SOCIAL MARKETING RESEARCH SERIES

Kenya (2007): Malaria TRaC Study Evaluating Bed Net Ownership and Use among Pregnant Women and Children under 5 (years)

Third Round

The PSI Dashboard

Nairobi, Kenya
March, 2008

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Suggested citation of this work

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Summary

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Background & Research Objectives In 2001 a malaria survey was incorporated in the national Knowledge and Attitude study in Kenya to provide baseline estimates on bed net ownership, net use, and knowledge of malaria symptoms to inform a PSI malaria program proposed to start in Kenya in 2002. Every two years, the malaria program indicators have been monitored and feedback provided to the donor community and government of Kenya, Ministry of Health. In 2007, a fourth round of survey was carried out using TRaC methodology to monitor trends of old and gather baselines of new indicators. All surveys were designed to inform programming, not only for PSI-Kenya but for the Government of Kenya and all interested implementing partners.

Description of Intervention Since 2002 PSI has been working to make Insecticide Treated Nets (ITNs) more accessible and affordable to those most in need. The intervention has combined an intensive educational campaign with a distribution strategy that has made bed nets available at different subsidy levels to specific target groups. Branded and generic educational campaigns were implemented to increase awareness about malaria transmission, sensitize communities about malaria high risk groups, and increase awareness on malaria prevention using ITNs. Though the program coverage is national, special emphasis has been placed on high malaria transmission Provinces including Coast, Western and Nyanza, and pandemic zones of North and South Rift Valley Province.

Methodology: This evaluation was based on three household-cross sectional survey rounds conducted in all provinces of Kenya except North Eastern. A multi-stage cluster sampling study design was used in all survey rounds. The first round was carried out in 2003 using the KAP survey methods. The second and third rounds were carried out in 2005 and 2007 following the TRaC methods. In all survey waves, respondents were recruited at the household level.

Households and households with malaria vulnerable groups (pregnant women and children less than 5 years of age) were the two main units of analysis. Multiple classification analysis generated estimates for the indicators across the three survey waves and are reported as adjusted proportions/means and presented in standard PSI Dashboard form.

Main Findings: Net ownership in malaria endemic areas increased significantly in the past five years from 33.7% in 2003 to 80.7% in 2007. The increase in net use was less dramatic among children under five years of age (28.8% to 61.2%) and especially among pregnant women (30.9% to 35.8%). Measurements of net ownership and net use are significantly higher in the urban areas of the malaria endemic regions.

Programmatic Recommendations The results indicate positive trends in net ownership and use and provide evidence of the effectiveness of mosquito net social marketing programs in promoting a 'net culture' in Kenya. Importantly, the results identify three actionable determinants of net ownership and use among those of lower SES and in rural, endemic areas of the country. These are: 1) perceptions of supportive social norms around net ownership, 2) knowledge of malaria transmission, and 3) knowledge of means of preventing malaria. Thus, interventions would be optimally effective if targeted to households of lower social economic categories in the rural areas. While these findings are important for a program that seeks to promote net ownership, the survey was not designed to optimally measure net use. Additional research would therefore be required to investigate possible predictors of net use, especially among vulnerable groups. Future malaria interventions should seek to influence the ultimate behavior (sleep under a treated net) while maintaining if not increasing the levels of the intermediate determinants: Opportunity, Ability, and Motivation. The data show that the malaria program has an opportunity to scale up the mean number of nets per household as well as to promote consistent net use among vulnerable groups.

Monitoring Table 1: Trends in behavior and behavioral determinants of mosquito net ownership in malaria endemic regions in Kenya, 2003, 2005, 2007
Risk: Any household in malaria endemic regions
Behavior: Net ownership

INDICATORS	Year 2003N=1030 2005N=1119 2007N=1403	Total	Sig.	Rural 2003N=759 2005N=824 2007N=1120	Sig	Urban 2003N=271 2005N=294 2007N=283	Sig
BEHAVIOR/USE		%		%			
- Ownership of at least one bed net							
	2003	33.7[a]	***	25.7[a]	***	60.5[a]	***
	2005	58.1[b]		51.4[b]		78.7[b]	
	2007	80.7[c]		78.4[c]		83.8[c]	
-Ownership of an ITN (among hh with nets)							
	2003	14.0[a] (371)	***	37.2[a] (210)	***	50.6[a] (161)	***
	2005	21.6[b] (657)		59.1[b] (424)		60.5[b] (231)	
	2007	63.3[c] (1101)		78.9[c] (863)		80.3[c] (238)	
-Ownership of at least two ITNs							
	2003	-	-	-	-	-	-
	2005	-		-		-	
	2007	35.8		35.1		37.8	
OPPORTUNITY		Mean		Mean		Mean	
Product Attributes for Nets							
	2005	3.34	ns	3.34	ns	3.38	ns
	2007	3.36		3.41		3.42	
Availability							
	2005	3.01	***	2.89	***	3.39	***
	2007	2.35		2.25		2.67	
Social Norms							
	2005	3.21	***	3.18	***	3.36	***
	2007	3.14		3.13		3.15	
ABILITY		%		%		%	
Knowledge Index							
-Modes of transmission	2005	90.2	ns	89.5	ns	97.8	Ns
	2007	91.3		87.9		97.9	
-Methods of prevention	2005	86.7	ns	85.7	ns	90.6	*
	2007	85.7		84.2		95.3	
MOTIVATION		Mean		Mean		Mean	
Threat							
-Perceived severity of Malaria	2005	3.73	ns	3.76	ns	3.62	Ns
	2007	3.72		3.74		3.66	
EXPOSURE(# of channels exposed)		%		%		%	
-No Exposure	2005	33.0	***	36.7	**	21.3	***
	2007	41.9		43.5		36.9	
- Medium (seen or heard 1-4)	2005	36.0	ns	37.4	***	33.2	ns
	2007	32.7		32.8		31.0	
- High (seen or heard 5 or more)	2005	31.0	***	25.9	ns	45.5	***
	2007	25.3		23.6		31.9	

-Percentages and means are adjusted for demographic characteristics
*- ns: not significant; *: p<.05; **: p<.01; ***: p<.001.*
-Scale values range from 1 to 4 with 1=strongly disagree and 4=strongly agree
-Percentages/means with the same letter in their superscripts do not differ significantly from one another, and percentages/means with different letter in their superscripts differ significantly from one another

Monitoring Table 1b: Trends in behavior and behavioral determinants of mosquito net ownership in Kenya, 2003, 2005, 2007
Risk: Any household
Behavior: Net ownership

INDICATORS	Year 2003N=2919 2005N=3191 2007N=4063	Total	Sig.	Rural 2003N=2143 2005N=2264 2007N=3015	Sig	Urban 2003N=777 2005N=928 2007N=1049	Sig
BEHAVIOR/USE		%		%			
- Ownership of at least one bed net							
	2003 2005 2007	30.4[a] 43.2[b] 65.1[c]	***	21.5[a] 35.9[b] 62.2[c]	***	54.7[a] 62.2[b] 72.4[c]	***
-Ownership of an ITN (among hh with nets)							
	2003 2005 2007	36.8[a] (885) 53.3[b] (1406) 76.8[c] (2617)	***	33.3[a] (462) 52.3[b] (829) 78.1[c] (1860)	***	40.7[a] (423) 54.5[b] (578) 73.6[c] (758)	***
-Ownership of at least two ITNs							
	2003 2005 2007	- - 26.8	-	- - 27.1	-	- - 24.5	-
OPPORTUNITY		Mean		Mean		Mean	
Product Attributes for Nets							
	2005 2007	3.38 3.38	ns	3.40 3.37	ns	3.38 3.42	ns
Availability							
	2005 2007	2.78 2.27	***	2.58 2.08	***	3.28 2.77	***
Social Norms							
	2005 2007	3.00 3.03	*	2.90 3.01	***	3.23 3.08	***
ABILITY		%		%		%	
Knowledge Index							
-Modes of transmission	2005 2007	90.4 91.6	ns	88.0 88.6	ns	96.4 96.3	ns
-Methods of prevention	2005 2007	81.4 86.2	***	77.6 83.5	***	91.1 93.4	*
MOTIVATION		Mean		Mean		Mean	
Threat							
-Perceived severity of Malaria	2005 2007	3.61 3.58	*	3.62 3.61	ns	3.59 3.51	*
EXPOSURE(# of channels exposed)		%		%		%	
-No Exposure	2005 2007	33.1 33.2	ns	36.6 36.4	ns	23.9 24.8	ns
- Medium (seen or heard 1-4)	2005 2007	35.6 33.3	*	36.7 35.8	ns	32.7 26.1	*
- High (seen or heard 5 or more)	2005 2007	31.3 33.2	ns	26.7 27.6	ns	43.3 48.6	*

Monitoring Analysis: Monitoring Dashboard Showing Trends in Net Ownership among Households in Malaria Endemic Areas of Kenya, 2003, 2005, 2007

This "monitoring dashboard" uses analysis of variance to test if ownership of mosquito nets in households in malaria endemic areas of Kenya has changed between three survey rounds, while controlling for socio-demographic factors. The table includes indicators that were measured across all three survey rounds, as well as those that were added in 2005 and 2007 due to findings from previous TRaC studies and the introduction of scaled constructs of opportunity, ability, and motivation. While data was collected at the national level (across all seven regions of Kenya) this analysis focuses on the three malaria endemic regions: Coast, Western and Nyanza. For programmatic purposes, the data are disaggregated by residence (urban or rural) within the malaria endemic regions.

Behavior: Net ownership in malaria endemic areas

Across all malaria endemic areas net ownership increased dramatically from 2003 to 2007 (33.7% to 80.7%), with the most notable increase in the rural areas, where net ownership increased from 25.7% to 78.4%. Importantly, ownership of treated nets increased from 14% to 63.3% in the malaria endemic areas; with similar increases within rural and urban areas (8.8% to 61.6 and 31.5 to 66.7%, respectively). Approximately 36% of households in malaria endemic areas own at least two treated nets as of the 2007 TRaC survey.

Increases in net coverage are attributed partly to the PSI intervention which distributes free long lasting nets through public health facilities, targeting mainly women seeking maternal and child health services and partly to the recent Global Fund initiative that distributed more than 3.4 million long lasting nets in 2006 and 2007.

Determinants of net use

In 2005, PSI introduced multiple item scales to measure constructs of the determinants of behavior: ability, opportunity, and motivation. Multi item scales consist of a number of statements that allow for measurement of complex concepts or constructs that are not easily measured through a single question, such as social support for condom use, or attitudes around ITN use for pregnant women.

Opportunity

In both 2005 and 2007 survey rounds, multi-item scales were utilized to measure attitudes, perceptions, and intentions, with each individual item in the scale comprised of a four point Likert scale: 1) 'strongly disagree', 2) 'disagree' 3) 'agree', and 4) 'strongly agree'. Determinants that were significant in predicting net ownership in 2005 survey round were retained in the 2007 survey round.

Perceived net availability showed a significant decrease between the two survey rounds, from a mean score of 3.01 in 2005 to a means score of 2.35 in 2007 across all malaria endemic areas. One possible explanation for such a decrease lies in the scale used to measure availability. Two questions describe net sales at nearby outlets. As stated previously, PSI and GFATM both started distribution of free nets in 2006 and 2007 which contributed to reduced sales at private sector outlets. Undoubtedly there are additional potential explanations for this finding and the MCH/Malaria programme at PSI-Kenya will continue to explore and address any that arise.

Like the net availability scale, the scale for social norms demonstrated a significant decrease between 2005 and 2007 across all malaria endemic areas. The scale measuring social norms contained two items that were no longer applicable in the context of a market saturated with free nets: 1) "Most people around here would try hard to buy nets for their families", and 2) "No one here thinks about buying nets for their family". These questions would reverse direction in the Likert scale, thereby reducing the score of the scaled construct as a whole.

Ability

Knowledge of the means of malaria transmission and prevention was measured using a single item variable in both 2005 and 2007. Among households in malaria endemic areas, knowledge of malaria transmission through mosquito bites, albeit insignificant, rose from 90.2% in 2005 to 91.3% in 2007. The same insignificant change was noted in both urban and rural areas. Knowledge of the means of malaria prevention (sleeping under a net and/or sleeping under a treated net) did not change significantly over time, except for in urban malaria endemic areas, where it rose from 90.6% to 95.3% across the two survey rounds. Perceived severity of malaria, likewise, did not change significantly over time. The data provides evidence that in malaria endemic areas, knowledge of malaria transmission and prevention are more important drivers of net ownership than is perceived severity of malaria as an illness.

Measurement of exposure to malaria prevention messaging was not limited to only the PSI sponsored campaign. Respondents were asked if in the last six months prior to the survey, they had seen or heard any malaria messages and the channels through which they got the messages, not the message itself or the producer of the message. Exposure levels were computed by a count of the number of channels through which messages were received. Three levels of exposure were generated: 'none' representing the segment of respondents who reported that they had never seen or heard of any malaria messages in the past six months or have seen/heard the message, but could not recall the channel (s); 'medium exposure' representing those who saw or heard the messages in between one and four channels; and 'high exposure' representing those respondents who had seen or heard the messages in five or more channels. Between 2005 and 2007 in Kenya, malaria messages were delivered through national television and radio channels, newsprints, posters, billboards, public health and community health workers, mobile cinemas, theater shows such as drama and poetry, and market promotions. Across all malaria endemic areas, in both urban and rural residences, exposure to malaria messages decreased between the two survey rounds. While PSI maintained the same volume of messaging from 2005 to 2007, the survey did not account for the source of the messaging, therefore, it is possible that the overall volume of messaging decreased among other partners.

Monitoring Analysis 1b: Monitoring Dashboard Showing Trends in Net Ownership in Households in Kenya, 2003-2007

This monitoring dashboard uses analysis of variance to test if ownership of mosquito nets in households in Kenya has changed between three survey rounds, while controlling for socio-demographic factors. The table includes indicators that were measured across all three survey rounds, as well as those that were added in 2005 and 2007 due to findings from previous TRaC studies and the introduction of scaled contructs of opportunity, ability, and motivation. Data was collected in all regions of Kenya, and includes information from malaria endemic regions as well as those where malaria is not endemic. Data is stratified by residence (rural and urban) in all districts.

Behavior: Net Ownership

Across all regions of Kenya, net ownership increased dramatically between 2003 and 2007, increasing from 30.4% to 65.1%. In rural areas throughout Kenya, net ownership increased from 21.5% to 62.2%, whereas it increased from 54.7% to 72.4% in urban areas. Among households with nets, ownership of insecticide treated nets increased significantly from 36.8% to 76.8% nationwide. This increase was signficiant in both rural and urban regions. Ownership of two ITNs was measured during the 2007 TRaC survey, which indicated that 26.8% of households in Kenya own two or more ITNs.

These increases in net ownership throughout Kenya are attributed in part to PSI activities which distribute free long lasting nets through public health facilities, targeting primarily women seeking maternal and child health services, and in part to a recent Global Fund initiative which distributed more than 3.4 million long lasting treated nets in 2006 and 2007.

Determinants of Net Use

In 2005, PSI introduced multiple items scales to measure constructs of the determinants of behavior: ability, opportunity and motivation. Multi-item scales consist of a number of statements that allow for measurement of complex constructs or concepts that are not easily ascertained through a single question.

Opportunity

In both 2005 and 2007 survey rounds, multi-item scales were used to measure attitudes, perceptions, and intentions, with each individual item in the scale comprised of a four point Likert scale: 1) 'strongly disagree', 2) 'disagree', 3) 'agree', 4) 'strongly agree'. Determinants that were significant in predicting net ownership were retained in the 2007 survey round.

Similar to malaria endemic regions, regions throughout Kenya exhibited a significant decrease between 2005 and 2007 survey rounds in perceived net availability. As previously mentioned, this may be in part due to the questions that were used to ascertain perceived net availability, which asked about the availability of nets at private outlets. As both PSI and GFATM distributed nets for free in 2006 and 2007, this may have lead to reduced private sales at outlets.

Also similar to malaria endemic regions, when used nationwide the scale for social norms demonstrated a significant decrease between 2005 and 2007. The scale measuring social norms contained two items that were no longer applicable in the context of a market saturated with free nets, and which would reverse the direction of the Likert scale, thereby reducing the score of the scaled construct as a whole.

Ability

Knowledge of the means of malaria transmission and prevention were measured using a single item variable in 2005 and 2007. Although it rose slightly, there was no significant change nationwide between 2005 and 2007 in knowledge pertaining to modes of malaria transmission. However, there was a significant increase in knowledge pertaining to methods of prevention of malaria transmission (sleeping under a mosquito net), particularly in rural regions. Nationwide, knowledge of the methods of malaria prevention increased from 81.4% to 86.2%.

Exposure

Measurement of exposure to malaria prevention messages was not limited to PSI sponsored campaigns. Respondents were asked if in the last six months prior to the survey, they had seen or heard any malaria messages and the messages through which they received the messages. Three exposure levels were created: 'none' representing the segment of respondents who reported that

they had never seen or heard of any malaria messages in the past six months or could not recall the channel through which they had heard any messages; 'medium exposure' represented informants who had seen or heard the messages between one and four channels, and 'high exposure' represented those who had heard messages through five or more channels. Between 2005 and 2007, malaria messages were delivered through national television and radio channels, newsprint, posters, billboards, public health and community health workers, mobile cinemas, theatre shows and market promotions. Throughout Kenya, the only significant change among rural and urban groups combined was among the medium exposure group, which decreased from 35.6% to 33.3%. However, there was a slight but insignificant increase in the high exposure group, which increased from 31.3% to 33.2% nationwide. The increase in high exposure was significant among urban informants, which increased from 43.3% to 48.6%. Although PSI maintained the same volume of messaging between 2005 and 2007, the survey did not account for the source of the messaging, therefore it is possible that the overall volume of messaging decreased among other sources.

Monitoring Table 2: Trends in behavior and behavioural determinants (opportunity, ability and motivation) of mosquito net ownership in malaria endemic regions in Kenya, 2003, 2005, 2007
Risk: Households in malaria endemic regions with at least one vulnerable member (pregnant woman or child under 5 years of age)
Behavior: Net use

INDICATORS	Year	Total (N)	Sig.	Rural (N)	Sig	Urban (N)	Sig
BEHAVIOR/USE		%		%			
- Children under 5 years of age slept under a net last night							
	2003	28.8[a] (822)	***	22.4[a] (645)	***	52.0[a] (177)	***
	2005	47.5[b] (826)		40.6[b] (664)		75.4[b] (162)	
	2007	61.2[c] (1123)		57.3[c] (946)		82.5[c] (177)	
-Children under 5 years of age slept under and ITN last night							
	2007	42.7 (1123)	-	41.2 (946)	-	50.3 (177)	-
-Pregnant women slept under a net last night							
	2003	30.9[a] (72)	*	29.3[a] (56)	*	36.3[a] (16)	-
	2005	49.6[b] (71)		28.8[a] (48)		92.8[b] (23)	
	2007	35.8[c] (177)		52.0[b] (130)		58.9[c] (47)	
-Pregnant women slept under an ITN last night							
	2007	44.6 (177)	-	34.6 (130)	-	70.2 (47)	-
OPPORTUNITY		Mean		Mean		Mean	
Availability							
	2005	3.04	***	2.94	***	3.38	***
	2007	2.29		2.26		2.54	
Product attributes							
	2005	3.35	ns	3.35	ns	3.33	ns
	2007	3.34		3.39		3.38	
Social Norms							
	2005	3.23	**	3.19	ns	3.37	***
	2007	3.16		3.17		3.14	
ABILITY		Mean		Mean		Mean	
Knowledge Index							
-Modes of transmission	2005	93.8	ns	92.6	*	98.8	ns
	2007	90.9		89.0		98.3	
-Methods of prevention	2005	90.8	ns	89.6	ns	95.9	ns
	2007	89.6		87.2		98.9	
MOTIVATION		Mean		Mean		Mean	
Threat							
-Perceived severity of Malaria	2005	3.76	ns	3.77	ns	3.70	ns
	2007	3.76		3.78		3.67	
EXPOSURE(# of channels exposed)		%		%		%	
-No Exposure	2005	29.7	***	33.9	**	14.1	***
	2007	41.7		43.3		35.8	
- Medium (seen or heard 1-4)	2005	33.4	ns	34.2	ns	32.5	ns
	2007	32.3		31.2		35.7	
- High (seen or heard 5 or more)	2005	37.0	***	31.9	*	53.5	***
	2007	26.0		25.5		28.1	

-NB: The OAM table is run at the household level, i.e., what are the determinants of a net use by

vulnerable groups within the larger household.

-Percentages and means are adjusted for demographic characteristics

*- ns: not significant; *: p<.05; **: p<.01; ***: p<.001.*

-Scale values range from 1 to 4 with 1=strongly disagree and 4=strongly agree

- Percentages/means with the same letter in their superscripts do not differ significantly from one another, and percentages/means with different letter in their superscripts differ significantly from one another according to a Least Significant Distance (LSD) test with a .05 limit on family wise error rate.

Monitoring Table 2a: Trends in behavior and behavioral determinants (opportunity, ability and motivation) of mosquito net ownership in Kenya, 2003, 2005, 2007
Risk: Households with at least one vulnerable member (pregnant woman or child under 5 years of age)
Behavior: Net use

INDICATORS	Year	Total (N)	Sig.	Rural (N)	Sig	Urban (N)	Sig
BEHAVIOR/USE		%		%			
- Children under 5 years of age slept under a net last night							
	2003	23.8[a] (2147)	***	16.9[a] (1701)	***	50.0[a] (446)	***
	2005	34.8[b] (2143)		29.0[b] (1633)		53.1[a] (510)	
	2007	55.8[c] (2826)		51.8[c] (2236)		71.0[b] (590)	
-Children under 5 years of age slept under and ITN last night							
	2007	40.3 (2826)	-	38.6 (2236)	-	46.8 (590)	-
-Pregnant women slept under a net last night							
	2003	24.9[a] (201)	**	17.0[a] (155)	**	51.8[a] (46)	-
	2005	37.4[b] (190)		26.1[b] (132)		62.5[b] (58)	
	2007	48.3[c] (323)		44.4[c] (224)		57.3[b] (99)	
-Pregnant women slept under an ITN last night							
	2007	38.4 (323)	-	32.1 (224)	-	52.5 (99)	-
OPPORTUNITY		Mean		Mean		Mean	
Availability							
	2005	2.78	***	2.58	***	3.28	***
	2007	2.27		2.08		2.77	
Product attributes							
	2005	3.38	ns	3.40	ns	3.38	ns
	2007	3.38		3.37		3.42	
Social Norms							
	2005	3.00	*	2.90	***	3.23	***
	2007	3.03		3.01		3.08	
ABILITY		%		%		%	
Knowledge Index							
-Modes of transmission	2005	90.4	ns	88.0	ns	96.4	ns
	2007	91.6		88.6		96.3	
-Methods of prevention	2005	81.4	***	77.6	***	91.1	*
	2007	86.2		83.5		93.4	
MOTIVATION		Mean		Mean		Mean	
Threat							
-Perceived severity of Malaria	2005	3.61	*	3.62	ns	3.59	*
	2007	3.58		3.61		3.51	
EXPOSURE(# of channels exposed)		%		%		%	
-No Exposure	2005	33.1	ns	36.6	ns	23.9	ns
	2007	33.2		36.4		24.8	
- Medium (seen or heard 1-4)	2005	35.6	*	36.7	ns	32.7	*
	2007	33.3		35.8		26.1	
- High (seen or heard 5 or more)	2005	31.3	ns	26.7	ns	43.3	*
	2007	33.2		27.6		48.6	

-NB: The OAM table is run at the household level, i.e., what are the determinants of a net use by vulnerable groups within the larger household.

-Percentages and means are adjusted for demographic characteristics

*- ns: not significant; *: p<.05; **: p<.01; ***: p<.001.*

-Scale values range from 1 to 4 with 1=strongly disagree and 4=strongly agree

- Percentages/means with the same letter in their superscripts do not differ significantly from one another, and percentages/means with different letter in their superscripts differ significantly from one another according to a Least Significant Distance (LSD) test with a .05 limit on family wise error rate.

Monitoring Analysis 2: Monitoring Dashboard Showing Trends in Net Use in Households in Kenya, 2003-2007

Behavior: Net use among children under five years of age and pregnant women in households in malaria endemic areas

In addition to net ownership, the malaria program also implemented initiatives that promoted consistent use of bed nets among vulnerable groups, specifically, pregnant women and children under the age of five.

Of all households with a child under 5 years of age in residence, the proportions that reported net usage by that child the night prior to the survey increased significantly from 28.8% in 2003 to 61.2% in 2007. The same important significant trend was evident in both the rural and urban sectors of the malaria endemic zones, 22.4% to 57.3% and 52.0% to 82.5%, respectively. Among households with pregnant women in residence, a significantly greater percentage reported that the pregnant woman slept under a net in 2007 (35.8%) than in 2003 (30.9%). Households in rural areas reported a significant increase in net usage by pregnant women between 2003 and 2007 (29.3% vs. 52.0%). The same trend is visible in urban areas (36.3% in 2003 vs. 58.9% in 2007).

In 2007, the indicators for ITN use by children under five and pregnant women were added to the TRaC survey. The survey data provide estimates of over 40% (42.7%) of children under 5 in the malaria endemic zones in Kenya slept under an ITN the night before the survey. In rural endemic areas, 41.2% of respondents reported that a child under five in the household slept under an ITN the night before the survey and in urban areas a full 50% reported the same. These estimates demonstrate that there is still much work to be done around promoting net, specifically ITN use by children under five in households in malaria endemic areas.

The new indicator "% of pregnant women that slept under an ITN the night before the survey" was added in 2007 and showed that the proportion of households reporting usage of ITN by pregnant women was 44.6% across all malaria endemic regions, 34.6% in rural areas and 70.2% in urban areas. The data support increased efforts in the rural areas of malaria endemic areas.

Determinants of net use

It is important to note that data related to determinants of net use among pregnant women and children under five years of age is analyzed at the household level. Additionally, the scales

utilized in this analysis were originally developed for measuring proximal determinants of net ownership, however can and should be considered as distal determinants of net use. Therefore, the same determinants are measured here for net use.

Opportunity

Net availability data in Monitoring Table 2 is consistent with Monitoring Table 1, demonstrating a significant decrease over time in households in malaria endemic areas with at least one member of a vulnerable group. Again, the decrease could be partly attributed to the large-scale distribution of free nets by the GFATM during 2006 and 2007, as well as PSI's free net programme. Due to the distribution of a high volume of free nets, questions relating to purchasing and sales of nets became obsolete. Questions that describe the next generation of concepts relevant to ITN use will be included in further studies. (See Reliability Analysis-Appendix 2 for new scale on Response efficacy for treated nets).

Perceptions of product attributes however, did not change significantly over time in either rural or urban malaria endemic areas.

Ability

Knowledge of transmission or prevention of malaria remained high at nearly or above 90% across both years in rural and urban areas. The only significant change was in the rural areas in malaria transmission and will be addressed programmatically through maintenance of messaging on transmission and prevention.

Motivation

The data show that perceived severity of malaria has not changed significantly over time and remains high at a mean score above 3.7 on the four point Likert scale.

Exposure

Exposure variables were calculated in the same way for Monitoring Table 2 as in Table 1. Exposure levels were computed by a count of the number of channels through which messages

were received. Three levels of exposure were generated: 'none' representing the segment of respondents who reported that they had never seen or heard of any malaria messages in the past six months or have seen/heard the message, but could not recall the channel (s); 'medium exposure' representing those who saw or heard the messages in between one and four channels; and 'high exposure' representing those respondents who had seen or heard the messages in five or more channels. Between 2005 and 2007 in Kenya, malaria messages were delivered through national television and radio channels, newsprints, posters, billboards, public health and community health workers, mobile cinemas; theater shows such as drama and poetry, market promotions. Across all malaria endemic areas, in both urban and rural residences, exposure to malaria messages decreased between the two survey rounds. While PSI maintained the same volume of messaging from 2005 to 2007, the survey did not account for the source of the messaging, therefore, it is possible that the overall volume of messaging decreased among other partners.

Monitoring Analysis 2a: Monitoring Dashboard Showing Trends in Net Use in Households in Kenya, 2003-2007

Behavior: Net use among children under five years of age and pregnant women throughout Kenya

In addition to net ownership, the malaria program also implemented initiatives that promoted consistent use of bed nets among vulnerable groups, specifically pregnant women and children under the age of five.

Of all households with a child under the age of five years in residence, the proportion that reported net usage by that child the night prior to the survey increased significantly from 23.8% in 2003 to 55.8% in 2007. This significant increase was evident in both rural and urban areas. Among Kenyan households with a pregnant woman in residence, a significantly greater percentage reported that the pregnant woman slept under a net the night before in 2007 (48.3%) than in 2003 (24.9%). This was most significant in rural areas where the proportion of pregnant women sleeping under a net increased from 17% in 2003 to 44.4% in 2007.

In 2007, indicators for ITN use by children under five and pregnant women were added to the TRaC survey. The survey data estimate that over 40% of Kenya children under the age of five throughout the country slept under an ITN the night before the survey. A larger proportion of urban children (46.8%) were reported to sleep under an ITN than children residing in rural areas (38.6%). The proportion of all Kenyan households that reported usage of an ITN by a pregnant woman was 38.4%. Similar to rates reported for children under the age of five, a larger proportion of pregnant women in urban areas (52.5%) reported sleeping under an ITN the previous night than pregnant women in rural areas (32.1%).

Determinants of Net Use

Data related to determinants of net use among pregnant woman and children under the age of five is analyzed at the household level. Additionally, the scales utilized in this analysis were originally developed for measuring proximal determinants of net ownership, however they can and should be considered as distal determinants of net use. Therefore, the same determinants are measured for net use as for net ownership.

Opportunity

Net availability data in Monitoring Table 2a is consistent with Monitoring Table 1b. There was a significant decrease in perceived availability between 2005 and 2007, and a significant increase in social norms between 2005 and 2007. The scale on perceived product attributes was not found to be significant. Again, due to the high volume of nets distributed for free, questions relating to the purchasing and sales of nets became obsolete. Questions that describe the next generation of concepts relevant to ITN use will be included in further studies (see Appendix 2 – Reliability Analysis for new scale on response efficacy for treated nets).

Ability

Knowledge of malaria transmission remained high around 91%, and did not differ significantly between 2005 and 2007. However, knowledge about methods of malaria prevention increased significantly over these two years, from 81.4% in 2005 to 86.2% in 2007. This was particularly true in rural areas, where knowledge of prevention increased from 77.6% in 2005 to 83.5% in 2007.

Motivation

Among all households in Kenya, the perceived threat of malaria actually decreased between 2005 and 2007, dropping from 3.61 to 3.58 on a 4 point Likert scale. This change was driven mostly by changes in urban areas, where the perceived severity dropped significantly from 3.59 to 3.51. There was not a significant drop in perceived severity in rural areas.

Exposure

Exposure variables were calculated the same was in Monitoring Table 2a as in Monitoring Table 1b. Exposure levels were computed by a count of the number of channels through which messages were received and recalled. The only significant change in exposure between 2005 and 2007 detected among Kenyan households nationwide was in the medium exposure category, which decreased from 35.6% to 33.3%. This was driven primarily by changes in urban households, for which the proportion of urban households reporting medium levels of exposure dropped from 32.7% to 26.1%. However, this may have occurred in part because of a significant

increase in urban households reporting high exposure to messages, from 43.3% in 2005 to 48.6% in 2007.

Segmentation Table 1: Determinants of net ownership, Kenya 2007.
Risk: Any household in malaria endemic areas
Behavior: Household owns a net

INDICATORS		Owns a net N=(1534)	Does not own a net N=(502)	OR	Sig.
OPPORTUNITY		Mean	Mean	OR	
Availability		-	-	-	ns
Net Attributes		-	-	-	ns
Social Norms		3.18	2.99	2.99	***
ABILITY		Mean	Mean	OR	
Knowledge of Malaria Transmission		90.9	84.3	1.91	**
Knowledge of Malaria Prevention		88.7	76.8	2.69	***
MOTIVATION		%	%	OR	
Perceived Severity of Malaria		-	-	-	ns
POPULATION CHARACTERISTICS		%	%	OR	
Socio-economic Status	*Lowest*	19.7	40.4	-	***
	Upper Lower	27.2	25.9	2.15	***
	Middle	23.3	20.3	2.36	***
	Upper Middle	15.6	6.6	4.72	***
	Highest	13.9	6.8	4.71	***
Residence (Urban vs. Rural)		-	-	-	ns
Income (Formal vs. Informal)		-	-	-	ns
Exposure to Malaria Messages	***Low***	42.1	39.7	-	ns
	Medium	31.7	36.5	0.98	ns
	High	26.2	23.8	1.50	*

-Note: Proportions or means for each variable are adjusted for all other variables in the model.
-Mean scores for scales/ items range (1-4): Strongly disagree (1), Disagree (2), Agree (3), and strongly agree (4).
-'R'=reverse coded
-Nagelkerke R square =0.189; Hosmer and Lemeshow test=0.396
-*: p<.05; **: p<.01; ***: p<.001; ns=not significant.

Segmentation Table 1b: Determinants of net ownership, Kenya 2007.
Risk: Any household in Kenya
Behavior: Household owns a net

INDICATORS		Owns a net N=(2617) %=65.0%	Does not own a net N=(1407) %=35.0%	OR	Sig.
OPPORTUNITY		Mean	Mean	OR	
Availability		2.34	2.02	1.21	***
Net Attributes		3.37	3.43	0.89	*
Social Norms		3.09	2.86	3.95	***
ABILITY		%	%	OR	
Knowledge of Malaria Transmission		91.7	88.3	1.57	***
Knowledge of Malaria Prevention		88.6	81.0	2.02	***
MOTIVATION		%	%	OR	
Perceived Severity of Malaria		91.4	89.3	1.284	*
POPULATION CHARACTERISTICS		%	%	OR	
Socio-economic Status	*Lowest*	15.2	24.5	-	***
	Upper Lower	20.2	23.0	1.42	**
	Middle	21.3	19.7	1.77	***
	Upper Middle	19.2	16.0	2.01	***
	Highest	23.9	16.7	2.49	***
Residence (Urban vs. Rural)		-	-	-	ns
Income (Formal vs. Informal)		-	-	-	ns
Exposure to Malaria Messages	***Low***	33.4	30.9	-	**
	Medium	32.1	37.2	0.80	*
	High	34.3	31.4	1.03	ns

-Note: Proportions or means for each variable are adjusted for all other variables in the model.
-Mean scores for scales/ items range (1-4): Strongly disagree (1), Disagree (2), Agree (3), and strongly agree (4).
-'R'=reverse coded
-Nagelkerke R square =0.180; Hosmer and Lemeshow test=0.021
-*: p<.05; **: p<.01; ***: p<.001; ns=not significant.

Segmentation Analysis 1: Determinants of net ownership among households in malaria endemic areas of Kenya, 2007

Segmentation Table 1 shows the differences in key determinants of net ownership among households in malaria endemic areas in 2007. It compares households within malaria endemic areas that reported that they owned a bed net with households that did not have a net. The two groups are compared in terms of hypothesized factors that influence net ownership, categorized into opportunity, ability, and motivation (OAM) factors, and reported earlier in the monitoring table. The significant differences between these two segments set priorities for the future net coverage social marketing program and action points for the 2008 marketing plans. The segments are further compared in terms of their non-mutable population characteristics. Those demographic attributes that differ significantly in the two segments define in detail the target group for the proposed interventions; that is, they answer questions such as who the program/interventions should target, where does the target group live, and what social economic class does the target group belong to.

The segmentation table for net ownership was generated from the sample of all households in malaria endemic areas. A multivariate logistic regression analysis with the dependent variable measuring whether or not the household owned a net (1=owned a net, 0= did not own a net), was prepared. Mean scores and adjusted percentages for determinants that were found to be statistically significant are shown in the table, with non-significant factors indicated with dashes. The mean scores and percentages are adjusted for other significant factors in the final logistic regression model. Three scales measuring the opportunity constructs and which were found to be reliable (Cronbach's alpha>0.690), were used in segmentation analysis. Individual items for knowledge of transmission and prevention of malaria and severity of malaria were included in the model. Covariates included social economic status, source of income (formal vs. informal), residence, and exposure to malaria messages.

Opportunity

Neither availability nor net attributes were significant determinant of net ownership in 2007. However, social norms proved significant, i.e., those households which owned a net were nearly three times more likely to think that social norms promote ownership of bed nets than those households that did not own a net.

Ability

Knowledge of both malaria transmission and prevention were highly significant determinants of net ownership. Nearly 91% of households that owned a net where knowledgeable of the means of malaria transmission, while only 84.3% of those that did not own a net had correct knowledge of malaria transmission. Among households that owned a net, 88.7% had correct knowledge of the means of malaria prevention in comparison to 76.8% of households that did not own a net. The segmentation data align with the significant trend over time in the Monitoring Table that knowledge of both transmission and prevention of malaria continue to be important determinants of net ownership.

Motivation

Motivation for net use was measured by perceived severity of malaria as an illness. However, this did not prove to be a significant predictor of net ownership in malaria endemic areas.

Population Characteristics

Socio-economic status proved to be the most significant predictor of net ownership in malaria endemic areas. Households that did not own a net dominated the lowest SES bracket, while households with nets were at least two times more likely to fall into the two middle quintiles and nearly five times as likely to be in the two highest quintiles. Neither residence (urban vs. rural) nor exposure to malaria messages proved to be significant determinants of net ownership.

Segmentation Analysis 1b: Determinants of Net Ownership among all households in Kenya, 2007

Segmentation Table 1b shows the differences in key determinants of net ownership among all households in Kenya in 2007. It compares households in all regions of Kenya (both malaria endemic and non-endemic) that reported that they owned a net with those that reported that they did not have a net. The two groups are compared in terms of hypothesized factors that influence net ownership, categorized into opportunity, ability and motivation (OAM) factors, which are reported earlier in the monitoring table. The significant differences between these two segments influence priorities for future net coverage social marketing programs and action points for the 2008 marketing plans. The segments are further compared in terms of their non-mutable population characteristics. Demographic attributes that differ significantly in the two segments define the target group for the proposed interventions; that is, they answer questions such as who the interventions should target, where does the target group live, and the social economic class to which the target group belongs.

Segmentation Table 1b for net ownership was generated from the sample of all households throughout Kenya. A multivariate logistic regression analysis with the dependent variable measuring net ownership was conducted. Mean scores and adjusted percentages for determinants that were found to be statistically significant are show in the table, with non-significant factors indicated with dashes. The mean scores and percentages are adjusted for other significant factors in the final logistic regression model. Three scales measuring the opportunity constructs which were found to be reliable were used in the segmentation analysis. Individual items for knowledge of transmission and prevention of malaria and severity of malaria were included in the model. Covariates included social economic status, source of income (formal vs. informal), residence and exposure to malaria messages.

Opportunity

Unlike in the analysis of just malaria endemic areas, availability and net attributes were found to be significant determinants of net ownership in a nationwide analysis. Similar to malaria endemic regions, social norms were also found to be significant determinants of net ownership. Social norms were the most significant predictor of new ownership, and households that owned a net were almost four times more likely to think that social norms promote net ownership than households that did not own a net.

Ability

Knowledge of both malaria transmission and malaria prevention were both highly significant determinants of net ownership among households throughout Kenya. Nearly 92% of households that owned a net were knowledgeable of the means of malaria transmission, whereas only 88.3% of households that did not own a net were knowledgeable. Additionally, among households that owned a net, 88.6% were aware of methods of malaria prevention, whereas among households that did not own a net, only 81% were knowledgeable of malaria prevention. These findings mirror those from the monitoring analysis which showed that knowledge of both malaria transmission and prevention are important determinants of net ownership.

Motivation

Motivation for net ownership was measured by perceived severity of malaria as an illness. Among households throughout Kenya, this was also a significant predictor of net ownership, as 91.4% of households that owned a never, versus 89.3% of households that did not, believed that malaria was a severe illness.

Population Characteristics

As was seen in malaria endemic areas, socio-economic status was found to be the most significant predictor of new ownership throughout Kenya. Households in the lowest and upper lower SES brackets were likely to not own a net, whereas households in the middle, upper middle and highest SES brackets were more likely to own a net. Although residence (rural or urban) and income (formal or informal) were not found to be significant determinants of net ownership, exposure to malaria messages among low exposure and middle exposure groups was found to be significant.

Segmentation Table 2: Determinants of net use, Kenya 2007.
Risk: Households in malaria endemic areas with at least one pregnant woman and/or children aged below five years
Behavior: Net Use

INDICATORS	Used a net N=(515) 65.6%	Did not use a net N=(270) 34.4%	OR	Sig.
OPPORTUNITY	Mean	Mean	OR	
Availability	-	-	-	ns
Net Attributes	-	-	-	ns
Social Norms	3.20	3.08	2.46	***
ABILITY	Mean	Mean	OR	Mean
Knowledge of Malaria Transmission	92.3	86.5	2.03	*
Knowledge of Malaria Prevention	90.9	86.0	1.74	*
MOTIVATION	Mean	Mean	OR	
Perceived Severity of Malaria *-Malaria is one of the worst diseases around here*	-	-	-	ns
POPULATION CHARACTERISTICS	%	%	OR	
Residence (Urban vs. Rural)	22.5%	11.5%	2.49	***
Socio-economic Status (ref: Lowest)	20.8	31.0	-	*
Upper Lower	27.4	23.8	1.67	ns
Middle	22.4	22.2	1.49	ns
Upper Middle	16.4	13.7	1.78	*
Highest	12.5	9.2	2.16	*
Income (Formal vs. Informal)	10.2	6.0	2.18	*
Exposure to Malaria Messages (low vs. Medium/High)	-	-	-	ns

Note: Proportions or means for each variable are adjusted for all other variables in the final logistic regression model.

Mean scores for scales/ items range (1-4): Strongly disagree (1), Disagree (2), Agree (3), and strongly agree (4).

'R'=reverse coded

Nagelkerke R square =0.139; Hosmer and Lemeshow test=.213

*: p<.05; **: p<.01; ***: p<.001; ns=not significant.

Segmentation Table 2a: Determinants of net use, Kenya 2007.
Risk: Households in Kenya with at least one pregnant woman and/or children aged below five years
Behavior: Net Use

INDICATORS	Used a net N=(1202) 58.1%	Did not use a net N=(865) 41.9%	OR	Sig.
OPPORTUNITY	Mean	Mean	OR	
Availability	-	-	-	ns
Net Attributes	-	-	-	ns
Social Norms	3.12	2.93	3.07	***
ABILITY	%	%	OR	
Knowledge of Malaria Transmission	-	-	-	ns
Knowledge of Malaria Prevention	92.6	84.3	2.32	***
MOTIVATION			OR	
Perceived Severity of Malaria *-Malaria is one of the worst diseases around here*	-	-	-	ns
POPULATION CHARACTERISTICS	%	%	OR	
Residence (Urban vs. Rural)	27.5	19.6	1.64	***
Socio-economic Status (ref: Lowest)	17.5	21.7	-	***
Upper Lower	23.4	19.0	1.67	***
Middle	22.1	20.2	1.49	***
Upper Middle	17.9	18.5	1.78	***
Highest	19.0	20.6	2.16	***
Income (Formal vs. Informal)	-	-	-	ns
Exposure to Malaria Messages (low vs. Medium/High)	-	-	-	ns

Note: Proportions or means for each variable are adjusted for all other variables in the final logistic regression model.

Mean scores for scales/ items range (1-4): Strongly disagree (1), Disagree (2), Agree (3), and strongly agree (4).

'R'=reverse coded

Nagelkerke R square =0.132; Hosmer and Lemeshow test=.459

*: p<.05; **: p<.01; ***: p<.001; ns=not significant.

Segmentation Analysis 2: Determinants of net use among households with at least one member in the vulnerable group (children under 5 years of age and pregnant women) in malaria endemic areas of Kenya, 2007

Like the previous segmentation table, the above table compares two populations, households with a member(s) in the most vulnerable group that reported that the member(s) slept under a bed net the night before the survey and those households in which the most vulnerable member(s) did not sleep under a net the night before the survey. The two groups are compared in terms of hypothesized distal determinants of net use, categorized into opportunity, ability, and motivation (OAM) factors, and reported earlier in Monitoring Table 2. Means, proportions, and odds ratios (OR) for each significant indicator are presented, adjusted for the effects of other significant factors in the model. All means reflect items scored on a four-point Likert scale whereby response options were “strongly disagree”, “disagree”, “agree” or “strongly agree”. Mean scores, ranging from 1 to 4, are presented, where higher means are indicative of more positive OAM factors. The segments are further compared in terms of their non-mutable population characteristics. Those demographic attributes that differ significantly in the two segments define in detail the target group for the proposed interventions. The significant differences between these two segments were employed to set priorities for the future net use social marketing programs and the 2008 marketing plan.

The segmentation table for net use was generated from the sub-sample of households in which one or more of its members are currently pregnant or below five years of age. A multivariate logistic regression analysis with the dependent variable measuring whether or not the vulnerable member(s) in the household used a net (1=used a net, 0= did not use a net) was conducted. Mean scores and adjusted percentages for determinants that were found to be statistically significant are shown in the table, with non-significant factors indicated with dashes. The mean scores and percentages are adjusted for other significant factors in the final logistic regression model. Three scales measuring the opportunity constructs were found to be reliable (Cronbach’s alpha>0.690) and subsequently were used in the segmentation analysis. Individual items for knowledge of transmission and prevention of malaria and perceived severity of malaria were included. Covariates included social economic status, residence, source of income (formal or informal) and exposure to malaria messages.

Those factors that significantly distinguish households in which a most vulnerable member used a net from those that did not are marked with one or more asterisks in the column titled

significance'. Six factors were identified as the important determinants of net use among vulnerable members of the households surveyed: perceptions of social norms supporting net ownership, knowledge of both malaria transmission and prevention, socio-economic status, residence, and source of income. Households in which the vulnerable member(s) slept under a net the night before the survey were more likely to report positive social norms promoting net ownership (mean score 3.20, OR=2.46), compared to those that did not (mean score, 3.08). Neither net attributes nor net availability were significant predictors of net use.

Three covariates were found significant; social economic status, residence (urban vs. rural), and source of income (formal vs. informal) Socio-economic status was categorized into quintiles. All but the lowest quintile was dominated by net users. Furthermore, net users were 1.8 times as likely to be in the 4th quintile and over two times as likely to be in the upper quintile. Net users were nearly 2.5 times more likely to live in the uran areas and 2.2 times as likely to work in the formal sector. Future interventions seeking to increase net coverage and usage should target rural, lower SES populations.

Segmentation Analysis Table 2a: Determinants of Net Use among Households with at least one vulnerable member in Kenya in 2007

Like the previous segmentation tables, this one compares two populations; households with a member in the most vulnerable group (children under the age of five and/or pregnant women) that reported that the member slept under a net the night before the survey and households in which the most vulnerable member(s) did not sleep under a net the night before the survey. The two groups are compared in terms of hypothesized distal determinants of net use, categorized into opportunity, ability and motivation (OAM) factors, as reported earlier in Monitoring Table 2a. Means, proportions and odds ratios for each significant OAM factor are presented, adjusting for the effects of other significant factors in the model. All means reflect items scored on a four point Likert Scale, ranging from 'stongly disagree', 'disagree', 'agree', and 'strongly agree'. Segments are further compared in their non-mutable population characteristics. Significant differences between these two groups were employed to set priorities for the future next use social marketing programs and the 2008 marketing plan.

The segmentation table for net use was generated from the sub-sample of households in which one or more of its members were currently pregnant or below the age of five years. A multivariate logistic regression analysis with the dependent variable measuring whether or not the vulnerable member(s) of the household used a net or not was conducted. Mean scores and adjusted percentages which were found to be statistically significant are presented in the table, while non-significant factors are represented by dashes. Covariates included social-economic status, residence, source of income and exposure to malaria messages.

Six factors were identified as important determinants of net use among vulnerable members of households throughout Kenya; perceptions of social norms supporting net ownership, knowledge of malaria prevention, rural or urban residence, and socio-economic status. Households in which a vulnerable member slept under a net the night before the survey were more likely to report positive social norms supporting net use (3.12) compared to those who did not (2.93). Neither net availability not net attributes were a significantly associated with net use. Additionally, households in which a vulnerable member(s) slept under a net were significantly more likely to be knowledgeable of malaria prevention (92.6%) than other households (84.2%).

Population characteristics that were found to be significant include residence (urban residents were 1.64 times more likely to use a net) and socio-economic status.

Programmatic Recommendations

In the last five years, the malaria social marketing program has demonstrated its effectiveness in influencing bed net ownership and use within the malaria endemic provinces of Kenya, particularly among the most vulnerable groups, children under 5 years of age and pregnant women. Net ownership across all malaria endemic areas more than doubled between 2003 and 2007, more than tripling in the rural areas. Ownership of an ITN increased four-fold, with a more than eight-fold increase in the rural areas. Net use among children under five years of age in malaria endemic areas more than doubled, particularly in the rural areas. Notably, net use among pregnant women in households in endemic areas did not change as dramatically, not even increasing by half over the four years between surveys. Furthermore, ITN use among both vulnerable groups stands at just over 40% in rural areas (children under 5: 41.2%; pregnant women: 34.6%). Percentages are much higher in the urban areas, 50.3% and 70.2% respectively.

There is enough evidence from the survey results suggesting that intensified campaigns are needed to persuade all households in malaria endemic areas, especially those with malaria high risk groups in residence to sleep under nets throughout the year, especially in the rural areas. Although there is approximately 80% coverage of bed nets within households in malaria endemic areas, the size of the population in the three regions and the level of endemicity support continued messaging directed at net ownership as well as use. The analysis presented in this paper supports the decision of the Kenya malaria program to respond to the World Health Organization efforts of increasing net coverage within households to a minimum of two nets. As of the date of the 2007 survey, only 35.8% of households in malaria endemic areas owned at least two ITNs (nets treated in the past six months or permanently treated nets). It is anticipated that increased messaging on the benefits of treated nets over untreated nets, along with the private sector trend in distributing only pre-treated nets, will increase ITN usage within these households.

On a more basic level, while there have been significant increases in usage among the most vulnerable populations, the fact remains that only 61.2% of children under five and just over 35% of pregnant women sleep under any kind of net. The results are even poorer for ITN use (42.7% and 44.6% respectively). Furthermore, the data show that the increases in overall use were driven largely by increases in the urban areas. Thus, increased efforts must be directed to the rural malaria endemic areas. The survey results identify key determinants that future interventions on net coverage and net use should focus on. Increasing and expanding perceived social norms

supporting net ownership and use, as well as maintaining high levels of knowledge around transmission and prevention of malaria will be required to both maintain and increase current levels of ownership and usage.

Additional scales will be developed to measure determinants of ITN usage vs. untreated nets as appropriate, given that the market is moving largely to the distribution of permanently treated nets. (See reliability analysis, Appendix 3 for the reliability analysis of a scale measuring perceived response efficacy of treated nets vs. untreated.)

Of major importance for future research efforts is a focus on proximal determinants of net usage. The scales developed in 2005 and utilized again in 2007 were developed primarily to measure determinants of net ownership. Scales targeted to net usage will be developed through qualitative and further quantitative research inspired by the results of the current analysis. A proposed qualitative research study scheduled for the first quarter of 2008 that will explore perceptions of susceptibility and severity of malaria, as well as sleeping patterns and distribution of malaria prevention resources within households, is expected to provide data that will be crucial to the development of reliable scales to measure ITN usage within households, particularly among the most vulnerable groups.

Population Characteristics

Sample characteristics	Year			
	2003 N=2919	2005 N=3191	2007 N=4063	Sign
Residence %				**
Urban	26.6	29.1	25.8	
Rural	73.4	70.9	74.2	
Province %				ns
Coast	8.5	8.6	8.7	
Nairobi	10.4	11.6	11.1	
Eastern	15.6	15.2	14.6	
Nyanza	15.4	14.7	15.5	
Central	14.9	13.9	14.3	
Western	11.3	11.2	11.1	
Rift Valley	24.0	24.8	24.6	
Malaria endemic provinces (vs. others)	35.3	35.1	34.5	ns
Social economic class				***
Low	18.8	22.7	37.2	
Medium	62.3	45.4	32.4	
High	19.0	31.9	30.4	

PERForMance Review Indicators

PERForMance REVIEW INDICATORS	2003	2005	2007
% of households that own one at least one net (among all households)	30.4 (N=2912)	43.2 (N=3191)	65.1 (N=4063)
% of household that own an ITN (a net treated in the past 6 months or a long lasting net, among all households)	11.0 (N=2912)	11.8 (N=3191)	49.8% (N=4063)
% of pregnant women who slept under a net the previous night (of all pregnant women in the sample)	24.9 (N=201)	37.4 (N=190)	48.3% (N=323)
% of pregnant women who slept under a an ITN the previous night (of all pregnant women in the sample)	-	-	38.4% (N=323)
% of children < 5 who slept under a net the previous night (of all children <5 in the sample)	23.8 (N=2147)	34.8 (N=2143)	55.8% (N=2826)
% of children < 5 who slept under an ITN the previous night (of all children <5 in the sample)	-	-	40.3 (N=2826)

Cost of Research

PERForMance REVIEW INDICATORS	$	Kshs
Study Design	-	-
Training	11, 743	822, 050
Data Collection (wages, transport, per-diems,	205,669	14, 396,804
Local guide and CBS consultancy services	14,694	1,028,604
Stationary , communications questionnaire copying	18,180	1,272,620
Analysis	-	-
Report	-	-
Courier services and other miscellaneous costs	1,318	92,239
Total	251,605	17,612,317

Methodology

Sampling and participants: All the three survey rounds drew samples of households from both rural and urban areas of the seven provinces of Kenya (Except North Eastern Province) namely Nairobi, Coast, Central, Rift Valley, Eastern, and Nyanza. In all survey rounds, a stratified multi-stage cluster sampling methodology was used to allow for estimates at the residence level (urban vs. rural).

The Kenya National Bureau of Statistics, Ministry of Planning and National Development maintains the census frame which is organized by Province, Administration Area, District and EA (An EA is the smallest residential geographic unit with a mean size of 100 households and range of 50 to 200 households). The sample population is drawn from enumeration areas (EA) of middle, lower middle, and lower social economic status selected probability proportional to size. The upper income EA are excluded from the sampling frame because they do not form part of the need/risk group for social marketing program in Kenya.

Sample Estimates, and Sample Selection Procedure: The Kenya National Bureau of Statistics, National Sample Survey and Evaluation Program IV (NASSEP IV) sampling frame listing 1,800 clusters in the country was used to draw a nationally representative sample for 2003, 2005, 2007 surveys. The sample size for each of the survey rounds was determined using a multiple indicator sampling calculation, due to the fact that the malaria questionnaire is one module in a larger household questionnaire. The maximum sample size was collected taking into consideration a study design effect of 1.75, 95% level of significance, $\pm$ 5% precision level, power of 80, and an estimated loss rate of 10%, as well as time and budget constraints.

In 2007, 280 enumeration areas were randomly selected probability proportional to size. A total of 4200 households were sampled. Since TRaC 2007 was a multi-indicator survey (condom use among youth, contraceptive use among unmarried women, net ownership and use, and safe water practices at household level) a sample size was calculated to yield enough youth to estimate condom use behavior. Within each EA selected, individual households were pre-selected using systematic random sampling. Where structures or household numbers were unavailable upon data collection, the ‘spin the bottle’ methodology was implemented to determine a starting point; the right hand rule was followed, counting 15 households (as per the sampling fraction) to

the first household for interviewing. Subsequently, every 15th household was interviewed until the required 15 households per EA were collected.

The 2007 TRaC survey achieved a 97% (4063) response rate, the missing 3% attributed to: responsible household members were unavailable during three successive visits to the household; respondent refusal to participate in the survey. Respondents were not eligible for the survey if they (1) could not speak or understand the survey language, or (2) were unable to talk or hear, or (3) were visitors in the selected household.

The table below shows the sample distribution (EA) by residence and administrative boundaries (province and districts).

Province	District	Sample (EA)allocation		
		Rural	Urban	Total
Nairobi	Nairobi	0	30	30
Central	Kiambu	6	2	8
	Kirinyaga	3	2	5
	Muranga	3	1	4
	Nyandarua	3	2	5
	Nyeri	5	4	9
	Thika	3	9	12
	Total	23	20	43
Coast	Kilifi	4	1	5
	Kwale	5	1	6
	Mombasa	0	6	6
	T/Taveta	3	1	4
	Malindi	2	1	3
	Total	14	10	24
Eastern	Embu	2	3	5
	Kitui	3	1	4
	Makueni	4	2	6
	Machakos	5	5	10
	Mbeere	1	0	1
	Meru Central	3	4	7
	Mwingi	2	1	3
	Meru Nort.	4	1	5
	Total	24	17	41

Province	District	Sample (EA)allocation		
		Rural	Urban	Total
Nyanza	Gucha	3	1	4
	H/Bay	2	2	4
	Kisii Central	4	1	5
	Kisumu	3	8	11
	Migori	4	2	6
	Nyamira	3	1	4
	Rachuonyo	2	1	3
	Siaya	4	1	5
	Total	25	17	42
R.Valley	Baringo	3	2	5
	Kajiado	4	4	8
	Kericho	4	3	7
	Nakuru	10	10	20
	Nandi	6	2	8
	T/Nzoia	5	3	8
	U/Gishu	4	8	12
	Total	36	32	68
Western	Bungoma	6	6	12
	Busia	3	2	5
	Kakamega	5	4	9
	Vihiga	4	2	6
	Total	18	14	32
Grand Total		140	140	280

Data Collection Procedure: The PSI-Kenya research department executed the survey with the help 16 field supervisors, 32 enumerators, 8 data entry clerks, and 4 office data editors. Each field team consisted of a supervisor, 3 enumerators (with at least a female and a male), a village elder, and a local guide/KNBS field enumerator provided by the Kenya National Bureau of Statistics. The supervisors, enumerators, data entry clerks, and office editors, were trained for 12 days. During the training, the teams covered the two sets of questionnaires (household and individual questionnaires), to ensure understanding of questions and instructions. Training contained a thorough review of the survey methodology and interviewing techniques, field logistics, study coordination, and problem solving, as well as a pre-test of the questionnaires and methodology. Village elders were consulted before data collection began to build confidence among potential respondents. The TRaC 2007 survey was conducted soon after four major national surveys including a malaria indicator study, which included blood sampling. To address potential survey fatigue, a local guide was identified to facilitate data collection at the EA level by identifying households and together with the village elder, introducing the team to household members.

Field teams were recruited on the basis of gender and language. Sixteen field teams were created representing nine of the most commonly spoken languages in the districts sampled. Each field team was assigned two or three districts for dat collection. On arrival at the assigned district, the survey team contacted the District Statistical Officer (DSO), who manages and coordinates all KNBS activities at the district level. The DSO helped coordinate the survey at the district level by identifying officers (local guides) who were most familiar with the pre-selected EAs, to accompany the team for the interviews. All teams started in Nairobi for a period of 5 days, covering a total 30 EAs. Thus, Nairobi was used as a final training for the field teams to perfect their survey skills and report back on any problems encountered. The remainder of the data was collected over 30 days of field work.

Once a household was identified for the interview, the head of household or other responsible party was informed of the purpose of the study and verbal consent was sought. The household scan was conducted to identify all members of the household. Respondents selected were either the head of household, deputy/spouse, or any other responsible adult (preferably a female). Interviewers made three attempts to interview the appropriate respondent. If the selected respondent was not available at the third visit, the field team would replace her or him with the most suitable alternative member of the household. Vacant households, non-existent households,

and households whose members could not participate in the survey due to language issues were replaced with the household in closest proximity. Households that refused to respond to the general household questionnaire were not replaced.

Survey Instrument(s) The 2007 TRaC survey gathered data using two separate questionnaires; the household questionnaire collected information on each habitual member of the household, including name, age, sex, pregnancy status and net usage. The individual questionnaire gathered data on ownership of durable and consumable items, knowledge of malaria, net ownership and use, net re-treatment, sources of water, awareness of waterborne diseases and their consequences, ability to identify groups at high risk for diarrheal illness, water treatment practices, perceptions on quality of drinking water, brand awareness of PUR and water guard, and willingness to pay for PUR. The questionnaires were translated from English into 9 local languages.

Analytic Technique In 2007, data were entered and cleaned using the EPIDATA 2.1b software, in 2005 CSPro version 2.5, and in 2003 an automated data capture process using omni extract software. All data was then exported to SPSS for windows for analysis. Data validation was carried out using original sampling frames to ensure consistency in identifiers such as EA numbers, residence, province and district. Macros were developed to identify inconsistencies and gross errors in the data. Weighting was carried out by senior statistician from Kenya National Bureau of Statistics with assistance from PSI research department, as the bureau is the custodian of the population estimations and projections at the national level. Below is a general description of the weighting process for the household data set.

The first three components in the household sample weight reflect the probability of selecting the household. The three components are derived from

1. Probability 1: the probability of selecting the cluster from the 1999 NASSEP IV frame,
2. Probability 2: the probability of selecting the EA, and
3. Probability 3: the probability of selecting a household from within each EA

The fourth component was the first household weight. This weight was calculated as the inverse of the products of the three probabilities described above. The fifth component of the weight is a household non-response adjustment. The sixth component was the second household sample weight after adjusting for non-response. The seventh component was the final post-stratification

weight to adjust the each domain (i.e. province and rural/urban) to reflect the current national projections. This weight was further normalized to ensure that the total weighted cases equaled the total sample cases.

Bivariate analysis was conducted for background population characteristics across the three survey rounds. For each monitoring table the data sets from the three survey rounds were merged on variables that stayed the same over time. Means and proportions were calculated using UNIANOVA and controlling for SES, province, residence, and survey round, as appropriate. Significance is based on Least Significant Distance (LSD) test with a .05 limit on family wise error rate. Levels for some indicators such use of treated net and ownership of two long lasting nets is presented for the 2007 survey round only, as they were not measured in previous survey rounds.

For each segmentation analysis, the initial full logistic regression model included all variables that were believed to influence the dependent variable (e.g. net ownership or net use the previous night). The model was then reduced to a restricted model by dropping non-significant variables and retaining those that were significant ($p < 0.05$) or borderline significant ($p < 0.10$). Removed variables were then re-entered into the model one by one in order of significance (starting with the lowest p-value) to check if they improved the model. If the addition of a variable produced a significant omnibus chi-square and/or if the individual variable was significant in the model, the variable was kept in the model. Variables that did not improve the model were dropped from the analysis. A final parsimonious model is presented (i.e. a model with significant variables only). UNIANOVA was conducted to calculate adjusted means or proportions for each variable in the final regression model, controlling for all other significant independent variables in the model as well as study design related variables. Significance is based on a LSD test with a 0.05 limit on the family-wise error rate.

Factor analysis was used to test the reliability of scaled OAM constructs and to test for sub-dimensions. Decisions on reliability were made by examining the standardized Cronbach's alpha and individual items were dropped until a minimally acceptable alpha of 0.70 was attained. Correlation analysis was carried out to test for multi-co linearity at a value of 0.65. No variables were found highly correlated.

Reliability Analysis

Composite Variables	Year 2005 (N=1119) Cronbach's Alpha	Year 2007 (N=1403) Cronbach's Alpha
OPPORTUNITY		
Availability (nets, range 1-4) 1: strongly disagree; 2: disagree; 3: agree; 4: strongly agree - *Outlets nearby sell mosquito nets.* - *Mosquito nets are available around here.* - *Mosquito nets are available within walking distance from your home.* - *You can always find mosquito nets at nearby outlets.*	0.8894	0.8334
***Net attributes** (range 1-4) 1: strongly disagree; 2: disagree; 3: agree; 4: strongly agree* - *It is difficult to find a place to hang a net over your sleeping place 'R'.* - *Setting up a net so that people can sleep under it can be difficult 'R'.* - *Hanging nets can be tiresome 'R'.*	0.7366	0.7165
***Social norms** (around nets, range 1-4) : 1: strongly disagree; 2: disagree; 3: agree; 4: strongly agree* - *Most people around here have nets* - *In this community having nets shows one cares for their family* - *Most people around here would try hard to buy nets for their families* - *No one here thinks about buying nets for their families 'R'* - *Having nets is considered a very important thing around here*	0.7377	0.6671
ABILITY-Knowledge measured as individual items		
MOTIVATION		
Response efficacy** (for treated net, range, 1-4). **1: strongly disagree; 2: disagree; 3: agree; 4: strongly agree - *Both untreated and treated net give you the same protection from malaria.* - *Treated nets are highly effective in preventing malaria* - *Insecticide treated nets protect people from mosquito bites better because they repel/kill mosquitoes.* - *Insecticide treated mosquito nets are more effective than untreated mosquito nets for preventing Malaria.*	0.8391	0.7532

2007 Trac scales

Availability	Means
- *Outlets nearby sell mosquito nets.*	*2.000*
- *Mosquito nets are available around here.*	*2.260*
- *Mosquito nets are available within walking distance from your home.*	*3.050*
- *You can always find mosquito nets at nearby outlets.*	*2.090*
Net attributes	
- *It is difficult to find a place to hang a net over your sleeping place 'R'.*	*3.389*
- *Setting up a net so that people can sleep under it can be difficult 'R'.*	*3.454*
- *Hanging nets can be tiresome 'R'.*	3.234

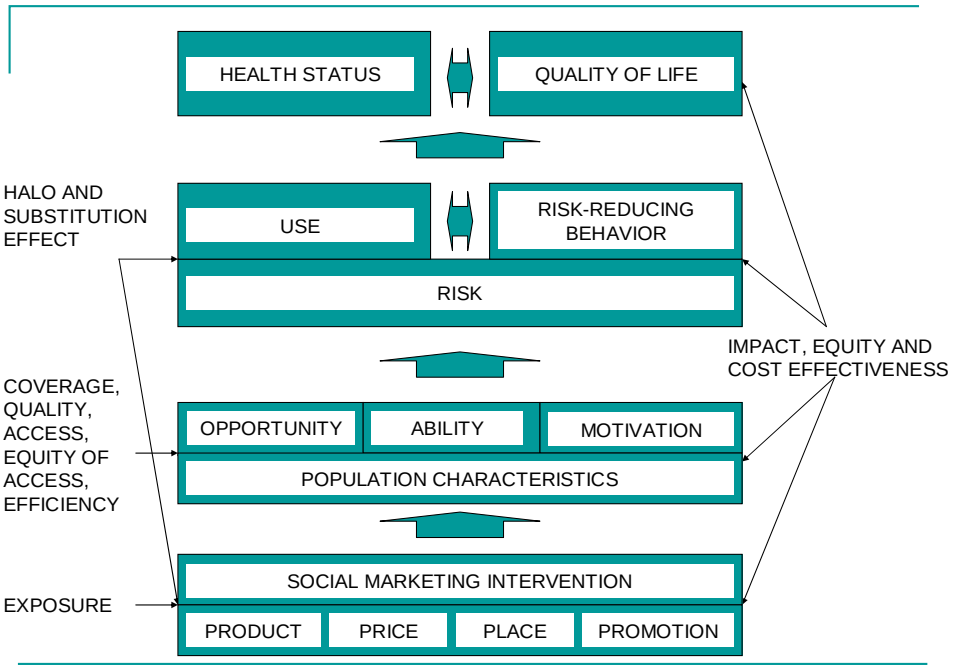
Social norms

-	*Most people around here have nets*	*3.160*
-	*In this community having nets shows one cares for their family*	*3.310*
-	*Most people around here would try hard to buy nets for their families*	*3.440*
-	*No one here thinks about buying nets for their families 'R'*	*3.216*
-	*Having nets is considered a very important thing around here*	*3.680*

Response efficacy (*for treated net)*

-	*Both untreated and treated net give you the same protection from malaria.*	*3.574*
-	*Treated nets are highly effective in preventing malaria*	*3.880*
-	*Insecticide treated nets protect people from mosquito bites better because they repel/kill mosquitoes.*	*3.800*
-	*Insecticide treated mosquito nets are more effective than untreated mosquito nets for preventing Malaria.*	*3.840*

Performance Framework for Social Marketing



This study design is guided by PSI's PERForM framework. PERForM describes the social marketing research process, identifies key concepts important for designing and evaluating social marketing interventions and mirrors the four levels and concepts in the logical framework.

The top level consists of the goal of social marketing for any health promotion intervention, namely improved health status and/or for interventions relating to coping with sickness or disability, quality of life.

The second level consists of the objectives of social marketing stated as product or service use on the left side and/or other risk-reducing behaviours that do not involve the use of a product or service on the right side. The adoption or maintenance of these behaviours in the presence of a given risk or need for health services is causally antecedent to improving or maintaining health and or quality of life.

The third level consists of the determinants of PSI Behaviour Change framework summarised in terms of opportunity, ability and motivation that may differ by population characteristics such as age and sex. The fourth level consists of the characteristics of the social marketing intervention.

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