4)
B52	59 (81.9)
Pink/blue/sky blue GF logo	1 (1.4)
White Olyset (LLIN)	1 (1.4)
Unbranded dark green	20 (27.8)
Unbranded white	2 (2.8)
Malanet (LLIN)	33 (45.8)
Blue Olyset (LLIN)	0 (-)
Other net[18]	34 (47.2)
Commercial hammock net	47 (65.3)
Commercial with hammock	17 (23.6)
Malanet hammock	26 (36.1)

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[18] Other nets mostly large and blue/pink (n=27)

Nearly 50% more net outlets were surveyed in 2007 compared to 2004. The demographic characteristics of the vendors remained similar between the two survey periods, although there seemed to be fewer respondents who sold nets in the general shops than in the markets in 2007 compared to 2004. The predominant type of net sold was the B52 net found in more than 80% of the vendors interviewed. Other types of nets, including commercial hammock nets, were also available. Commercial hammock nets were found in 65% of the vendors surveyed.

Table 4.3.13 Cost of nets to buy / sell, 2007

| Type of net | Number of outlets | Cost to buy nets | | | Cost nets are sold | | |
		Mean	Median	Minimum / maximum	Mean	Median	Minimum / maximum
Siamdutch	6	35917	36250	30000,43000	40166	40000	33000,45000
Siamdutch no label	1	12000	12000	-	14000	14000	
B52	59	14440	14500	4500,22000	17037	18000	6000,25000
Pink/blue/sky blue (GF logo)	1	9000	9000		13000	13000	
White Olyset	1	6500	6500		7000	7000	
Unbranded dark green	20	12252	8500	5000,70000	15391	12000	7000,90000
Unbranded white	2	50250	50250	10000,90500	11500	11500	11000,12000
Malanet	33	10881	11000	6500,14000	12833	12000	9000,17000
Other net	34	10351	9000	5500,36000	12609	11500	6500,39000
Commercial hammock net	47	7541	6200	4500,15000	9586	8250	6000,18000
Commercial with hammock	17	39950	45000	6000,50000	46450	50000	10000,65000
Malanet hammock	26	9323	9400	5000,12000	11134	11000	6000,15000

The wholesale and retail prices of nets and hammocks varied greatly according to the survey. For nets, the range of costs (in Riels) for vendors was from 4500 (B52) to 70000 (Unbranded green net), and the mark up price tended to range from 6000 to 90000, respectively. For hammock nets, the vendor costs ranged from 4500 to 50000, with a mark up price ranging 6000 to 65000, respectively. Exchange rate was approximately 4,000 riel: USD$1.

Table 4.3.14 Net Stock and suppliers

	CMBS 2004		CMS 2007	
	Mosquito nets	**Hammock nets**	**Mosquito nets**	**Hammock nets**
Number of outlets selling nets	48 (98.0)	40 (81.6)	72 (100.0)	64 (88.9)
Where do you buy your mosquito / hammock nets?[19]				
Local market	9 (18.8)		34 (47.2)	
Government or NGO project	0		0 (-)	
Hawker / itinerant seller	1 (2.1)		5 (6.9)	
Travelling sales person	-		27 (37.5)	
Olympic market/Phnom Penh	21 (43.8)		40 (55.6)	
Distributor	6 (12.5)		9 (12.5)	
Other	11 (22.9)		1 (1.4)	
How many nets did you sell last week?				
Median	2	1	2	1
(range)	(0,15)	(0,10)	(0,50)	(0,20)
When was last stock bought?				
Within last week	9 (18.8)	6	8 (11.1)	8 (12.5)
Within last month	26 (54.2)	13	31 (43.1)	22 (34.4)
More than a month	13 (27.1)	21	33 (45.8)	32 (50.0)
Not sure				2 (3.1)
How many nets did you buy last time?				
Median	10	8	10	8
(range)	(2,100)	(2,30)	(3,100)	(1,40)
When will you buy your next stock?				
Within next week	6 (12.5)	2 (5.0)	6 (8.3)	6 (9.4)
Within next month	9 (19.8)	14 (35.0)	7 (9.7)	4 (6.3)
In more than a month	33 (68.8)	24 (60.0)	11 (15.3)	9 (14.1)
Not sure	-	-	48 (66.7)	45 (70.3)

Compared to 2004, more vendors purchased their nets from markets themselves (19% in 2004 to 47% in 2007). A significant proportion (38%) purchased their nets from travelling sales persons (such as PSI agents). Overall, even though the range of nets sold varied considerably from one vendor to another, the median number of nets sold and/or purchased is generally quite conservative. The lack of demand for these commodities has resulted in more than two-thirds of respondents not knowing when they will purchase their next stock of net or hammock nets.

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[19] Respondents were only asked to specify one source in CMBS 2004

Table 4.3.15 Insecticide stock and suppliers, 2007 for net outlets

	CMS 2007
	N = 72 (%)
Number of outlets that stock insecticide?	7 (9.7)
Where do you buy your insecticide treatments?	**% of those who sell**
Local market	0
Manufacturer	0
Project	1 (14.3)
Travelling sales person	0
Travelling sales person (PSI)	7 (100.0)
Olympic market/ Phnom Penh	0
Distributor	0
Other	1 (14.3)
How many insecticides did you sell last week?	
Median	0
(interquartile range)	(0,10)
When was last stock of insecticide bought?	
Within last week	0
Within last month	2 (28.6)
More than a month	4 (57.1)
Not sure	1 (14.3)
How many insecticide treatments did you buy last time?	
Median	10
(interquartile range)	(2,10)
When will you buy your next stock?	
Within next week	0
Within next month	1 (14.3)
In more than a month	0
Not sure	6 (85.7)

None of the vendors stocked insecticides for net retreatment in 2004. In 2007, less than 10% of vendors stocked insecticides for retreatment of mosquito nets.

Table 4.3.16 Net outlets, type of insecticide sold and costs, 2007

Type of insecticide	Number of outlets that sell N=7 (%)	Cost to buy Median (min, max)	Cost to sell Median (min, max)
Malatab	6 (85.7)	800 (700,1000)	1000 (1000,1500)
Icon	0		
Fendona	0		
Other	1	600	1000

The majority of the insecticide (86%) sold was the Malatab, with a median vendor purchase price of 800 Riels and a mark up price of 1000 Riels.

4.4 Malaria treatment

The questions on malaria treatment in the household survey included a series on knowledge about treatment and a series on treatment seeking. The health facility survey included questions on stocks of drugs and diagnostics as well as on availability of microscopes and training of staff. The outlet survey looked at availability of drugs.

4.4.1 Knowledge of treatment

Questions on recognition of malaria and knowledge of treatment practice were designed to measure changes in 1) knowledge of malaria related to educational interventions and 2) knowledge of use of Malarine related to promotion of highly subsidised drugs through private providers. They provide data for the following supplementary indicators:

Supplementary indicators
S1 % mothers and care takers able to recognize signs and symptoms of danger of a febrile illness in a child <5 years.
S8 % awareness of Malarine among the targeted populations
S9 % of target groups who know where to obtain testing and treatment for malaria
S10 % of target groups who know that Malarine treatment is effective only if entire course is taken

Table 4.4.1 Household respondents' knowledge of malaria and danger signs and symptoms

	CMBS 2004		CMS 2007	
	N	% (95% CI)	N	% (95% CI)
Know malaria[20]	2259	76.1 (71.6,80.1)	2270	75.5 (73.0,77.8)
Know serious fever[21]	2259	94.2 (92.5,95.6)	2270	100.0

Respondent knowledge about malaria and its danger signs and symptoms has not changed between the 2004 and 2007 surveys. However mothers and caregivers were able to distinguish between malaria and other forms of serious fevers. All household respondents in 2007 were able to describe signs and symptoms of serious fevers.

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[20] Know malaria: fever, chills

[21] Know serious fever: unconscious, fast breathing, convulsions, very hot, not breast feeding, not eating, vomiting or diarrhoea

Table 4.4.2 Knowledge of signs and symptoms of malaria

	CMBS 2004 (N=2259)		CMS 2007 (N=2270)	
	N	%	N	%
fever	1986	89.3	1926	84.9
chills	1765	79.7	1886	84.2
sweating	112	4.3	185	7.4
headache	1124	51.0	1233	51.8
bodyache	323	14.0	331	15.7
loss of appetite	184	8.6	140	5.7
diarrhoea	43	1.8	48	1.7
other	199	8.5	79	3.0

Knowledge of signs and symptoms associated with malaria was similar between 2004 and 2007 surveys. In both surveys, it is interesting that sweating is not perceived as a major symptom associated with malaria.

S1	% mothers and care takers able to recognize signs and symptoms of danger of a febrile illness in a child <5 years.

This supplementary indicator is largely derived from the following question, although the data are based on respondents, who may or may not be mothers and caretakers.

Table 4.4.3 Knowledge of signs and symptoms for serious fever
(Note: not only asked about children)

	CMBS 2004 (N=2259)		CMS 2007 (N=2270)	
	N	%	N	%
unconscious	644	30.4	930	43.3
convulsions	481	21.7	534	21.6
fast breathing	199	8.3	136	6.4
very hot (fever)	1944	85.4	1670	74.5
yellow eye colour	77	3.5	231	9.9
pale skin	82	3.3	342	14.7
not breast feeding	267	11.7	10	0.3
not eating	15	0.8	269	12.1
vomiting	173	7.8	282	11.5
diarrhoea	58	3.0	56	2.3
other	194	8.5	258	9.8

S8	% awareness of Malarine among the targeted populations
S9	% of target groups who know where to obtain testing and treatment for malaria

S10 % of target groups who know that Malarine treatment is effective only if entire course is taken

Table 4.4.4 Household respondents knowledge of appropriate treatment

	CMBS 2004		CMS 2007	
	N	% (95% CI)	N	% (95% CI)
Respondents who know Malarine				
	2238	47.3 (38.3, 56.4)	2266	72.0 (66.4, 76.9)
'Households' know where to go for testing & treatment				
	2259	10.3 (6.9, 15.1)	2270	38.9 (34.2, 43.9)
'Households' know treatment effective if entire course is taken				
	2259	10.3 (6.9, 15.1)	2270	38.9 (34.2, 43.9)

Household respondents' knowledge of Malarine has increased significantly from 47% in 2004 to 72% in 2007, with statistical significance.

A significant proportion of household respondents may know Malarine as a treatment for malaria, but they are still not aware of the need to take the entire course for the treatment to be effective. However, it is encouraging that the proportion of respondents who know that the effective treatment requires the full regimen has significantly increased from 10% in 2004 to nearly 40% in 2007.

4.4.2   Treatment practice – patients

Core indicator
C1   % of people seeking treatment from trained providers within 48 hours of developing a fever

Supplementary indicator
S2   % seeking treatment from trained provider/total cases of febrile illness

The percent of respondents seeking treatment from trained providers within 48 hours of developing a fever increased from 67% in 2004 to 74% in 2007. However, two-thirds of these consultations are within the private sector, although public sector use has increased slightly from 25% to 34% in 2004 and 2007, respectively. A majority of these febrile consultations are typically not confirmed using diagnostic tests. If a test is performed, 60% of providers use rapid diagnostic test kits (RDT), while the remainder use blood slides.

Table 4.4.5 Prevalence and treatment of fever

	2004		2007		
	N	%	N	%	p-value
Total	1442	100.0	1214	100.0	
Age / Sex					
< 5 years	360	24.1	296	23.5	0.9
5 to <15 years	443	30.2	341	29.7	
male 15+ years	322	24.3	286	23.9	
female 15+ years	317	21.3	291	22.9	
Seek advice / treatment					
Yes	957	66.6	886	74.2	<0.001
No	485	33.4	328	25.8	
Where seek treatment					
Public health facility	234	25.5	292	34.1	0.1
Private sector	707	74.5	536	65.9	
Time to seek treatment					
More than 48 hrs	423	41.0	340	37.1	0.2
Within 48 hrs	532	59.0	544	62.9	
Take drugs within 48 hrs					
Yes	525	58.2	549	64.6	0.1
No	429	41.8	335	35.4	
Diagnostic test					
Yes	173	21.4	302	27.9	0.3
No	783	78.6	584	72.1	
Place of test					
Public health facility	91	54.3	111	35.6	0.03
Private sector	58	35.0	110	39.2	
VMW	22	10.4	67	18.3	
Drug shop/other	2	0.3	18	6.9	
Type of test					
Blood slide	89	56.6	123	38.8	0.08
RDT	69	43.4	166	61.2	
Test result for blood slide					
Positive			73	70.7	
Negative			43	29.3	
Test result for RDT					
Positive			93	57.0	
Negative			71	43.0	

Table 4.4.6 Type and source of drugs, 2007

Type of drug[22]	Already had at home	Health facility / worker	Pharmacy	Shop	Elsewhere	Don't know	Total
ACT	0 (0)	38 (92.7)	0 (0)	3 (7.3)	0 (0)	0 (0)	41
Other ACTs	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	1
AMT	3 (16.7)	13 (72.3)	0 (0)	1 (5.6)	1 (5.6)	0 (0)	18
Non AMT	0 (0)	9 (60.0)	4 (26.7)	2 (13.3)	0 (0)	0 (0)	15
Other malaria drug	1 (5.6)	12 (66.7)	0 (0)	3 (16.7)	2 (11.1)	0 (0)	18
Non antimalarial	48 (4.4)	513 (46.8)	110 (10.0)	405 (36.9)	18 (1.6)	3 (0.3)	1097
Cocktail	0 (0)	93 (52.0)	23 (12.9)	58 (32.4)	5 (2.8)	0 (0)	179
Don't know	4 (2.3)	87 (50.0)	29 (16.7)	44 (25.3)	10 (5.8)	0 (0)	174
	56	**766**	**166**	**516**	**36**	**3**	**1543**

The majority of artemisinin combination therapies (ACTs) [Malarine] was available through health facilities and health workers, and some drug outlets. Although the number of artesunate monotherapies (AMT) encountered during the survey was quite small, it is interesting to note that 17% of respondents already had these drugs available at home presumably for self-treatment. Also noteworthy is the significant numbers of cocktails available through the health facility and health workers.

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[22] ACT: Malarine (child & adult); A+M2; A+M3; A+M4
Other ACT: Artekin/ Artequick;
AMT: Artesunate (tablet/suppository/injection); Cotexin; Artemether (tablet/injection); Artemisinin
Non AMT: Mefloquine; Quinine (tablet/injection); Tetracycline/doxycycline; Chloroquine; Primaquine
Non antimalarial Aspirin; Paracetamol; non malaria drug

Table 4.4.7 Cost of drugs taken for fever

Type of drug	N	Average cost	Median cost	Minimum	Maximum
ACT	39	1717	0	0	15000
Other ACTs	1	6000	6000	6000	6000
AMT	16	2625	3000	0	8000
Non AMT	15	1207	700	0	5000
Non antimalarial	1073	10487	2000	0	500000
Cocktail	177	18503	5000	0	320000
Other malaria drug	17	33235	9000	0	200000
Don't know	160	14554	3000		350000

The average cost for a treatment course of Malarine was 1700 Riels ($0.43 USD), although the maximum price was up to 15,000 Riels ($3.75 USD), for the treatment of fever. The use of non-antimalarial drugs for the treatment of fever was considerably more expensive – ranging from 2000 Riels ($0.50 USD) to 500,000 Riels ($125 USD), perhaps including hospitalization.

4.4.3   Treatment practice – providers

Core indicators
C5   % of patients with malaria in public health facilities prescribed correctly according to national guidelines
C6   % of public health facilities which maintain stocks of antimalarials and rapid tests with no out-of-date stocks

Supplementary indicators
S6   % of public health facilities able to confirm malaria diagnosis according to national guidelines
S7   % availability of antimalarial regimens other than A+M and Malarine in the market
S11   % of public health facilities reporting no disruption of stock of antimalarials for more than 1 week during the previous 3 months

Health Centres (public sector)

C5   % of patients with malaria in public health facilities prescribed correctly according to national guidelines

A total of 91 public health facilities were surveyed including 15 referral hospitals, 23 health centres with beds, 44 health centres without beds, and 9 health posts (Table 3.3). Due to the few numbers of patients with malaria in public health facilities during the time of the survey, it was difficult to obtain accurate estimates for percent of patients with malaria in public health facilities who were prescribed correct treatment according to national guidelines.

C6   % of public health facilities which maintain stocks of antimalarials and rapid tests with no out-of-date stocks

Availability of antimalarial drugs in public sector health facilities appears to be a significant issue across the board (Table 4.4.8). It is important to note that availability of second-line antimalarial drugs such as quinine (including both quinine tablets and injections) was quite low, particularly in health facilities with beds.

Furthermore, only half of health facilities without beds had stocks of RDTs (Paracheck) and 13% had Malacheck RDTs available during the day of the survey. It will be important for CNM to ensure that effective antimalarials and supplies and reagents are available and adequately stocked at point of care.

S11	% of public health facilities reporting no disruption of stock of antimalarials for more than 1 week during the previous 3 months

S6	% of public health facilities able to confirm malaria diagnosis according to national guidelines

Two-thirds of public health facilities surveyed had national laboratory diagnosis guidelines/manuals for malaria available (Table 4.4.9). However, the majority of these manuals were not observed during the time of the visit, and those available were older versions (as early as 1991). One-quarter of the health facilities reported to use microscropy and RDT for malaria diagnosis. More than 90% of those health facilities surveyed reported to have enough slides during the last previous 3 months. Furthermore, it is encouraging that most laboratory registers were present, up-to-date, and in MOH format.

Table 4.4.8 Review of Pharmacy Stock (public sector) , 2007

Antimalarial/ diagnostic	Facility with bed (N=38)				Facility with no bed (N=53)				Total (N=91)			
	Have stock survey day N (%)	Median stock (min,max)	Stock-Out [23] N (%)	Expired stock N (%)	Have stock survey day N (%)	Median stock (min/max)	Stock-Out N (%)	Expired stock N (%)	Have stock survey day N (%)	Median stock (min/max)	Stock-Out N (%)	Expired stock N (%)
A+M2	30 (79.0)	9 (1,70)	8 (21.1)	4 (13.3)	38 (71.7)	5 (1,20)	16 (30.2)	5 (13.2)	68 (74.7)	6 (1,70)	24 (26.4)	9 (13.2)
A+M3	31 (81.6)	10 (2,51)	7 (18.4)	1 (3.2)	37 (69.8)	4 (1,29)	18 (34.0)	3 (8.1)	68 (74.7)	6 (1,51)	25 (27.5)	4 (5.9)
A+M4	34 (89.5)	11 (1,84)	5 (13.2)	1 (2.9)	47 (88.7)	8 (1,60)	8 (15.1)	2 (4.3)	81 (89.0)	10 (1,84)	13 (14.3)	3 (3.7)
Quinine tablets 300mg	22 (57.9)	550 (16,1500)	16 (42.1)	0	15 (28.3)	200 (50,1000)	39 (73.6)	0	37 (40.7)	300 (16, 1500)	55 (60.4)	0
Quinine injection 600mg	14 (36.8)	46 (8,100)	24 (63.2)	2 (14.3)	3 (5.7)	20 (10,30)	50 (94.4)	1 (33.3)	17 (18.7)	30 (8,100)	74 (81.3)	3 (17.7)
Tetracycline	21 (55.3)	780 (24, 5000)	18 (47.4)	0	16 (30.2)	195 (50, 1000)	38 (71.7)	0	37 (40.7)	300 (24, 5000)	56 (61.5)	0
Artesunate tablet	2 (5.3)	39 (10, 67)	36 (94.7)	0	1 (1.9)	200 (-)	52 (98.1)	0	3 (3.3)	67 (10, 200)	88 (96.7)	0
Artesunate injection	1 (2.6)	80 (-)	37 (97.4)	0	1 (1.9)	20 (-)	52 (98.1)	0	2 (2.2)	50 (20 , 80)	89 (97.8)	0
Artesunate suppository 50mg	11 (29.0)	36 (3, 416)	27 (71.1)	1 (9.1)	11 (20.8)	12 (5,124)	42 (79.3)	0	22 (24.2)	30 (3,416)	69 (75.8)	1 (4.6)
Artesunate suppository 200mg	0	-	38 (100)	-	1 (1.9)	3 (-)	53 (100)	0	1 (1.1)	3 (-)	91 (100)	10
Artemether tablet	0	-	38 (100)	-	0	-	53 (100)	-	0	-	91 (100)	-
Artemether injection 80mg	25 (65.8)	24 (8,226)	13 (34.2)	0	4 (7.6)	16 (5,78)	49 (92.50)	0	29 (31.9)	23 (5,226)	62 (68.1)	0
Artemisinin suppository, 100, 200,300,500 (mg)	0	-	38 (100)	-	0	-	53 (100)	-	0	-	91 (100)	-
Cotexin	0	-	38 (100)	-	3	7 (5,45)	50 (94.3)	0	3 (3.3)	7 (5,45)	88 (96.7)	0

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[23] Disruption of antimalarial stocks for more than 1 week during the previous 3 months.

Table 4.4.8 Review of Pharmacy Stock (Public Sector) , 2007 cont.

Antimalarial/ diagnostic	Facility with bed (N=38) Have stock survey day N (%)	Median stock (min,max)	Stock-Out [24] N (%)	Expired stock N (%)	Facility with no bed (N=53) Have stock survey day N (%)	Median stock (min/max)	Stock-Out N (%)	Expired stock N (%)	Total (N=91) Have stock survey day N (%)	Median stock (min/max)	Stock-Out N (%)	Expired stock N (%)
Chloroquine 100mg	2	650 (300,1000)	36 (94.7)	0	0	-	53 (100)	-	2 (2.2)	650 (300,1000)	89 (97.8)	0
Chloroquine 150mg	24 (63.2)	120 (10,1100)	14 (36.8)	1 (4.2)	31 (58.50	145 (20,1320)	22 (41.5)	0	55 (60.4)	140 (10,1320)	36 (39.6)	1 (1.8)
Chloroquine 300mg	6 (15.8)	125 (81,567)	32 (84.2)	0	6 (11.30)	45 (28,100)	47 (88.7)	1 (16.7)	12 (13.2)	86 (28,567)	79 (86.8)	1 (8.3)
Mefloquine 250mg	18 (47.4)	40 (10,750)	20 (52.6)	0	11 (20.8)	30 (2,50)	42 (79.3)	0	29 (31.9)	39 (2,750)	62 (68.1)	0
Artekin	2 (5.3)	86 (38,133)	36 (94.7)	2 (100)	1 (1.9)	38 (-)	52 (98.1)	1 (100)	3 (3.3)	38 (38, 133)	88 (96.7)	3 (100)
RDT paracheck	15 (39.5)	25 (1,125)	25 (65.8)	1 (6.7)	27 (50.9)	20 (1,72)	27 (50.9)	2 (7.4)	42 (46.2)	20 (1,125)	52 (57.1)	3 (7.1)
RDT malacheck	5 (13.2)	3 (2,40)	33 (86.8)	1 (20.0)	7 (13.2)	10 (1,40)	46 (86.8)	0	12 (13.2)	7 (1,40)	46 (86.8)	1 (8.3)
Microscope slide	21 (55.3)	210 (70, 3360)	17 (44.7)	0	9 (17.0)	210 (70,1400)	44 (83.0)	0	30 (33.0)	210 (70, 3360)	61 (67.0)	0
Giemsa 100ml	18 (47.4)	150 (100,6000)	20 (52.6)	2 (11.1)	9 (17.0)	100 (50,400)	44 (83.0)	0	27 (29.7)	100 (50, 6000)	64 (70.3)	2 (7.4)
Other tests	0	-	-	-	0	-	-	-	0	-	-	-

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[24] Disruption of antimalarial stocks for more than 1 week during the previous 3 months.

Table 4.4.9 Review of laboratory services

Laboratory service	Facility with bed N=37	Facility with no bed N=27	Total N=64
	N (%)	N (%)	N (%)
Have national laboratory diagnosis manual for malaria	29 (78.4)	9 (33.3)	38 (59.4)
Date of version:			
• Not seen	16 (55.2)	7 (77.8)	23 (60.5)
• 1991	4	2	
• 2002	3	0	
• 2003	1	0	
• 2004	4	0	
• 2006	1	0	
Use microscopy	35 (94.6)	13 (48.2)	48 (75.0)
Use RDT	24 (64.9)	26 (96.3)	50 (78.1)
Enough slides for last 3 months	31 (88.6)	13 (100)	44 (91.7)
Laboratory register present	37 (100)	21 (77.8)	58 (90.6)
Laboratory register up to date	36 (97.3)	21 (100)	57 (98.3)
Laboratory register in MOH format	37 (100)	21 (100)	58 (100)
Last send slides for quality control			
within last month	5 (13.9)	4 (28.6)	9 (18.0)
>1 to =< 3 months	11 (30.6)	4 (28.6)	15 (30.0)
>3 to =< 6 months	7 (19.4)	2 (14.3)	9 (18.0)
> 6 months	5 (13.9)	3 (21.4)	8 (16.0)
not sure	8 (22.2)	1 (7.1)	9 (18.0)

Table 4.4.10 Patients' records in laboratory register – Median (minimum, maximum)

Number of patients :	Facility with bed (N=38)				Facility with no bed (N=53)			
	August	September	October	Total	August	September	October	Total
Slides examined	47 (0,509)	81 (0,339)	57 (0,265)	179 (0,965)	37 (0,161)	16 (5,184)	14 (0,230)	70 (5,575)
Positive *P.falciparum*	7 (0,99)	7 (0,58)	8 (0,77)	27 (0,234)	5 (0,72)	5 (0,33)	3 (0,46)	12 (0,89)
Positive *P.vivax*	1 (0,47)	1 (0,27)	1 (0,30)	5 (0,102)	0 (0,27)	0 (0,19)	0 (0,89)	0 (0,18)
Positive mixed	0 (0,6)	0 (0.5)	0 (0,3)	0 (0,10)	0 (0,18)	0 (0, 6)	0 (0, 10)	0 (0, 34)

Drug Outlets (private sector)

S7	% availability of antimalarial regimens other than A+M and Malarine in the market

Table 4.4.11 Drug outlet survey: Summary details of drug outlet, 2007

	N (%)
Total number of outlets	**131 (100.0)**
Respondents position	
Owner	125 (95.4)
Employee	4 (3.1)
Family member	2 (1.5)
Respondents sex	
Male	56 (42.7)
Female	75 (57.3)
Respondent training	
Doctor	1 (0.8)
Pharmacist	4 (3.1)
Medical assistant	12 (9.2)
Nurse	30 (22.9)
Midwife	7 (5.3)
Other training	2 (1.5)
None	75 (57.3)
Place of outlet	
Village	57 (43.5)
Town	74 (56.5)
Type of outlet	
Village drug outlet	44 (33.6)
Clinic	3 (2.3)
Health cabinet/health worker home	25 (19.1)
Pharmacy	17 (13.0)
General store/shop	13 (9.9)
Drug seller in market	29 (22.1)
Offer consultations	
Yes	57 (43.5)
No	74 (56.5)

Nearly all the respondents were owners of the drug outlets. Although there were a few respondents who were pharmacists, nearly two-thirds of the respondents did not have any type of training in dispensing drugs. The distribution of types of outlets varied from village drug outlets (33%), drug sellers in the market (22%), to a health workers home (19%).

Table 4.4.12 Drug outlet survey: Respondents with specific malaria training, 2007

Type of training	Number of respondents with training N = 131 (%)	Length of training In days - Median (minimum,maximum)
Government	29 (22.1)	3 (1, 24)
PSI malaria training	40 (30.5)	1 (1,7)
Other NGO malaria	13 (9.9)	3 (1,20)
Other	1 (1.0)	1

Despite the lack of adequate pharmaceutical training, 83/131 (63%) of respondents had at least some type of malaria training from government or NGOs.

Table 4.4.13 Number of outlets selling Malarine and A+M and stocks

	CMBS 2004 (N=123)		CMS 2007 (N=131)	
	Malarine	**A+M**	**Malarine**	**A+M**
Have you heard of this drug?	70 (75.3)		128 (97.7)	96 (73.3)
Do you sell this drug?	28 (22.8)	18 (14.6)	79 (60.3)	10 (7.6)
How much does one box sell for?	3000	6000	3500	4000
Median (range)	(2500, 10000)	(3200, 10000)	(2000,7000)	(2500,7000)
How much was sold last week?				
Median	2	4	2	5
(range)	(0,60)	(0,30)	(0,60)	(0,15)
When was last stock bought?				
Within last week	14 (50.0)	4 (23.5)	7 (8.9)	1 (10.0)
Within last month	7 (25.0)	7 (41.2)	31 (39.2)	3 (30.0)
More than a month	7 (25.0)	6 (35.3)	38 (48.1)	6 (60.0)
Not sure	-		3 (3.8)	-
How many packs did you buy last time?	5	15	24	10
Median	(1,48)	(2,48)	(3,360)	(1,80)
(minimum/maximum)				
When will next stock be bought?				
Within next week	6 (21.4)	7 (46.7)	7 (8.9)	1 (10.0)
Within next month	13(46.4)	5 (33.3)	31 (39.2)	1 (10.0)
More than a month	9 (32.1)	3 (20.0)	38 (48.1)	0
Not sure	-		**3 (3.8)**	**8 (80.0)**
Why do you not sell this drug?				
Not available	5 (5.6)	6 (7.2)	8 (16.3)	31 (36.1)
Too expensive	6 (6.7)	6 (7.2)	4 (8.2)	2 (2.3)
No demand	34 (37.8)	18 (21.7)	24 (49.0)	23 (26.7)
People don't know it	15 (16.7)	24 (28.9)	5 (10.2)	9 (10.5)
Don't know where to buy	-	-	1 (2.0)	15 (17.4)
Other	30 (33.3))	29 (34.9)	-	-
Not sure			7 (14.3)	6 (7.0)
Where do you buy your drugs?				
Operational district/CMS			**4 (3.1)**	
Manufacturer			0	
Wholesaler			34 (26.0)	
Olympic market			13 (9.9)	
Province / district pharmacy			64 (48.9)	
Health facility			1 (0.8)	
Retail outlet			14 (10.7)	
Travelling sales person (PSI)			58 (44.3)	
Other			11 (8.4)	

Nearly all respondents have heard of Malarine compared to only 75% in 2004 (Table 4.4.13). Three-quarters of respondents have also heard of the artesunate + mefloquine (A+M) combination packs, but only about 7% of respondents sell it. Among those who do not sell Malarine, half of the respondents cited the lack of demand, and 36% of those who did not sell A+M blamed the lack of availability. Half of the vendors purchased their drugs from the province/district pharmacy and another 44% purchased it from PSI's travelling sales persons.

Table 4.4.14 Sources of drugs

	Village drug outlet	Clinic	Health cabinet/ health worker home	Pharmacy	General store/shop	Drug seller in market	Total
Operational district/CMS	2	0	1	0	0	1	4
Wholesaler	10	1	5	8	3	7	34
Olympic market	1	0	5	4	0	3	13
Province / district pharmacy	25	1	9	5	11	13	64
Health facility	0	0	0	0	0	1	1
Retail outlet	10	0	1	0	1	2	14
Travelling sales person (PSI)	11	2	15	13	2	15	58
Other	4	0	1	0	1	5	11

A significant proportion of village drug outlets (40%) obtain their stocks of antimalarial drugs from the provincial/district pharmacies (Table 4.4.14). It is also interesting to note that a similar proportion of pharmacies obtained their antimalarial drugs from travelling sales persons (namely from PSI).

Table 4.4.15 Antimalarials and diagnostics sold by outlet, 2007

Antimalarial/ diagnostic	Number of outlets			
	Drug usually sold N (%)	Drug out of stock >1 week in last 3 months (of outlets who sell) N (%)	Drug in stock now (of outlets who sell) N (%)	Any expired stock (of those with stock) N (%)
Malarine (child dose)	58 (44.3)	13 (22.4)	50 (86.2)	0 (-)
Malarine (adult dose)	82 (62.6)	15 (18.3)	72 (87.8)	0 (-)
A+M2	7 (5.3)	2 (28.6)	6 (85.7)	0 (-)
A+M3	5 (3.8)	2 (40.0)	3 (60.0)	0 (-)
A+M4	10 (7.6)	4 (40.0)	7 (70.0)	0 (-)
Artekin/Artequick	16 (12.2)	3 (18.8)	13 (81.3)	0 (-)
Mefloquine alone	10 (7.6)	3 (30.0)	6 (60.0)	0 (-)
Artesunate tablet alone	54 (41.2)	13 (24.1)	43 (79.6)	0 (-)
Artesunate suppository	4 (3.1)	0 (-)	4 (100.0)	0 (-)
Artesunate injection	24 (18.3)	10 (41.7)	18 (75.0)	0 (-)
Artemether tablet	5 (3.8)	1 (20.0)	4 (80.0)	0 (-)
Artemether injection	38 (29.0)	4 (10.5)	35 (92.1)	1 (2.9)
Artemisinin	0 (-)			
Quinine tablet	38 (29.0)	13 (34.2)	27 (71.1)	0 (-)
Quinine injection	29 (22.1)	6 (20.7)	26 (89.7)	0 (-)
Tetracycline/Doxycycline	96 (73.3)	4 (4.2)	93 (96.9)	1 (1.1)
Chloroquine	68 (51.9)	12 (17.9)	57 (83.8)	1 (1.8)
Primaquine	1 (0.8)	1 (100.0)	0 (-)	-
Cotexin	12 (9.2)	4 (33.3)	10 (83.3)	1 (10.0)
Drug cocktail for malaria	37 (28.2)	1 (2.7)	35 (94.6)	1 (2.9)
Aspirin	69 (52.7)	12 (17.4)	62 (89.9)	1 (1.6)
Paracetamol	131	6 (4.6)	129 (98.5)	0 (-)
Other drug for malaria	5 (3.8)	2 (40.0)	4 (80.0)	0 (-)
RDT paracheck	19 (14.5)	2 (10.5)	18 (94.7)	0 (-)
RDT malacheck	64 (48.8)	9 (14.1)	62 (96.9)	0 (-)
Optimal	2 (1.5)	0 (-)	2 (100.0)	0 (-)
Other malaria test	11 (8.4)	3 (27.3)	8 (72.7)	0 (-)

Despite the fact that most drug outlets have adequate stocks of antimalarial drugs available during the time of the survey, a large proportion of drug outlets do report stock-outs of antimalarial drugs of more than 1 week during the previous 3 months (Table 4.4.15). It is encouraging that relatively few antimalarial drugs available in drug outlets were expired or out-of-date. The high stocks of chloroquine may relate to its use for *P. vivax.*

Table 4.4.16 Drugs and tests sold and recommended for malaria

Most common drugs sold for malaria	Number of outlets who specified N (%)	Median Cost (Riel) (range)
A+M2	64 (48.9)	3500 (300, 7000)
Chloroquine	43 (32.8)	200 (50, 9000)
Artesunate tablets	39 (29.8)	7000 (500, 10000)
Paracetamol	37 (28.2)	800 (100,2000)
Quinine tablets	31 (23.7)	200 (100,3000)
Have you sold any tests in the last 3 months		
RDT	49 (37.4)	
Microscopy	4 (3.1)	
Both	10 (7.6)	
Neither	68 (51.2)	
Which drug recommended for *P.vivax*		
Chloroquine	36 (27.5)	
A+M2	13 (9.9)	
Artesunate tablet	6 (4.6)	
Quinine tablet	4 (3.1)	
Artekin	1 (0.8)	
Artesunate injection	1 (0.8)	
Artemether injection	1 (0.8)	
Do not recommend	31 (23.7)	
Don't know	38 (29.0)	
Which drug recommended for *P.vivax* (3 most frequent)		
A+M2	32 (24.4)	
Quinine tablet	9 (6.9)	
Artesunate tablet	7 (5.3)	
Artemether injection	5 (3.8)	
Artekin	3 (2.3)	
A+M4	2 (1.5)	
A+M2	1 (0.8)	
Mefloquine	1 (0.8)	
Artesunate suppository	1 (0.8)	
Quinine injection	1 (0.8)	
Chloroquine	1 (0.8)	
Drug cocktail	1 (0.8)	
Do not recommend	23 (17.6)	
Don't know	44 (33.6)	

Drug outlet prescriber knowledge about treatment for malaria is poor. Despite half of the respondents named A+M2 as a common drug for the treatment of malaria, nearly one-third of these respondents also cited artesunate and quinine tablets and paracetamol as common drugs for the treatment of malaria (Table 4.4.16). It is worrying that the majority of respondents recommended incorrect antimalarial drugs for the treatment of *P. vivax,* one-third did not know, and 20% did not recommend any treatment for *P. vivax*. Despite nearly 40% of drug outlets selling RDTs, it will be important to ensure accuracy of diagnosis and treatment of malaria species in drug outlets. A comprehensive BCC/IEC strategy targeting the private sector will be critical.

5   Conclusions and Recommendations

Interpretation of results has been included with presentation of the results. This section highlights the most notable findings.

This 2007 survey demonstrated that significant progress has been made since the 2004 baseline survey in terms of mosquito net coverage, availability and use of insecticide-treated nets, general knowledge of malaria, prevention measures, and treatment-seeking behaviors. However, with the goal of moving towards pre-elimination of malaria in Cambodia, much more work is needed.

5.1   Key recommendations for the programme

- ***Improve targeted BCC/IEC strategies and messages***. Since the survey in 2004, knowledge about malaria transmission and prevention has remained generally high among respondents. However, there is a great need for improvement of treatment-seeking knowledge and behaviour. Knowledge of Malarine for the treatment of malaria has increased since the 2004 survey, but more effective strategies for BCC/IEC regarding full treatment courses may still needed. Regarding mosquito net use, improved BCC/IEC strategies and messages targeted for people going to the forest should be considered – as mosquito net use among these at risk populations is low.

- ***Promote training and refresher trainings for health facility providers and private drug outlet prescribers, particularly on the diagnosis and treatment for P. vivax***. Prescriber knowledge about treatment for *P. vivax* is low, and more information for the treatment of *P. vivax* should be included in the training modules for case management of malaria. As the case load for P. falciparum is decreasing in favour of P. vivax, it will be important to ensure that health staff in public, private, and communities, are better equipped to diagnosis and treat malaria, including increasingly non-malaria fevers.

- ***Increase sufficient ITN coverage and use is needed.*** Efforts by the national malaria programme to increase coverage of mosquito nets have largely been successful due to the intensive distribution programme supported by the Global Fund, World Bank, and other key stakeholders. However, the programme should now focus on ensuring sufficient ITN coverage (at least one ITN for every two persons), particularly among larger households. Besides ownership of ITNs, it will be important to strengthen strategies to increase the regular *use of ITNs*.

- ***Maintain efficacy of ITNs.*** Increased frequency of washing mosquito nets will undoubtedly reduce the residual insecticidal efficacy of ITNs. A significant proportion (40%) of mosquito nets was reported to be washed at least once per month. The national programme should develop targeted BCC/IEC communications to reduce the frequency of washing of mosquito nets.

- ***Consider more emphasis on mosquito net retreatment.***   According to the 2007 survey, the availability of insecticides for the retreatment of mosquito nets was found to be low. Nearly one-quarter of mosquito nets were more than 3 years old, and the majority were at least 12 months old. Despite increased distribution and use of LLINs, mosquito nets (including conventional nets) are used for several years and with the frequent washing of these nets, it would seem advantageous to increase the availability of mosquito net retreatment.

- ***Ensure availability of antimalarial and RDTs.*** The issue of stock-outs of antimalarial drugs and RDTS in health facilities of more than 1 week within the past 3 months should be addressed. It is especially important to ensure that effective antimalarials, supplies and regents are available and adequately stocked at point of care, particularly for health facilities offering in-patient care where more severe cases would likely be seen.

- ***Promote further operational research addressing the changing epidemiology of malaria.*** The epidemiology of malaria will likely change as the incidence of malaria continues to decline in the region. More research may be needed to evaluate the impact of changing species distributions (i.e., increasing *P. vivax* burden) on disease transmission dynamics. There is also a need for more information on the effect of the rapidly changing environment on malaria vector behaviour and possible secondary malaria species.

- ***Develop and test innovative strategies to improve data collection for M&E indicators.*** As the malaria burden continues to decline it is important to ensure that M&E systems adequately reflect and can address the changing epidemiology. Due to the few numbers of malaria patients, the health core indicator of malaria patients receiving appropriate treatment according to national guidelines could not be adequately addressed. It is recommended that new strategies should be developed and tested in the upcoming CMS 2010 survey (e.g., conducting exit interviews with patients receiving treatment for fever not only malaria cases).

Annex 1.

GFATM FUNDED MALARIA PROGRAMME IN CAMBODIA
Terms of Reference for Local Agency Assistance in Carrying Out the Cambodia GFATM Round 2 Malaria End
of Project Evaluation Survey 2007

Background

Malaria is one of the leading public health problems in Cambodia, and Cambodia successfully applied to the Global Fund for support in Round Two. The initial period was for two years (budget of US $ 5,013,262 including a 5.9% contribution to the Principal Recipient office), and the total budget for the five-year period was US $ 9,998,371.

In order to track progress of the National Malaria Control Programme (NMCP) during the period of support from GFATM, Cambodia undertook a comprehensive and rigorously conducted Baseline Survey in 2004 with the intention of following up with a second comparable survey. *These Terms of Reference outline the objectives and tasks for a local agency to be contracted to assist in implementing the final survey.*

GFATM Malaria Programme Description:

Title of proposal: Strengthening of the Cambodian National Malaria Control Programme by taking to scale proven interventions

Population impact goal:

Reduce malaria related mortality among the general population in Cambodia by 50% and morbidity by 30%, within five years through the implementation of a comprehensive national malaria control strategy.

Main Objectives:

1. To significantly increase community awareness and improve care-taking practices on malaria prevention and control with promotion of proper health seeking behaviour in endemic areas.
2. To improve access to preventive measures (nets and insecticide) through a community based approach.
3. To increase access to early diagnosis and treatment (EDAT) through a three-pronged approach (public, private, VMW).
4. To strengthen the institutional capacity of the national programme at all levels.

Implementing Partners:

The National Centre for Parasitology, Entomology and Malaria Control (CNM) in collaboration with selected NGOs have been successful in securing funding from the Global Fund to implement a comprehensive programme for malaria control and prevention in Cambodia. The CNM will be the major government partner charged with the responsibility of guiding policy formulation, strategic prioritization, planning, coordinating, direct implementation of EDAT in malaria hyper endemic communities, monitoring and supervision of a decentralized malaria control programme in the country. The international NGO, Partners for Development (PFD) is working with CNM and the Provincial Health Departments in Kratie and Koh Kong to implement the decentralized strategy for malaria as developed by the RBM Technical Advisory Group. Another international NGO, Health Unlimited (HU) is playing a similar role in Ratanakiri and Preah Vihear provinces. A third international NGO, Population Services International, Cambodia (PSI/C) is implementing the social marketing of Malarine and Rapid Diagnostic Tests (RDTs) and Long Lasting Insecticide Treated Net (LLIN)/hammock net in the private sector. Other partners include Provincial Health Departments (PHDs), Operational District (OD) Health Offices, Referral Hospitals, Health Centres and Health Posts.

Innovative Aspects:
1. EDAT through microscopy/RDTs & prepackaged antimalarial combinations at all public facilities
2. Social marketing of RDTs and Malarine through private sector
3. Social marketing of insecticide-treated hammock nets through private sector
4. Training and support of locally recruited village malaria workers for EDAT in hyper endemic villages
5. Accelerating the implementation of the decentralization strategy through partnership with NGOs.

The four Sub-recipients (SRs) under the GFATM Round 2 Malaria programme committed themselves to the organization of a Baseline Survey and Final evaluation.

Purpose and objectives of the Cambodia GFATM Round Final Malaria Survey

The **purpose** of the Final Malaria Survey is to assess the performance and impact of malaria control activities in Cambodia in comparison with the results of the 2004 baseline. While the survey includes all the indicators required for monitoring and evaluation of the GFATM Round 2 support, it will also be used more broadly by the NMCP to achieve the following **objectives**:

- Document the current malaria epidemiological situation compared to 2004
- Determine coverage of key interventions compared to 2004
- Track key knowledge, attitude, behaviour and practice indicators compared to 2004 to assess communication strategies
- Assess current strategies for malaria control
- Assess performance of the programme implemented by government and partners
- Assess options and recommend improvements where needed

Specific Indicators on which follow-up data are required:
The four sub-recipients included the following prioritized coverage indicators in their revised Monitoring and Evaluation Plan submitted to the Global Fund on 8th April 2004.

Core Indicators (C)
C1 % people seeking treatment from trained providers within 48 hours of developing a fever
C2 % target population who can explain how malaria is transmitted and prevented
C3 % families living in endemic areas that have sufficient treated mosquito nets
C4 % population at risk sleeping under insecticide treated nets the previous night, measured during peak malaria transmission season
C5 % patients with malaria in public health facilities prescribed correctly according to national guidelines
C6 % public health facilities which maintain stocks of antimalarials and rapid tests with no out-of-date stocks

The sub-recipients had earlier included eleven supplementary coverage indicators in their integrated proposal submitted to the Global Fund in September 2002 (note, two of the original eleven Supplementary Indicators were omitted as they were redundant – previously S3, S4).

S1 % mothers and care takers able to recognize signs and symptoms of danger of a febrile illness in a child <5 years.
S2 % seeking treatment from trained provider/total cases of febrile illness
S3 % children under-5 sleeping under treated mosquito nets that have sufficient treated mosquito nets the previous night
S4 % public health facilities able to confirm malaria diagnosis according to national guidelines
S5 % availability of antimalarial regimens other than A+M and Malarine in the market
S6 % awareness of Malarine among the targeted populations

S7   % of target groups who know where to obtain testing and treatment for malaria

S8   % of target groups who know that Malarine treatment is effective only if entire course is taken

S9   % of public health facilities reporting no disruption of stock of antimalarials for more than 1 week during the previous 3 months

The following additional indicators will be added to this final survey, which relate to activities supported by GFATM Round 6:

S10   % of private sector providers in target provinces recommending appropriate_ treatment for malaria (CNM)

S11   % of temporary forest workers/mobile populations in high endemic areas less than 1 kilometre from forest who slept under a treated net last time the person spent the night in the forest (CNM)

The point prevalence of *Plasmodium* infection and malaria illness will be estimated by a blood survey linked to information on fever history. This is proposed to be undertaken by the LA with technical assistance from the US Armed Forces Research Institute of Medical Sciences (AFRIMS), Bangkok, Thailand.

Approaches to the conduct of Final Survey:
It has been envisaged that the proposed Final Survey would have three sub-components:
- a KABP study (of specific interest to all four partners; CNM, PSI, PFD and HU). The KABP part of the Baseline Study is expected to guide CNM and other partners on key messages to be delivered through a Behaviour Change Communication (BCC) approach, identify the priority media to be used for communicating the messages and design and develop appropriate materials in addition to establishing the baseline figures for several of the key indicators that will be monitored and evaluated over the course of the implementation of the GFATM supported malaria control programme.

- a prevalence study (which is proposed to be conducted along with the KABP study) (of specific interest to CNM, PFD and HU). The prevalence data would be used to establish baseline figures and monitoring the progress of the programme in terms of impact, particularly at midterm and end of the programme.

- a health facility/provider study to measure coverage (of very specific interest to PSI and CNM). The scope of the survey will include both public and private distribution of antimalarial therapies as well as mosquito nets and other personal protection measures.

All the four SR partners (CNM, PFD, HU and PSI) have agreed to pool their resources for carrying out the Final Survey in a conjoint fashion. For this, they have recently commenced obtaining the Technical Assistance (TA) services of Malaria Consortium experts, acquired through WHO support. While the TA would help in the design of the study as well as the data analysis and report writing responsibilities, the 4 SRs would like to invite proposals from interested and reputed Cambodian research/consultancy firms and select the most appropriate agency. Such an agency would be contracted for assisting the Malaria Consortium in carrying out the data collection, data entry, data cleaning, slide cross-check , data analysis and report writing responsibilities. The TA would assist in training the field investigators of the selected Cambodian research/consultancy firm, as well as in quality control during data collection, data entry and data cleaning phases of the study. The TA would also be responsible for finalizing data analysis, finalizing report, discussing dissemination and follow-up activities. The whole process would be overseen and facilitated by a small Task Force specially set up for this purpose.

Technical and operational assistance from AFRIMS and Pasteur Institute will be availed for conducting the prevalence study subcomponent.

Methods
The draft study design including sample size is described in Annex 1, and a draft responsibility matrix is attached in Annex 2.

While the baseline survey had three domains only two of these will be included in the final survey. This change is based on the low malaria prevalence rate in domain 3, so it was decided to focus efforts and limited resources on the areas where data on malaria prevalence will be useful for action. The Task Force and TA thus decided to exclude domain 3 from the final survey, but add an extra risk zone beyond 2 kilometers from the forest to collect malaria-related data especially from the people who usually visit the forest.

Ensuring proper implementation of the Final Survey
A small task force comprising representatives of the four SRs, AFRIMS and WHO, has been constituted. The responsibilities of the Task Force include the finalization of the ToRs for the Final Survey, review of the proposal submitted by the external technical agency identified by WHO, discussion and finalization of the study design proposed by the TA, following up on the progress of the study and dissemination of results. The Task Force will be especially responsible for quality assurance through supervision of the data collection process.

Phases of the study and expected involvement of Local Agency
The selected local agency would be required to undertake data collection, data entry, quality control, data cleaning, slide cross-check, data analysis functions and assist in report writing under the technical guidance of the TA and the oversight of the Task Force. The various phases of the study are envisaged to be as follows.

Phase 1: Design of Final Survey
The TA is currently working closely with the Task Force in designing the final survey adapting the design from the baseline study to ensure comparability, while making some adjustments in view of baseline results and needs for Round 6 monitoring.

Phase 2: Training of Field Staff of selected Cambodian research/consultancy firm (LA)
The local agency is expected to utilize the assistance of the selected TA in the training of its field staff. Dates will be agreed following recruitment of the LA

Phase 3: Data collection
The local agency is expected to undertake data collection in the field during October to December 2007 (exact dates to be agreed following contract award).

Phase 4: Data entry
The local agency is expected to undertake data entry from December 2007 to January 2008.

Phase 5: Data cleaning and slide cross-checking
AFRIMS will assist the local agency in data cleaning and slide cross-checking. CHECK IF AGREED

Phase 6: Data analysis and report writing
The TA is expected to be in Cambodia between January and March 2008 to:
a. finalise data analysis in collaboration with the local agency
b. finalise report in collaboration with the local agency
c. discuss dissemination and follow-up actions with the Task Force

Phase 7: Dissemination
The Task Force is expected to make a presentation of the key findings of the Final Survey to the members of the RBM Technical Advisory Group, CCC members and other interested parties at the end of the study period.

Expected outputs from the local agency:
The selected local agency is expected to provide the following outputs to the National Malaria Control Programme:
- Process reports relating to the training, data collection and data entry phases of the Final Survey.
- Data sets from the data collection and data entry phases

Expected contents of proposal from local agency:
The proposal must offer services for the total requirement contained in the ToRs. A proposal in two parts (a technical and a financial part) is required to be submitted.

The technical proposal (not more than 15 pages) must provide the following information:
- A description of the methodology (work plan) which the agency proposes to use in conjunction with the TA including a time schedule for completion of the work; any comments on or suggestions for improving the ToR; expected resource inputs from the CNM and its partners (PFD, HU and PSI) and the Agencies providing TA (namely the Malaria Consortium and AFRIMS)
- Identification of "key professional staff" for this assignment, the composition of the proposed consultant team, the tasks which would be assigned to each team member and the allocation of time for each team member, and curriculum vitae for proposed professional staff.
- A brief description of the consultancy organization, including type of organization (e.g., NGO, government institution, etc.), and primary sources of funding. Provide an outline of recent experience in similar studies/surveys.

The financial proposal should detail how the agency arrived at its financial bid, including the level of effort related to each key task described in its proposed methodology. The financial proposal should provide the detailed costs as consultancy rates applied per day, number of workdays, travel cost estimates, material costs (if any), etc.

Annex 2. GFATM Round 2 Malaria Final Survey: Partners' Responsibilities &Tentative Timeline

	Feb-2007	Mar-2007	Apr-2007	May-July 2007	Jun-2007	Jul,2007	Aug-2007	Sep2007	Oct-2007	Nov-2007	Dec-2007	Jan-2008	Feb-2008	Mar-2008	Apr-2008	May-2008	Jun-2008
	Task Force **(TF)**; Technical Agency **(TA)** and Local Agency **(LA)**			Survey design	Obtain Ethical Clearance and Selection of LA		Finalize Survey Protocol	Field Staff Training	Data collection		Data entry and cleaning Microscopy Examination		Data analysis		Report writing and translation		Dissemination
TF meetings	green			green		green		green	green		green	green		green			
Partners Roles & responsibilities	**TF:** CNM, PSI, PFD, HU, WHO, AFRIMS Other new Partners? (e.g. MSH, Pasteur) **TA:** Malaria Consortium **LA:** To be selected			**MC** / TF	**TF** / MC		**TF** / **MC** / **LA**	**LA** / MC / TF	**LA** / MC / TF		**LA** / MC / TF		**MC** / LA / TF	**MC** / **LA**			**TF** / LA / MC

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Annex 3. Rainfall patterns for Domains 1 and 2 in 2004 and 2007

Estimated rainfall for Domain 1: 2004 and 2007 (bars represent standard error range 2003-7). Shown by 10 day period (top) and month (bottom)
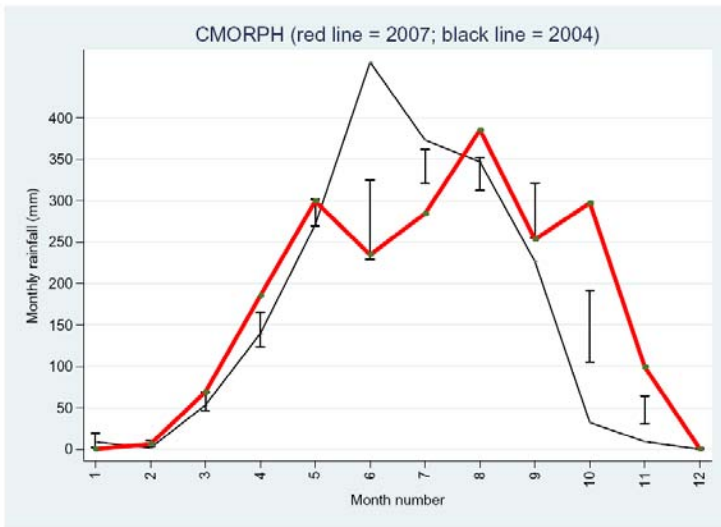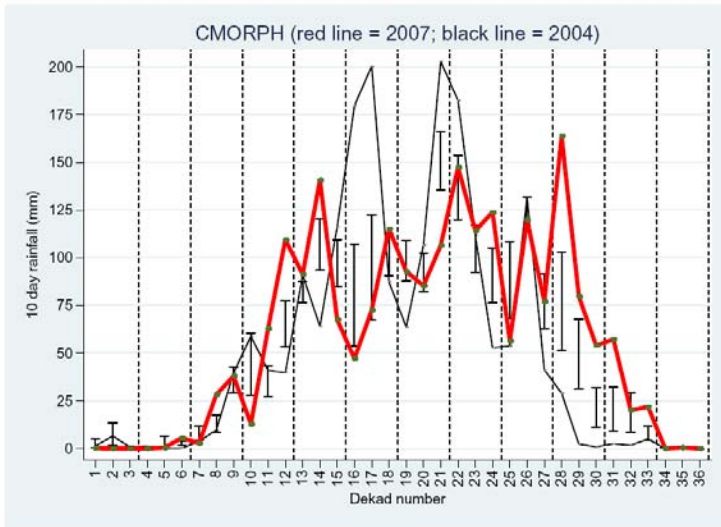
Estimated rainfall for Domain 2: 2004 and 2007 (bars represent standard error range 2003-7). Shown by 10 day period (top) and month (bottom)

CMORPH (red line = 2007; black line = 2004)

CMORPH (red line = 2007; black line = 2004)
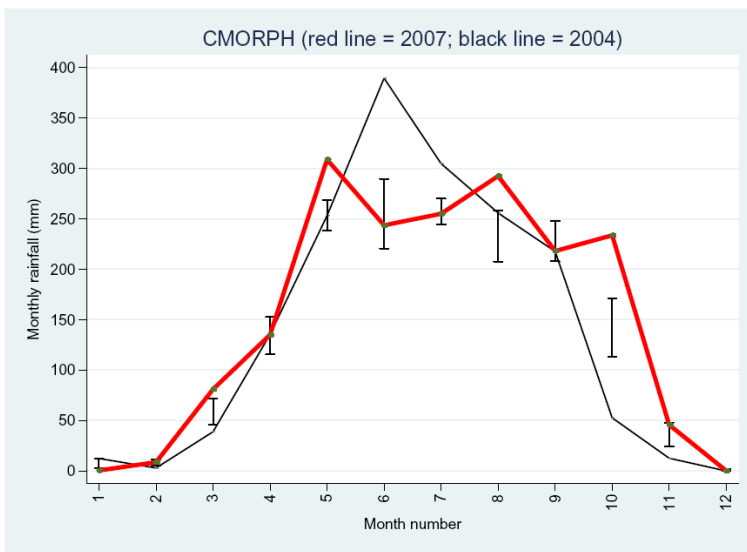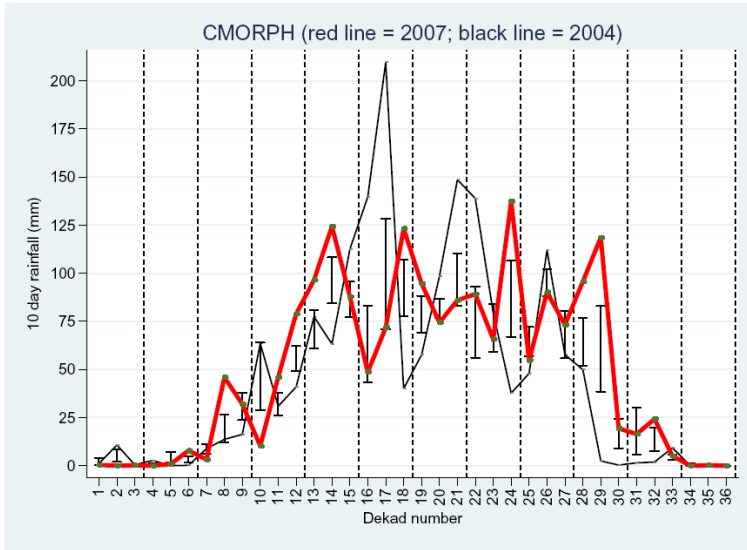
Annex 4. Household questionnaire

Cambodia Malaria Survey
(CMS 2007)

Household Questionnaire

Introduction and Consent

INFORMED CONSENT

Hello. My name is _____ and I am working with the Ministry of Health. We are conducting a national survey about malaria. We would very much appreciate your participation in this survey. The information you provide will help the government to plan health services. The survey usually takes between 20 and 30 minutes to complete. Whatever information you provide will be kept strictly confidential and will not be shown to other persons.

Participation in this survey is voluntary and you can choose not to answer any individual question or all of the questions. However, we hope that you will participate in this survey since your views are important.

After asking the questions we would like to test the blood of five members of your household for malaria. We shall test one woman, one man, one pregnant woman, one child under five years old and one child between five and fourteen years (if present). In addition we also provide RDT to whom with symptomatic of malaria in your household. If the result of the person with symptomatic is positive we shall give you malaria medicine or advise you to go to the clinic.

At this time, do you want to ask me anything about the survey?
May I begin the interview now?

Signature of interviewer: _____   Date: _____

RESPONDENT AGREES TO BE INTERVIEWED	☐
RESPONDENT DOES NOT AGREE TO BE INTERVIEWED	☐

Identification

	HOUSEHOLD ID	☐☐☐☐
Name of head of household_____	Domain	☐
	Risk Zone	☐
Province _____	Province code	☐☐
District _____	District code	☐☐
Commune_____	Commune code	☐☐
Village _____	Village (Cluster) code	☐☐
	Household Number	☐☐

Household Visits

	Visit 1	Visit 2	Visit 3		Final visit
Date	_____	_____	_____	Date	☐☐☐☐☐☐
Interviewer's name	_____	_____	_____	Interviewer ID	☐☐
Result*	_____	_____	_____	Result	☐
Next planned visit: date	_____	_____	Total no. of visits	☐	
time	_____	_____			

Codes for Result * 1=completed 2=no one (or no potential respondent) at home 3=refused 4= dwelling not found 5=other	COMPLETE AFTER HOUSEHOLD LISTING	Total members in household ☐☐
		Line no. of respondent ☐☐

Supervisor	Field Editor	Office Editor	Entered By
Name _____ Date _____	☐☐	Name _____ Date _____	☐☐	☐☐	☐☐

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Household Schedule

We would first like some information on the people living/the guests in your household.

LINE NO.	USUAL RESIDENTS AND VISITORS	RELATIONSHIP TO HEAD OF HOUSEHOLD	SEX		RESIDENCE		AGE		ELIGIBLE WOMEN	CURRENTLY PREGNANT		
Circle the line number if bood samples	Give names of people who usually live in the house and visitors last night.	What is the relationship of (NAME) to the head of the household?*	Is (NAME) male or female?		Did (NAME) stay here last night?		How old is (NAME)? If less than 1 year write 00 in the box and give number of **months** in next column.		CIRCLE **LINE NUMBER** OF ALL WOMEN AGE 15-49	FOR ELIGIBLE WOMEN, Is (NAME) currently pregnant?		
Q1	Q2	Q3	Q4		Q5		Q6		Q7	Q8		
			M	F	Yes	No	Years	Months		Yes	No	DK
01			1	2	1	2			01	1	2	8
02			1	2	1	2			02	1	2	8
03			1	2	1	2			03	1	2	8
04			1	2	1	2			04	1	2	8
05			1	2	1	2			05	1	2	8
06			1	2	1	2			06	1	2	8
07			1	2	1	2			07	1	2	8
08			1	2	1	2			08	1	2	8
09			1	2	1	2			09	1	2	8
10			1	2	1	2			10	1	2	8
11			1	2	1	2			11	1	2	8
12			1	2	1	2			12	1	2	8
13			1	2	1	2			13	1	2	8

Codes for Q3:
Relationship to household head

01=head
02=wife/husband/partner
03=son/daughter

04=son/daughter in law
05=grandchild
06=parent

07=parent in law
08=brother/sister
09=neice/nephew

10=other relative
11=adopted/foster/stepchild
12=not related

Tick here if more than 13 people in house and continuation sheet used.

	Just to make sure that I have a complete listing:				
1)	Are there any other persons such as small children or infants that we have not listed?	YES	⬜→	ENTER EACH IN TABLE	NO ⬜
2)	In addition, are there any other people who may not be members of your family, lodgers or friends who usually live here?	YES	⬜→	ENTER EACH IN TABLE	NO ⬜

Section 1: Household Details

	Questions	Optional categories	Skip
Q9	What is the main source of drinking water in your household	Private tap/vendor/bottle 1 Rain 2 Well/borehole 3 Public/shared 4 Public well/spring 5 River etc 6 Other 7 Specify _____	
Q10	What kind of toilet facilities does your household use?	Inside house 1 In neigbours house 2 In the compound 3 No facility / in field 4 Other 5 Specify _____	
Q11	Does your household have any of the following assets?	Yes No Electricity (all types) 1 2 Radio 1 2 Television 1 2 Telephone 1 2 Mobile phone 1 2 Freezer / refrigerator 1 2 Water storage jar 1 2 Bed 1 2 Kettle 1 2 Plastic bucket 1 2 Sewing machine/ loom 1 2 Battery (12v) 1 2 Floor mat 1 2 Pigs 1 2 Cows/buffalo/goats 1 2 Chickens/ducks 1 2	
Q12	What type of fuel does your household mainly use for cooking?	Electricity 1 Gas / kerosene 2 Charcoal 3 Firewood/straw 4 Other 5 Specify _____	
Q13	What is the main material of the roof?	Plastic sheet / tent 1 Thatch/Palm / bamboo 2 Fibre glass/ Iron/Aluminum 3 Tiles / cement 4 Other 5 Specify _____	

	Questions	Optional categories	Skip
Q14	What is the main material of the floor?	Bamboo 1 Wooden 2 Tiles/cement 3 Earth 4 Other 5 Specify _____	
Q15	Does any member of your household own:	Yes No Ox cart / Horse cart 1 2 Bicycle 1 2 Motorcycle/scooter 1 2 Car/truck 1 2	
Q16	Does your household use metal or plastic screens on windows to keep mosquitoes out?	Yes 1 No 2 Not sure 8	
Q17	Does your household use any chemicals to keep mosquitoes away (eg spray, coil, repellent)?	Yes 1 No 2 Not sure 8	**If NO skip to Q19**
Q18	If yes, how much did your household spend on this in the past 30 days?	_____ Riel Dont know 8	
Q19	Does your household have any mosquito nets (or hammock nets) that can be used for sleeping under?	Yes 1 No 2 Not sure 8	**If NO skip to Q35**
Q20	How many mosquito nets does your household have?	Number of mosquito nets ☐☐ Number of hammock nets ☐☐ Total number of nets ☐☐	

Section 2: Household Nets

	Questions	NET 1	NET 2	NET 3
Q21	Ask to see the nets in the household. IF MORE THAN 3 NETS USE ADDITIONAL SHEETS	Observed 1 Not observed 2	Observed 1 Not observed 2	Observed 1 Not observed 2
Q22	How long ago did your household obtain the net?	<6m 1 6m to <1yr 2 1yr to <3yr 3 3yr or more 4 Don't know 8	<6m 1 6m to <1yr 2 1yr to <3yr 3 3yr or more 4 Don't know 8	<6m 1 6m to <1yr 2 1yr to <3yr 3 3yr or more 4 Don't know 8
Q23	Where did your household obtain your mosquito net?	Gift 1 Govt/NGO/ 2 Health Project Market stall 3 Shop by market 4 Itinerant seller 5 Other 6 Spec _____ Don't know 8 **If Gift skip to Q25**	Gift 1 Govt/NGO/ 2 Health Project Market stall 3 Shop by market 4 Itinerant seller 5 Other 6 Spec _____ Don't know 8 **If Gift skip to Q25**	Gift 1 Govt/NGO/ 2 Health Project Market stall 3 Shop by market 4 Itinerant seller 5 Other 6 Spec _____ Don't know 8 **If Gift skip to Q25**
Q24	What price did the household pay for this net?	Riel_____ Don't know 8	Riel_____ Don't know 8	Riel_____ Don't know 8

	Questions	NET 1		NET 2		NET 3	
Q25	OBSERVE OR ASK TYPE OF MOSQUITO NET	*Mosquito nets*		*Mosquito nets*		*Mosquito nets*	
		Siamdutch	1	Siamdutch	1	Siamdutch	1
		Siamdutch no label	2	Siamdutch no label	2	Siamdutch no label	2
		B52	3	B52	3	B52	3
		Pink/blue/sky blue (GF logo)	4	Pink/blue/sky blue (GF logo)	4	Pink/blue/sky blue (GF logo)	4
		White Olyset (single, large holes)	5	White Olyset (single, large holes)	5	White Olyset (single, large holes)	5
		Unbranded dark Green	6	Unbranded dark Green	6	Unbranded dark Green	6
		Unbranded white	7	Unbranded white	7	Unbranded white	7
		Malanet (family, mid-green, algae)	8	Malanet (family, mid-green, algae)	8	Malanet (family, mid-green, algae)	8
		Blue Olyset (family, large holes)	9	Blue Olyset (family, large holes)	9	Blue Olyset (family, large holes)	9
		Other	10	Other	10	Other	10
		Colour _____		Colour _____		Colour _____	
		Pattern _____		Pattern _____		Pattern _____	
		Hammock nets		*Hammock nets*		*Hammock nets*	
		Commercial hammock net	11	Commercial hammock net	11	Commercial hammock net	11
		Commercial with hammock	12	Commercial with hammock	12	Commercial with hammock	12
		Malanet for hammock (dark green with bag)	13	Malanet for hammock (dark green with bag)	13	Malanet for hammock (dark green with bag)	13
		Dont know	98	Dont know	98	Dont know	98

	Questions	NET 1	NET 2	NET 3
Q26	Has the net got any holes?	Yes 1 No 2 **If NO skip to Q28**	Yes 1 No 2 **If NO skip to Q28**	Yes 1 No 2 **If NO skip to Q28**
Q27	IF YOU CAN OBSERVE THE NET RECORD THE CONDITION OF THE NET BASED ON THE NUMBER OF HOLES If >20 holes of one size record as 25	Number of holes Head size ☐☐ Hand size ☐☐ Finger size ☐☐	Number of holes Head size ☐☐ Hand size ☐☐ Finger size ☐☐	Number of holes Head size ☐☐ Hand size ☐☐ Finger size ☐☐
Q27a	Is the net too torn to count holes?	Yes 1 No 2	Yes 1 No 2	Yes 1 No 2
Q28	When you got the mosquito net was it already treated with an insecticide to kill or repel mosquitoes?	Yes 1 No 2 Not sure 8	Yes 1 No 2 Not sure 8	Yes 1 No 2 Not sure 8
Q29	Since you have had the net has it ever been soaked or dipped in a liquid to repel mosquitoes?	Yes 1 No 2 Not sure 8 **If NO skip to Q32**	Yes 1 No 2 Not sure 8 **If NO skip to Q32**	Yes 1 No 2 Not sure 8 **If NO skip to Q32**
Q29a	**Where** did you get your net treated the last time?	Home 1 Health Centre 2 At village by a 3 project At nearby 4 village Other 5 Specify_____	Home 1 Health Centre 2 At village by a 3 project At nearby 4 village Other 5 Specify_____	Home 1 Health Centre 2 At village by a 3 project At nearby 4 village Other 5 Specify_____
Q30	How much did your household pay for dipping the net, if it paid anything? If not paid record 00.	Riel _____ Don't know 8	Riel _____ Don't know 8	Riel _____ Don't know 8
Q31	How long since the net was last soaked or dipped in a liquid to repel mosquitoes? If less than a month record 00.	Months ☐☐ More than 3 95 years ago Not sure 98	Months ☐☐ More than 3 95 years ago Not sure 98	Months ☐☐ More than 3 95 years ago Not sure 98

	Questions	NET 1	NET 2	NET 3
Q32	How frequently was this net washed since you received it?	at least once a month 1 at least once every 6 months 2 at least once every year 3 Less than once a year 4 Never 5 Not sure 8	at least once a month 1 at least once every 6 months 2 at least once every year 3 Less than once a year 4 Never 5 Not sure 8	at least once a month 1 at least once every 6 months 2 at least once every year 3 Less than once a year 4 Never 5 Not sure 8
Q33	Did anyone sleep under this mosquito net last night?	Yes 1 No 2 Not sure 8 **If no or not sure skip to Q35**	Yes 1 No 2 Not sure 8 **If no or not sure skip to Q35**	Yes 1 No 2 Not sure 8 **If no or not sure skip to Q35**
Q34	Who slept under this mosquito net last night? ASK FOR NAME AND AGE CHECK ON THE LIST OF HOUSEHOLD MEMBERS AND GUESTS FOR THE CORRESPONDING ID (LINE NO)	Name _____ Line no. ▢▢ Name _____ Line no. ▢▢ Name _____ Line no. ▢▢ Name _____ Line no. ▢▢ Name _____ Line no. ▢▢	Name _____ Line no. ▢▢ Name _____ Line no. ▢▢ Name _____ Line no. ▢▢ Name _____ Line no. ▢▢ Name _____ Line no. ▢▢	Name _____ Line no. ▢▢ Name _____ Line no. ▢▢ Name _____ Line no. ▢▢ Name _____ Line no. ▢▢ Name _____ Line no. ▢▢ **Continue to other net if there is any**

	Questions	Optional categories	Skip
Q35	If you wanted to buy a net where would you go to buy one?	Shop / seller in village 1 Nearest market 2 Would not buy 3 Wait till someone come to sell in 4 village Other 5 Specify _____ Don't know 8	
Q36	If you decided you needed to treat or re-treated net where would you go?	Wait for project/health staff 1 Hospital/health facility 2 Private health facility 3 NGO office 4 Pharmacy 5 Market/shop 6 Have no nets 7 Nets are all pre-treated 8 Don't want insecticide 9 (Village Health Volunteer , Village Net Distribution, Village Malaria Worker) 10 VHV, VND, VMW Other 11 Specify _____ Don't know 98	
Q37	What are the benefits of a mosquito net treated with insecticide compared to an untreated net? (Multiple answer)	Prevents mosquito bites 1 Repels mosquitoes 2 Kills mosquitoes 3 Sleep better 4 Kills other bugs 5 Protects from malaria 6 Other 7 Don't know 98	
Q38	Does anyone in your household sometimes go to the forest and sleep there overnight? (Prey Klang)	Yes 1 No 2 Don't know 8	**If NO skip to Q52**
Q38a	How many people in your household sometimes go to the forest and sleep there overnight?	Number of people ☐☐	

Section 3: People who go to the forest

		PERSON 1	PERSON 2	PERSON 3
Q39	Who in your household sometimes go to the forest and sleeps there overnight? ASK FOR NAME AND AGE CHECK ON THE LIST OF HOUSEHOLD MEMBERS FOR THE ID (LINE NO) Use additional sheets if more than 3 persons	Name _____ Line no.	Name _____ Line no.	Name _____ Line no.
Q40	Were they in the forest last night?	Yes 1 No 2 Not sure 8 **If NO skip to Q45**	Yes 1 No 2 Not sure 8 **If NO skip to Q45**	Yes 1 No 2 Not sure 8 **If NO skip to Q45**
Q41	Did they use a hammock or mosquito net in the forest last night?	Yes 1 No 2 Not sure 8 **If NO skip to Q44**	Yes 1 No 2 Not sure 8 **If NO skip to Q44**	Yes 1 No 2 Not sure 8 **If NO skip to Q44**
Q42	What type of net was used in the forest last night?	Hammock net 1 Mosquito net 2 Not sure 8	Hammock net 1 Mosquito net 2 Not sure 8	Hammock net 1 Mosquito net 2 Not sure 8
Q43	Was the net used last night treated to repel mosquitoes?	Yes 1 No 2 Not sure 8 **skip to Q49**	Yes 1 No 2 Not sure 8 **skip to Q49**	Yes 1 No 2 Not sure 8 **skip to Q49**
Q44	If a net was not used in the forest last night why not?	Did not want to use 1 Forgot to take 2 Not enough nets in house 3 Don't have hammock net 4 Nowhere to hang in forest 5 No money to buy 6 Don't know 8 **Skip to Q51**	Did not want to use 1 Forgot to take 2 Not enough nets in house 3 Don't have hammock net 4 Nowhere to hang in forest 5 No money to buy 6 Don't know 8 **Skip to Q51**	Did not want to use 1 Forgot to take 2 Not enough nets in house 3 Don't have hammock net 4 Nowhere to hang in forest 5 No money to buy 6 Don't know 8 **Skip to Q51**
Q45	If they were not in the forest last night, when were they last there?	< 1 week 1 1 to < 4 weeks 2 >= 4 weeks 3 Not sure 8	< 1 week 1 1 to < 4 weeks 2 >= 4 weeks 3 Not sure 8	< 1 week 1 1 to < 4 weeks 2 >= 4 weeks 3 Not sure 8
Q46	Did they use a hammock or mosquito net in the forest last time?	Yes 1 No 2 Not sure 8 **If NO skip to Q50**	Yes 1 No 2 Not sure 8 **If NO skip to Q50**	Yes 1 No 2 Not sure 8 **If NO skip to Q50**

		PERSON 1		PERSON 2		PERSON 3	
Q47	What type of net was used?	Hammock net Mosquito net Not sure	1 2 8	Hammock net Mosquito net Not sure	1 2 8	Hammock net Mosquito net Not sure	1 2 8
Q48	Was this net treated to repel mosquitoes?	Yes No Not sure	1 2 8	Yes No Not sure	1 2 8	Yes No Not sure	1 2 8
Q49	Was this net usually used by others in the household?	Yes No Not sure **skip to Q51**	1 2 8	Yes No Not sure **skip to Q51**	1 2 8	Yes No Not sure **skip to Q51**	1 2 8
Q50	If a net was not used in the forest during the last visit, why not?	Did not want to use Forgot to take Not enough nets in house Don't have hammock net Nowhere to hang in forest No money to buy Don't know	1 2 3 4 5 6 8	Did not want to use Forgot to take Not enough nets in house Don't have hammock net Nowhere to hang in forest No money to buy Don't know	1 2 3 4 5 6 8	Did not want to use Forgot to take Not enough nets in house Don't have hammock net Nowhere to hang in forest No money to buy Don't know	1 2 3 4 5 6 8
Q51	How many nights did they stay in the forest on their last visit?	Nights		Nights		Nights	

Section 4: Malaria knowledge and recognition

	Questions	Optional categories	Skip
Q52	What are the signs and symptoms of malaria? **(Multiple choice)**	Fever 1 Chills 2 Sweating 3 Headache 4 Body ache 5 Loss of appetite 6 Diarrhoea 7 Other 8 Specify _____ Don't know 98	**If Don't know skip to Q53**
Q52 a	How can you be sure that someone with these signs and symptoms has malaria and not another illness?	Blood test 1 Other 2 Specify _____ Don't know 8	
Q53	What signs and symptoms make you decide the illness is serious? **(Multiple choice)**	Unconscious 1 Convulsions 2 Fast breathing 3 Very hot 4 Yellow eye colour 5 Very pale skin 6 Not breastfeeding 7 Not eating 8 Frequent vomiting 9 Diarrhoea 10 Other 11 Specify _____ Don't know 98	
Q54	How do people get malaria? **(Multiple choice)**	Mosquito bite 1 Drinking dirty water 2 Not boiling water 3 Visiting forest 4 Staying in forest 5 Bathing in river 6 Bad air 7 Bad talking 8 Spirits 9 Bad food 10 Poor hygiene 11 Other 12 Specify _____ Don't know 98	

	Questions	Optional categories	Skip
Q55	How do people prevent malaria? (Note if they say mosquito net, ask if treated or not) **(Multiple choice)**	Mosquito net 1 Insecticide treated net 2 Mosquito coil 3 Repellent 4 Insecticide spray 5 Burn leaves 6 Wear covered clothing 7 Stay out of the forest 8 Boil water 9 Other 10 Specify _____ Don't know 98	
Q56	If you think someone in your household has malaria, where would you go to get a test to find out if it is malaria?	Facility code ☐☐ Other source _____ Don't know about test 97 Don't know 98	
Q57	If you think someone in your household has malaria, where would you go for advice or treatment?	Facility code Other source _____ Don't know 98	
Q58	Have you heard of Malarine? (Show package)	Yes 1 No 2 Not sure 8	**If No skip to Q63**
Q59	If yes, what illness does Malarine treat?	Fever 1 Malaria 2 Both fever & Malaria 3 Other 4 Specify _____ Don't know 8	**If not Malaria skip to Q63**
Q60	How many days should you take Malarine for if you have malaria?	Days ☐☐ Don't know 98	

	Questions	Optional categories		Skip
Q61	It is recommended to take Malarine for 3 days, what do you think happens if you take it for fewer days than this?	Nothing Patient gets sick again Patient does not get well Other Specify _____ Don't know	1 2 3 4 8	
Q62	What happens if you don't take all the tablets?	Nothing Patient gets sick again Patient does not get well Other Specify _____ Don't know	1 2 3 4 8	
Q63	Have you heard of A+M? (Show package)	Yes No Not sure	1 2 8	**If No skip to Q68**
Q64	If yes, what illness does A+M treat?	Fever Malaria Both fever & Malaria Other Specify _____ Don't know	1 2 3 4 8	**If not Malaria skip to Q68**
Q65	How many days should you take A+M for if you have malaria?	Days ☐☐ Don't know 98		
Q66	It is recommended to take A+M for 3 days, what do you think happens if you take it for fewer days than this?	Nothing Patient gets sick again Patient does not get well Other Specify _____ Don't know	1 2 3 4 8	
Q67	What happens if you don't take all the tablets?	Nothing Patient gets sick again Patient does not get well Other Specify _____ Don't know	1 2 3 4 8	

Section 5: Malaria diagnosis and treatment

	Questions	Optional categories		Skip
Q68	Has anyone in the household been ill with a fever in the last 2 weeks?	Yes 1 No 2		**If no go to Q89**
Q68a	If yes, How many people were ill with fever?	Number of people ⬚⬚		
		PERSON 1	PERSON 2	
If more than 2 people ill use separate sheets		**ASK FOR NAME AND AGE CHECK ON THE LIST OF HOUSEHOLD RECORD LINE NO (Q1)**		
Q69	Who was ill with a fever in the last 2 weeks?	Name _____ Line no. ⬚⬚	Name _____ Line no. ⬚⬚	
Q70	What type of fever did (NAME) have?	Krung janh 1 Krung gadow/kluan 2 Krung looa 3 Dengue fever (chhiem) 4 Night fever (yop) 5 Other 6 Specify _____ Don't know 9	Krung janh 1 Krung gadow/kluan 2 Krung looa 3 Dengue fever (chhiem) 4 Night fever (yop) 5 Other 6 Specify _____ Don't know 9	
Q71	Did (NAME) seek advice or treatment for the fever?	Yes 1 No 2 Not sure 8 **If No skip to Q76**	Yes 1 No 2 Not sure 8 **If No skip to Q76**	
Q72	Where did (NAME) first seek advice or treatment for the fever	Facility code ⬚⬚ Other source 97 Specify _____ Not sure 98	Facility code ⬚⬚ Other source 97 Specify _____ Not sure 98	
Q73	How did (name) get there?	Walk 1 Bicycle 2 Moto 3 Car 4 Ox/horse cart 5 Boat 6 Other 7 Specify _____	Walk 1 Bicycle 2 Moto 3 Car 4 Ox/horse cart 5 Boat 6 Other 7 Specify _____	

		PERSON 1	PERSON 2
Q74	How long did it take?	Time (mins) ☐☐☐ Not sure　　98	Time (mins) ☐☐☐ Not sure　　98
Q75	How long after first symptoms did (NAME) first seek advice (or treatment)?	Same day　　1 Day after　　2 Two days after　　3 Three or more days　　4 Don't know　　8 **Skip to Q77**	Same day　　1 Day after　　2 Two days after　　3 Three or more days　　4 Don't know　　8 **Skip to Q77**
Q76	Why did (name) not seek treatment outside the home?	Waited for fever to go　　1 No money for treatment　　2 No transport　　3 Did not know where to get drugs　　4 Did not feel ill enough　　5 Spiritual treatment　　6 Traditional medicine　　7 Other　　8 Specify _____ Don't know　　98	Waited for fever to go　　1 No money for treatment　　2 No transport　　3 Did not know where to get drugs　　4 Did not feel ill enough　　5 Spiritual treatment　　6 Traditional medicine　　7 Other　　8 Specify _____ Don't know　　98
Q77	Did (name) take drugs for the fever	Yes　　1 No　　2 Not sure　　8 If No skip to Q82	Yes　　1 No　　2 Not sure　　8 If No skip to Q82
Q78	Where did these drugs come from?	At home　　1 Health facility　　2 pharmacy　　3 shop/market　　4 somewhere else　　5 Not sure　　8	At home　　1 Health facility　　2 pharmacy　　3 shop/market　　4 somewhere else　　5 Not sure　　8
Q79	What drugs did (NAME) take and how much did they cost? **Use drug codes write name if necessary**	Code　　Name Drug 1 Price 1 Drug 2 Price 2 Drug 3 Price 3 Drug 4 Price 4 Drug 5 Price 5	Code　　Name Drug 1 Price 1 Drug 2 Price 2 Drug 3 Price 3 Drug 4 Price 4 Drug 5 Price 5

		PERSON 1	PERSON 2
Q80	How long after first symptoms did (NAME) first take drugs for the fever?	Same day 1 Day after 2 Two days after 3 Three or more days 4 Don't know 8	Same day 1 Day after 2 Two days after 3 Three or more days 4 Don't know 8
Q81	For how many days did (NAME) take these drugs?	Days ☐☐ Not sure 98	Days ☐☐ Not sure 98
Q82	Did (NAME) have a diagnostic test?	Yes 1 No 2 Not sure 8 **If no skip to Q88**	Yes 1 No 2 Not sure 8 **If no skip to Q88**
Q83	When did you have the test, before or after you took drugs?	Before taking drugs 1 After taking drugs 2 Not sure 8	Before taking drugs 1 After taking drugs 2 Not sure 8
Q84	What type of diagnostic test was it?	Blood slide 1 Rapid test 2 Not sure 8	Yes 1 No 2 Not sure 8
Q85	Where did you obtain the test?	Private health facility 1 Public health facility 2 Village malaria worker 3 Drug shop 4 Other 5 Specify_____ Don't know 8	Private health facility 1 Public health facility 2 Village malaria worker 3 Drug shop 4 Other 5 Specify_____ Don't know 8
Q86	If you paid for the test how much did it cost? IF NOT PAYMENT '00'	Cost of test _____Riels Don't know 8	Cost of test _____Riels Don't know 8
Q87	What was the result of the test?	Positive 1 Negative 2 Don't know 8	Positive 1 Negative 2 Don't know 8

		PERSON 1		PERSON 2	
Q87a	Did (name) seek treatment anywhere else?	Yes No **If YES, go to supplementary sheet** **If NO, go to 88**	1 2	Yes No **If YES, go to supplementary sheet** **If NO, go to 88**	1 2
Q88	Does (name) still have a fever	Yes No Not sure	1 2 8	Yes No Not sure	1 2 8

Section 6: Inpatient Hospital and Outpatient Care

	Questions	Optional categories		Skip
Q89	In the last year, has anyone in the household been an patient in hospital for at least one night?	Yes No	1 2	**If No skip to Q94**
Q89a	If yes, How many people?	Number of people		

		PERSON 1	PERSON 2
If more than 2 people ill use separate sheets		**ASK FOR NAME AND AGE CHECK ON THE LIST OF HOUSEHOLD RECORD LINE NO (Q1)**	
Q90	Who was a patient in hospital for at least one night in the last year?	Name _____ Line no.	Name _____ Line no.
Q91	What type of health care facility did (NAME) have an overnight stay?	Public hospital 1 Private hospital 2 Health Centre with bed 3 Other 4 Specify _____ Don't know 9	Public hospital 1 Private hospital 2 Health Centre with bed 3 Other 4 Specify _____ Don't know 9

		PERSON 1	PERSON 2
Q92	How much did it cost for (NAME) for the following services during their stay in hospital? **(If not sure record 888888 and not paid 00)**	Cost Medicines _____ Tests _____ Ambulance only _____ Other transport _____ Other _____ Specify _____	Cost Medicines _____ Tests _____ Ambulance only _____ Other transport _____ Other _____ Specify _____
Q93	During the hospital stay, how much was the overall cost for (NAME)?	Total cost _____ _ Not sure 98	Total cost _____ Not sure 98

		PERSON 1		PERSON 2	
Q94	Over the last 30 days how many times did each member of your household receive health care or consultation for malaria or fever?	Number of times _____ Not sure 98 **If 0 skip to section7**		Number of times _____ Not sure 98 **If 0 skip to section7**	
Q95	Over the last 30 days ,what was the last (most recent) health care facility visited for malaria or fever ?	Private doctor's office	1	Private doctor's office	1
		Private clinic or health care facility	2	Private clinic or health care facility	2
		Private hospital	3	Private hospital	3
		Public clinic or health care facility	4	Public clinic or health care facility	4
		Public hospital	5	Public hospital	5
		Home visit		Home visit	
		Other		Other	
		Specify _____		Specify _____	
		Don't know	9	Don't know	9
Q96	Over the last 30 days ,what was the last (most recent) health care provider visited for malaria or fever ? NOTE RESPONSES! Providers for malaria ??	MEDICAL DOCTOR (INCLUDING SURGEON, GYNECOLOGIST, PSYCHIATRIST, OPHTHALMOLOGIST,…)	1	MEDICAL DOCTOR (INCLUDING SURGEON, GYNECOLOGIST, PSYCHIATRIST, OPHTHALMOLOGIST,…)	1
		NURSE/MIDWIFE	2	NURSE/MIDWIFE	2
		DENTIST	3	DENTIST	3
		PHYSIOTHERAPIST OR CHIROPRACTOR	4	PHYSIOTHERAPIST OR CHIROPRACTOR	4
		TRADITIONAL MEDICINE PRACTITIONER (INYANGA, ISANGOMA)	5	TRADITIONAL MEDICINE PRACTITIONER (INYANGA, ISANGOMA)	5
		HOME HEALTH CARE WORKER	6	HOME HEALTH CARE WORKER	6
		FAITH HEALER	7	FAITH HEALER	7
		COMPLEMENTARY PRACTITIONER (HOMEOPATHIC)	8	COMPLEMENTARY PRACTITIONER (HOMEOPATHIC)	8
		Don't know	98	Don't know	98

		PERSON 1	PERSON 2
Q97	During the last 30 days how much did your household pay for the following services? **(If not sure record 888888 and not paid 00)**	Cost Health care provider fees _____ Medicines _____ Tests _____ Ambulance only _____ Other transport _____ Other _____ Specify _____	Cost Health care provider fees _____ Medicines _____ Tests _____ Ambulance only _____ Other transport _____ Other _____ Specify _____
Q98	During the last 30 days how much was spent overall for health for (NAME)?	Total cost _____ Not sure 98	Total cost _____ Not sure 98

Section 7: Pregnancy and Treatment Seeking

Q99	Can I ask again, is anyone in the house currently pregnant?	Yes 1 No 2 Don't know 8	**If No end interview**
Q99a	Is the pregnant woman response the below questions?	Yes 1 No 2	

Pregnant women only   [Use additional sheets if more than 1 pregnant woman]

Q100	How many months pregnant are you?	Months ⬜⬜	
Q101	Did you have malaria during this pregnancy?	Yes 1 No 2 Don't know 8	**If no skip to Q106**
Q102	How many times did you have malaria during this pregnancy?	Times ⬜⬜	
Q103	Have you used antimalarials during this pregnancy?	Yes 1 No 2 Don't know 8	**If no skip to Q105**
Q104	How many times did you use antimalarials during this pregnancy?	Times ⬜⬜	**Skip to Q106**
Q105	If no antimalarials when you had malaria why not?	Waited for fever to go 1 No money for treatment 2 No transport 3 Did not know where to get drugs 4 Did not feel ill enough 5 Spiritual treatment 6 Traditional medicine 7 Other 8 Specify _____ Don't know 98	
Q106	How many times have you attended antenatal care during this pregnancy?	Times ⬜⬜	

END INTERVIEW

Thank respondent for taking the time to be interviewed.

FACILITY CODES:

CODE	FACILITY NAME
	PUBLICSECTOR:
1	GOVT. HOSPITAL
2	GOVT. HEALTH CENTRE
3	GOVT. HEALTH POST
4	VILLAGE MALARIA WORKER
5	VILLAGE HEALTH VOLUNTEER
	PRIVATE MEDICAL SECTOR:
6	PRIVATE HOSPITAL/CLINIC
7	PRIVATE LABORATORY
8	PHARMACY
9	DRUG SHOP
10	PRIVATE DOCTOR
11	TRADITIONAL PRACTITIONER
12	HOME VISIT
98	DON'T KNOW

DRUG CODES

CODE	DRUG NAME	CODE	DRUG NAME
1	MALARINE (CHILD DOSE)	14	QUININE TAB
2	MALARINE (ADULT DOSE)	15	QUININE INJECTION
3	A+M2 (ARTESUNATE/MEFLOQUINE)	16	TETRACYCLINE/DOXYCYCLINE
4	A+M3	17	CHLOROQUINE
5	A+M4	18	PRIMAQUINE
6	ARTEKIN (AK)/ ARTEQUICK	19	COTEXIN
7	MEFLOQUINE ALONE	20	DRUG COCKTAIL FOR MALARIA
8	ARTESUNATE TABS ALONE	21	ASPIRIN
9	ARTESUNATE SUPPOSITORY (PLASMOTRIM)	22	PARACETAMOL
10	ARTESUNATE INJECTION	23	OTHER DRUG FOR MALARIA
11	ARTEMETHER TAB	24	NON MALARIA DRUG
12	ARTEMETHER INJECTION	98	DON'T KNOW
13	ARTEMISININ		