Integrated Child Health Project

Activity Report II

Insecticide Treatment Campaign

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American Red Cross

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I. Summary

The Cambodian Red Cross implemented a second insecticide treatment campaign on June 5 and 6, 2006. This activity resulted in the treatment of an additional 660 mosquito nets in five malaria vulnerable villages of Angkor Chum and Varin administrative districts of Siem Reap province. The total number of unduplicated, direct and indirect beneficiaries is 3,101. Approximately 1,518 people sleeping under these newly treated mosquito nets are protected from malaria. This second campaign is expected to avert two child deaths.[1]

The activity was carried out as part of the USAID-funded Siem Reap Integrated Child Health Project. The campaign was undertaken with strong collaboration and support from the National Malaria Center, the Siem Reap Provincial Health Department, the Angkor Chum Operational Health District, and Health Centers of Angkor Chum, and Svay Sor, as well as the American Red Cross. The first campaign was carried out on March 25-26 in 12 priority villages resulting in the treatment of 1,702 bed nets. A detailed account and analysis of the first campaign can be found in the *Insecticide Treatment Campaign Activity Report* (May, 2006).

Collectively, the campaigns achieved insecticide treatment of 2,362 bed nets, directly benefiting 5,433 villagers in 17 communities. The average cost per net treated is $1.06, or $0.46 per direct beneficiary. Collectively, the campaigns are expected to prevent seven child deaths. Summary results from both activities, as well as the total achievement, are shown in Table 1 below.

Table 1. Summary Results from Phase I and II Insecticide Treatment Campaigns

Description	Phase I	Phase II	Total / Average
1. Dates	March 25-26	June 4-5	-
2. Villages	12	5	17
3. Nets treated	1702	660	2362
4. Direct beneficiaries	3915	1518	5433
5. Cost per net	$0.69	$1.39	$1.06*
6. Cost per beneficiary	$0.30	$0.60	$0.46*
7. Child deaths averted	5	2	**7**
8. Cost per life saved	$233.59	$457.35	**$358.11***

*includes training costs in calculation

Insecticide treatment of bed nets supports the joint malaria control action plan developed by stakeholders following the recommendations of malaria formative research recently completed in the Angkor Chum and Varin administrative districts.[2] The activity and joint action plan are directly linked to the Integrated Child Health Project's malaria control strategy, intermediate results, strategic objectives, and goal.

[1] Beneficiary and deaths averted calculations are detailed in Section IV. Results, Beneficiaries

[2] Kolesar R. January, 2006 *Understanding Malaria Prevention and Control in Rural Cambodia: A formative research study*, Siem Reap, Cambodia

II. Background

Cambodia has the worst malaria mortality and morbidity rates in Southeast Asia and one of the highest rates of malaria drug resistance in the world.[3] According to the National Health Statistics Report 2003, malaria is the third most common cause of outpatient attendance, the fifth main health problem among inpatients, and the second most common cause of hospital mortality. The American Red Cross (AmCross), with funding from the United States Agency for International Development (USAID) Child Survival and Health Grants Program, is providing financial and technical support to the Cambodian Red Cross (CRC) to implement the Integrated Child Health (ICH) Project. The goal of the ICH Project is to reduce child morbidity and mortality in a sustainable fashion in Angkor Chum Operational Health District of Siem Reap province, Cambodia. Insecticide treatment of mosquito nets is linked to the Integrated Child Health (ICH) Project's malaria control strategy, and supports the achievement of the project's intermediate results, strategic objectives, and goal.[4]

In September 2005, a formative research study was undertaken to fine tune malaria control interventions in Angkor Chum and Varin administrative districts. The American Red Cross and Cambodian Red Cross worked in partnership with numerous stakeholders to carry out the study. The National Malaria Center, the Siem Reap Provincial Health Department, and the Angkor Chum Operational District with support from the Belgian Technical Cooperation (BTC), Reproductive and Child Health Alliance (RACHA), and Population Services International (PSI) were all involved in various aspects of the research.

The study findings and recommendations were reviewed during a one-day stakeholder workshop at the Angkor Chum Operational Health District office. That workshop resulted in the development of a malaria control joint action plan detailed in table 2 below.

Table 2. Planned Activities and Responsible Parties

Number	Activities	Responsible
1.	*Health education*	
1.1	Prevention, early identification, and referral training to field officers	ARC/CRC OD, RACHA
1.2	Prevention, early identification, and referral training to CRC volunteers	CRC, VMW
1.3	Prevention, early identification, and appropriate care-seeking (to shift demand to health centers, VMWs, and *malarine* sales agents) training to households	CRC volunteers
1.4	Engage community leaders in implementation	ARC/CRC
1.5	Media messaging (radio, advertisements)	PSI
1.6	Mobile Video Unit (MVU)	PSI
1.7	IEC materials development, provision of prototype	RACHA, CNM
1.8	Train VHSGs on diagnosis, primary care, and referral	further discussion

[3] http://www.cambodia.net/malaria/facts.html, retrieved January 17, 2006
[4] Kolesar R, Ricca J, Willard A, Edwards N, Ram S, June, 2005 *Siem Reap Integrated Child Health Project, Detailed Implementation Plan,* Phnom Penh, Cambodia

(table 2 continued)

Number	Activities	Responsible
2.	*Insecticide treatment*	
2.1	Provision of insecticide (ARC to write request letter)	CNM, PHD
2.2	Organization of treatment stations linked to HC outreach	OD, ARC/CRC
2.3	Community mobilization to bring mosquito nets for treatment	ARC/CRC
2.4	Develop insecticide-treated sling for children removed from under the net at night	PSI
2.5	Pre-test and pilot insecticide-treated sling in 10 villages to demonstrate impact; explore potential for scale-up following results of pilot	ARC/CRC
3.	*Mosquito nets*	
3.1	Procurement of nets	PHD/OD, ARC/CRC
3.2	Free/heavily subsidized distribution to pregnant women via HCs	OD
3.3	Criteria development for free/heavily subsidized distribution to high risk poorest of the poor in the community	OD, ARC/CRC
3.4	Free/heavily subsidized community distribution	VHSG, CRC volunteers
3.5	Social marketing of subsidized nets	ARC/CRC, PSI
3.6	Monitoring for correct use	all
4.	*Increase drug availability and access*	
4.1	Ensure drug supply in the HCs	PHD, OD
4.2	Increase *Malarine* distributors in the community	PSI
4.3	Follow-up monitoring	OD to coordinate
4.4	Reduce inappropriate drug supply from community vendors	government authorities

Following-up on the joint action plan, CRC volunteer groups in all 254 participating villages of Angkor Chum Operational Health district were trained in malaria transmission, prevention, and early identification and referral from January through March, 2006. In turn, each CRC volunteer completed approximately 20 home visits to motivate improved health practices among all caretakers in their respective communities. Interpersonal communication with each household was undertaken prior to the insecticide treatment campaign. As detailed in the joint action plan (above), activities 2.1, 2.2, and 2.3 relate to insecticide treatment of existing mosquito nets.[5]

[5] Due to staffing issues, the activity was not linked to health center outreach as originally planned.

III. Activities

Training
ICH project staff were initially trained on malaria control, including an overview of insecticide treatment, from December 26-27, 2005. A follow-up training, focusing on communication skills related to malaria control messaging, was conducted on February 3, 2006. A one-day training focusing exclusively on insecticide treatment was jointly planned and organized by the PHD malaria technical expert, the CRC ICH interim project manager, and the AmCross ICH technical training officer. The training was conducted on March 10, 2006 at the Angkor Chum Operational Health District office. The training was interactive with practice sessions to ensure participants mastered the skills needed to undertake insecticide treatment activities in the targeted villages. The training also included preliminary logistics planning for the campaign.

Planning & Logistics
The Provincial Health Department malaria expert prioritized five (5) malaria vulnerable villages in Angkor Chum and Varin districts. CRC ICH field officers visited each priority village. Working with village leaders and CRC volunteers in each of the target villages, a campaign schedule was developed; village leaders and CRC volunteers announced the treatment activity throughout their respective villages.

Additionally, a mosquito net census was conducted in the target villages from June 1-2. Nets were counted and classified according to condition (new/old) and size (small/medium/large). A total of 791 mosquito nets were counted. Annex 3 details the mosquito net census results by village. A summary table is shown below.

Table 3. Summary of mosquito net census and total nets treated by village

No.	Village	Commune	Families	Family member		Number of Children		Total Net Census	Total Nets Treated
				Total	Female	<2 years old	2-5 years old		
1	Teuk Thla	Srae Khvav	96	476	236	4	53	96	83
2	Rolum	Srae Khvav	191	951	497	56	300	186	128
3	Reach Chontol	Srae Khvav	131	755	410	36	97	60	75
4	Kab Dai	Prasath	171	959	472	48	60	320	268
5	Ou	Svay Sar	97	542	273	37	50	129	106
Totals			**686**	**3683**	**1888**	**181**	**560**	**791**	**660**

A final coordination meeting was conducted on the afternoon of June 4 at the ICH project office in Angkor Chum. Fifteen (15) staff from the Cambodian Red Cross (7), health centers (2), OD (1), and the American Red Cross (5) was divided into two field teams. Target villages were grouped by geographic proximity and assigned to the teams. The field team lists and assigned villages are detailed in Annex 4. Teams were deployed on the afternoon of June 4, and stayed overnight in the villages on June 4 and 5. This was done to facilitate work in the villages during early morning and late afternoon as many villagers were working all day in the field transplanting rice.

A central location in each target village, usually where health center outreach sessions occur, was used to set up the insecticide treatment station. Before beginning insecticide treatment in the village, each team reviewed appropriate mosquito net care and use with beneficiaries. Mosquito net washing following treatment was discouraged. Typically, each treatment station was running from 2 to 3 hours as many people came late. No villagers were turned away. The teams waited for approximately 20 minutes after the last treatment before packing up and moving on to the next site.

Insecticide Treatment

The National Malaria Center, through the Provincial Health Department and the Operational Health District, donated six (6) bottles of liquid ICON® 2.5 CS, synthetic parathyroid lambda-cyhalothrin insecticide (300 milliliters/bottle); and, 15 bottles of liquid K-Otrine®, deltamethrin insecticide (1 liter bottles), were procured with project funds from Caritas International in Siem Reap to use for the campaign.

IV. Results

Beneficiaries
The mosquito net census counted a total of 791 nets in the five (5) target villages. The total number of nets treated was 660, or 83 percent of the total number of nets counted during the census. Some villages reported lower than expected turn out on the campaign day due to villagers visiting or working outside of the village.

Assuming that 2.3 people sleep under one mosquito net[6], the treatment of 660 nets is expected to protect 1,518 people. The protective effect of insecticide treatment lasts for a minimum of six months following treatment. Therefore, the total people-years of protection achieved as a result of the campaign is 759 people protected for one year. Assuming (conservatively) that half of the people sleeping under these nets will be children under five years of age yields the equivalent of 380 children under the age of five protected for one-year. As 1,000 mosquito nets are expected to save 5.5 lives over a one-year period[7], protecting 380 children can be expected to save two lives. Additionally, malaria morbidity, and its associated economic burden, can be expected to significantly reduce in the target villages.

Villagers who came to the treatment station with mosquito nets (participating beneficiaries) were asked their names and number of nets they brought for treatment. Three-hundred and eighty (380) individuals brought mosquito nets for treatment, yielding the average number of mosquito nets brought for treatment per participating beneficiary to be 1.74. It is known that many participating beneficiaries also brought their neighbors' nets for treatment (e.g. non-participating beneficiary nets); however, the total number of households which had a net treated was not recorded during the campaign. It is recognized that many households have more than one mosquito net and some households have none.

According to the *Report of the Cambodia National Malaria Baseline 2004*, "sufficient" is defined as 2.3 people per mosquito net. "Within Southeast Asia, a commonly used index of coverage is the number of people divided by the number of nets (i.e. the people: net ratio). It is also a convention, within Cambodia, and we believe also regionally, to use 'less than 2.3 people per net' as the standard for this index, in order to define programmed targets and to estimate procurement needs."

However, interpretation of the net ratio should be made with caution. According to the same *Report of the Cambodia National Baseline Survey, 2004*, "setting a required standard of 1 net for every 2.3 people may be excessively demanding." "The survey data suggest that this is NOT an appropriate cut-off for "sufficient" in this setting, i.e. it is excessively rigorous." And, "that very high levels of net use occur [among children under 5] even with people: net ratios of >1.20." The report further states that, "The overall person: net ratio in the survey population was 2.6, and this was sufficient to give a usage rate in under-five children of almost 90%."

Table 4 below details coverage achievement by population and households.

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[6] The *Report of the Malaria National Baseline Survey 2004* defines 'sufficient' as one net for 2.3 people; therefore, 2.3 has been used to calculate the average number of people sleeping under one net.
[7] Lengeler C. Issue 2, 2004 *Insecticide treated bednets and curtains for preventing malaria*

Table 4. Coverage Achievement

No.	Village	Population Census	Target nets to achieve "sufficient"	Total Nets Treated	Percentage of Target reached	Treated Net Ratio	Households	Total Nets Treated	Ratio of nets treated to households
1	Teuk Thia	476	207	83	40.1	5.7	95	83	0.9
2	Rolum	951	413	128	31.0	7.4	190	128	0.7
3	R. Chontol	755	328	75	22.8	10.1	151	75	0.5
4	Kab Dai	959	417	268	64.3	3.6	192	268	1.4
5	Ou	542	236	106	45.0	5.1	108	106	1.0
Totals		**3683**	**1601**	**660**	**41.2**	**5.6**	**737**	**660**	**0.9**

In reference to Table 4 above, *target nets to achieve "sufficient" coverage* was calculated by dividing the village populations by 2.3. *Percentage of target reached* was calculated by dividing *target nets to achieve coverage* by *total nets treated*. The *treated net ratio* average is 5.6 with a range of 3.6 to 10.1.

Although household coverage data was not collected as part of the campaign (see above), the number of treated nets divided by the total number of households reveals the ratio of treated nets to households, averaging 0.9 with a range of 0.5 to 1.4. In other words for every household in the five villages there are 0.9 treated nets as a result of the campaign. Assuming one net per household, it can be estimated that 90 percent of all households are protected with an insecticide treated net.

Overall, this data suggests that the campaign achieved coverage rates in excess of the 60-70 percent needed to achieve the community-wide effect[8,9] in four of the villages. The community-wide effect is an overall reduction in malaria transmission for both net users and non-users, which has been proven to result from high levels of insecticide treated bed nets within a community. Thus, it is likely that all 2,928 villagers from these four villages will directly or indirectly benefit from the treatment activity as a result of the community-wide effect. Therefore, the total number of unduplicated, direct and indirect beneficiaries is 3,101. This is calculated by adding the total populations of the four villages achieving coverage rates in excess of 70 percent and the total direct beneficiaries for R. Chontol (total treated nets multiplied by 2.3 equals 173 direct beneficiaries).

Cost-Effectiveness

The total cost of training and both field activities is $2,506.80. This includes $424.15 in training costs, $1,167.95 in Phase I field costs, and $914.70 in Phase II field costs. Itemized costs are summarized in Table 5 below.

[8] Maxwell CA et al. (December 2002) *Effect of community-wide use of insecticide-treated nets for 3-4 years on malarial morbidity in Tanzania*, Journal of Tropical Medicine and International Health, Volume 7 No 12, pp. 1003-1008

[9] Hawley WA et al. (2003) *Community-wide effects of permethrin-treated bednets on child mortality and malaria morbidity in western Kenya*, American Journal of Tropical Medicine and Hygiene, 68 (Supp. 4), pp. 121-127

Table 5. Costs

No.	Description	Training	Phase I	Phase II	Total
1	Per diems/accommodation-MOH staff	209.5	209.00	96.00	305.00
2	Per diems/accommodation-ICH staff	80	96.50	118.00	214.50
3	Fuel (estimated)	10	91.00	60.00	151.00
4	Supplies	124.65	51.45	10.7	62.15
6	Insecticide		720.00	630.00	1350.00
	TOTAL	**424.15**	**1167.95**	**914.70**	**2506.80**

Table 6 below shows costs per net, direct beneficiary, and life saved by training, Phase I and Phase II activities. Cost per net was calculated using the total cost divided by total number of nets treated; cost per direct beneficiary was calculated by taking the total cost divided by total direct beneficiaries; cost per life saved was calculated by taking the total cost divided by the estimated number of lives saved.

The cost of Phase II field activities was double that of Phase I activities. This has two explanations. First, ICON insecticide yielded a per net cost $0.42 during phase I. Phase II used a combination of ICON and K-Otrine with a cost per net of $0.95 (not shown). Second, Phase I per diem payments averaged $25.46 per village; Phase II per diem payments averaged $42.80 per village (not shown). Although the team size (15 personnel) and campaign days (2) remained the same for both Phase I and Phase II, the number of villages targeted decreased from 12 villages in Phase I to five (5) villages in Phase II.

Table 6. Cost-Effectiveness

No.	Unit Costs in USD	Training	Phase I	Phase II	Total
1	Per net	0.18	0.69	1.39	1.06
2	Per direct beneficiary	0.08	0.30	0.60	0.46
3	Per life saved	60.59	233.59	457.35	358.11

Combining costs for both activities reveals an average cost per net treated to be $1.06, or $0.46 per direct beneficiary. By comparison, long-lasting insecticide treated bed nets cost less than $5.00 per net, and have an expected repellent life of 4-5 years. The cost of maintaining one bed net with insecticide treatment over a four-year time period (using a campaign strategy) would cost an equivalent of $8.48. This figure excludes the cost of the bed net. Therefore, it is more cost effective to provide new long-lasting insecticide treated bed nets than continue retreatment campaigns.

The average cost per life saved as a result of both campaigns is $358.11.

Annex 1. Mosquito net census and campaign treatment result by village

Village	Nº of families in village	Family members		Families have nets	Number of Nets Census								Total nets Census	Nets Treated Campaign Results
					New nets				Old nets					
		Total	Female		Small	Medium	Large	Total	Small	Medium	Large	Total		
Teuk Thla	96	476	236	67	0	0	1	1	15	5	75	95	96	83
Rolum	191	951	497	144	3	1	4	8	36	14	128	178	186	128
R. Chontol	131	755	410	52	0	0	0	0	4	5	51	60	60	75
Kab Dai	171	959	472	156	2	39	7	48	27	208	37	272	320	268
Ou	97	542	273	80	17	23	5	45	13	50	21	84	129	106
Total	**686**	**3683**	**1888**	**499**	22	63	17	**102**	95	282	312	**689**	**791**	**660**

Annex 2. Field teams lists

Group I

Nº	Name	Organization	Location from	Target Village	Commune
1	Suong Sar	CRC, FO	Varin		
2	Phoeun Chhy	CRC, FO	Angkor Chum		
3	Roth Romnea	CRC, APM	Angkor Chum		
4	PHD	Absent	Siem Reap		
5	Pen Monorum	ARC,TOT	Angkor Chum	1-Rolum	Srae Khvav
6	Chhun Sona	ARC, M&E	Angkor Chum	2-Teuk Thla	Srae Khvav
7	Phon Navuth	ARC, Driver	Phnom Penh	3-Reach Chantol	Srae Khvav
8	Kao Mok (HC Svay Sar	HC Staff	Svay Sar		
9	Village Leader	Community	Rolum		
10	Village Leader	Community	Teuk Thla		
11	Village Leader	Community	Reach Chantol		
12	Volunteer Leader	Community	Rolum		
13	Volunteer Leader	Community	Teuk Thla		
13	Volunteer Leader	Community	Reach Chantol		

Group II

Nº	Name	Organization	Location from	Target Village	Commune
1	Uon Eath	CRC, FO	Varin		
2	Ean Kang	CRC, FO	Varin		
3	Eung Phaly	CRC, FO	Angkor Chum		
4	Sor Sara	ARC, PC	Angkor Chum		
5	Kroch Samoeun	OD Staff	Puok	1-Kap Dai	Prasath
6	Nop Chansery	CRC, A/F	Angkor Chum	2-Ou	Svay Sar
7	Hel Kim Morn	ARC, Driver	Angkor Chum	3-Reach Chantol	Srae Khvav
8	Nop Vanny	HC Staff	Angkor Chum		
9	Village Leader	Community	Kap Dai		
11	Village Leader	Community	Ou		
12	Volunteer Leader	Community	Kap Dai		
13	Volunteer Leader	Community	Ou		

Annex 3. Insecticide treatment campaign result by village

Insecticide treatment campaign result on June 5-6, 2006

Nº	Village	Commune	Family nets treated	Pregnant nets treated	Nets treated by villages						Total nets treated
					New nets			Old nets			
					Small	Medium	Big	Small	Medium	Big	
1	Teuk Thla	Srae Khvav	53	3	21	1	56	2	0	3	83
2	Rolum	Srae Khvav	96	12	47	1	80	0	0	0	128
3	R.Chontol	Srae Khvav	48	1	21	0	51	1	0	2	75
4	Kab Dai	Prasat	123	9	59	82	83	17	10	17	268
5	Ou	Svay Sar	60	1	30	26	39	0	5	6	106
	Total:		**380**	**26**	**178**	**110**	**309**	**20**	**15**	**28**	**660**