President's Malaria Initiative

Tanzania Vector Control Scale-up Project: Spray Performance Report

August 2010–June, 2011

Contract No. 621-A-00-10-00015-00
March 9, 2010–March 8, 2015

Prepared for:
U.S. Agency for International Development/Tanzania

Prepared by:
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July 15, 2011

This publication was produced for review by the U.S. Agency for International Development. It was prepared by RTI International.

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Submitted on:
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List of Acronyms

ACT	Artemisinin-based Combination Therapy
BCC	Behavior Change Communication
CBO	Community-Based Organization
CDA	Community Development Agents
CHMT	Council Health Management Team
DC	District Council
DED	District Executive Director
DITC	District IRS Technical Committee
DMFP	District Malaria Focal Person
DMO	District Medical Officer
FAO	Food and Agriculture Organization
FAQ	Frequently Asked Questions
FBO	Faith-Based Organization
FY	Fiscal Year
HR	Human Resources
IEC	Information, Education and Communication
IMCI	Integrated Management of Childhood Illness
IMVC	Integrated Malaria Vector Control
IPTp	Intermittent Preventive Treatment for Pregnancy
IRS	Indoor Residual Spraying
ITC	Information Technology and Communication
ITN	Insecticide-Treated Net
JHU-CCP	Johns Hopkins University–Center for Communication Program
LLIN	Long Lasting Insecticide Treated Net
M&E	Monitoring and Evaluation
MIS	Malaria Indicator Survey
MoHSW	Ministry of Health and Social Welfare
NEMC	National Environment Management Council
NGO	Nongovernmental Organization
NIMR	National Institute for Medical Research
NMB	National Microfinance Bank
NMCP	National Malaria Control Program
OPD	Out Patient Department
OS	Operation Site
PEA	Preliminary Environmental Assessment
PMI	President's Malaria Initiative
PPE	Personal Protective Equipment
RHMT	Regional Health Management Team
RTI	Research Triangle Institute
SEA	Supplemental Environmental Assessment
SOP	Standard Operating Procedure
THMIS	Tanzania HIV and Malaria Indicator Survey
ToT	Training of Trainers
TPRI	Tropical Pesticide Research Institute

USAID	United States Agency for International Development
VC	Vector Control
VHW	Village Health Workers
VEO	Village Executive Officer
WEO	Ward Executive Officer
WHO	World Health Organization
WHOPES	World Health Organization Pesticide Evaluation Scheme
ZMCP	Zanzibar Malaria Control Program

I. Executive Summary

In 2006, RTI International was awarded a first cooperative agreement by the U.S. Agency for International Development (USAID) under the U.S. President's Malaria Initiative to implement indoor residual spraying (IRS) and other malaria control and prevention activities in Mainland Tanzania and Zanzibar. Between 2006 and July 2010, RTI conducted IRS in Zanzibar and Kagera Region in the Lake Zone in Mainland Tanzania. In 2010, IRS was expanded to cover two additional Lake Zone regions, Mwanza, and Mara.

Over the course of the 2010–2011 IRS spray season, spanning from August 2010 to June 2011, a total of 18 districts in the Lake Zone (seven districts in Kagera Region, six districts in Mwanza Region, and five districts in Mara Region) and 10 districts in Zanzibar benefited from IRS. In Mwanza (six districts) and Mara (five districts) regions, a first blanket spray round was conducted. In Kagera Region—where IRS began in selected areas in 2007 and scaled up to the entire region in 2009—second, third, fourth, and fifth spray rounds were conducted in seven districts, based on the time period that each district was added to the program. In Zanzibar, a sixth round of blanket spraying was conducted in all 10 districts.

Prior to any spraying, however, many preparatory and foundational activities had to be carried out, such as the following:

- Select eligible spray areas based on national strategic priorities and logistic and epidemiological considerations.
- Conduct preliminary logistic assessment to quantify eligible house structures, target population, spray equipment, insecticide, and spray teams and identify suitable sites to host temporary storage and effluent waste disposal facilities.
- Perform environmental impact assessments in the selected areas to satisfy both USAID's and the Government of Tanzania environmental requirements for the use of pyrethroids.
- Develop the selected sites for temporary, proper storage of IRS equipment and insecticide and construct effluent waste disposal facilities.
- Implement a plan for safer use of insecticide and institute an environmental mitigation plan, including safe transport and secure storage of insecticide, testing female spray technicians for pregnancy, and training clinicians on pesticide side effects treatment.
- Perform insecticide quality assurance tests.
- Procure, transport, and store all necessary spray and personnel protective equipment (PPE), insecticides, and consumables
- Train spray teams in a variety of positions, including site managers, team leaders, spray operators, suit washers, site attendants, security guards, and water fetchers.
- Promote acceptance of IRS in the targeted communities through information, education and communication (IEC) activities.

In the Lake Zone, at the close of IRS operations in March 2011, a total of 1,144,621 house structures (94.5% of those eligible) were sprayed, and as a result 6,095,891 people were protected, including 178,497 pregnant women and 1,330,674 children under the age of five. In Zanzibar, a total of 194,808 house structures were sprayed (94.6% of those eligible), with 1,033,742 people protected, including 23,458 pregnant women and 180,995 children under the age of five.

II. Country Background

IRS Intervention Areas

The United Republic of Tanzania is located between longitudes 28°E and 40°E; latitudes 1°S and 12°S. The country has a total area of 947,480 km^2, of which 883,349 km^2 constitute land, and the remainder is made up of water bodies. Administratively, the country includes Mainland Tanzania and the archipelago of Zanzibar.

Mainland Tanzania

Mainland Tanzania has 21 regions and 132 councils. Each council is divided into 4–5 divisions, which in turn are composed of 3–4 wards. Approximately 5–7 villages form a ward. There is an approximate a total of 10,045 villages. Each village is subdivided into hamlets (3–6 per village). The country has an estimated population of 43.1 million (2010 estimate), with an annual growth rate of 2.8%. Seventy-six percent of the population lives in rural communities. Twenty percent of the population is made up of children under five years of age, 27% are 5–15 years old, and 20% are women of reproductive age (between 15 to 49 years of age).

The Lake Zone Regions in Mainland Tanzania

Mainland Tanzania is divided into seven zones (East, South, Southern Highlands, West, Central, Lake, and North). The Lake Zone has a total surface of 77,392 sq km and a population of 11,794,791 (based on a 2010 estimate). The Lake Zone is divided into four regions: 1) Shinyanga (50,781 sq km, 8 districts, and 3,841,788 residents, based on a 2010 estimate); 2) Kagera (40,838 sq km, eight districts, and 2,563,870 residents, based on a 2010 estimate); 3) Mwanza (19,592 sq km, 8 districts, and 3,566,263 residents, based on a 2010 estimate); and 4) Mara (16,962 sq km, 6 districts, and 1,822,870 residents, based on a 2010 estimate). In the Lake Zone, two new regions were recently instituted, Simiyu and Geita, with a consequent redistribution of the administrative districts, surface area, and population. In this report, we will use the old administrative designations prior to the rearrangement.

Zanzibar

The Zanzibar archipelago consists of two main islands, Unguja and Pemba, and several minor islands. The total surface is 1,658 sq km, with a population of 1.3

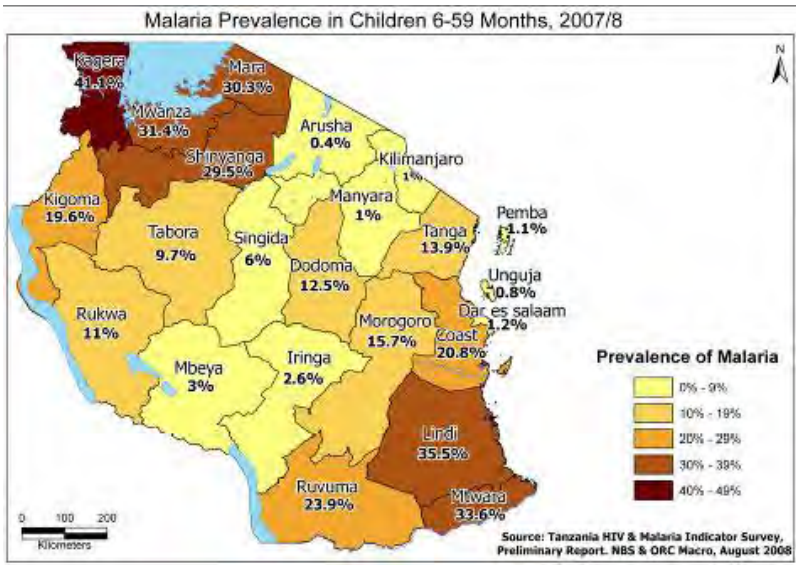
million (2010 census projection). The administrative setup in Zanzibar includes five regions—three in Unguja and two in Pemba—10 districts, and 335 *shehia*[1].

Malaria Transmission in Mainland Tanzania and Zanzibar

The transmission of malaria in Mainland Tanzania is highly variable, depending on geographic, climatic, and human settings. The most recent national population-based survey data (Tanzania Health Management Information Survey [THMIS] 2008) show that 18% of children under five years of age tested positive for malaria in Mainland Tanzania in contrast to only 0.8% in the two islands of Pemba and Unguja in Zanzibar. In Zanzibar, a Malaria Indicator Survey (MIS) carried out by the ZMCP in 2010 showed further reduction of malaria prevalence to less than 0.1%.

The 2008 THMIS data show marked regional variations ranging from 0.4% in Arusha to 41.1% in the northwestern region of Kagera (see *Figure 1)* in the Mainland. Perennial intense malaria transmission is typical in the Lake Zone (upper northwest) and Coastal Belt (east and south), with prevalence between 20% and more than 40%. There is seasonal malaria transmission, with prevalence between 5% and 20% in the Central Plateau. Low or seasonal transmission (shorter than 3 months per year) is the pattern in the Southern and Northern Highlands, with a prevalence of lower than 5%. Dar es Salaam City has exceptionally low malaria transmission. In Mainland Tanzania, rural areas had a higher prevalence (20%) compared to urban areas (8%).

Figure 1. Tanzania malaria prevalence in children under five years of age



[1] *Shehia* is the equivalent of ward in Zanzibar's administrative set up.

Malaria Medium-Term Strategic Plan for Mainland Tanzania and Zanzibar

Mainland Tanzania

In Mainland Tanzania, the goal of the second 2008-2013 Medium-Term Strategic Plan is to reduce malaria prevalence by 50% by the end of 2013. The main targets are

- 80% of malaria patients diagnosed and treated with effective antimalarial medicines, such as artemisinin-based combination therapy (ACT), within 24 hours of the onset of fever;
- 80% of all pregnant women receive 2 or more doses of intermittent preventive treatment (IPTp);
- 80% of people in malarious areas protected through the use of insecticide-treated nets (ITNs);
- 80% of people in target areas protected through IRS; and
- Early detection and containment of 80% of malaria epidemics within 2 weeks from onset.

The current plan aims to rapidly scale up the levels of coverage for the main interventions and includes a comprehensive array of activities. The plan also includes measures for strengthening malaria surveillance systems to inform decision makers and institute timely preventive measures.

Zanzibar

In Zanzibar, the long-term goal is malaria elimination. The medium-term goal of the current strategic plan is to assess the potentialities for malaria elimination and to reduce morbidity and mortality due to malaria in Zanzibar's population to a level that the disease no longer poses a public health threat, especially among most vulnerable groups, such as children under five, pregnant women, and the poor. The Zanzibar targets are similar to those for Mainland Tanzania and also include the following objectives: provide effective epidemic preparedness and response by ensuring that for > 90% of health facilities, reports are on time; investigation of reported epidemics is initiated within 24 hours; and supplies are at hand to mount a response, if necessary. Furthermore, the strategic plan includes a target to assess the potential for sustainable elimination of malaria from Zanzibar, using newly available data from surveillance and operational research, as well as experience from implementation of previous IRS rounds.

III. IRS in the Context of Malaria Strategies in Mainland Tanzania and Zanzibar

Recent History of IRS in Mainland Tanzania and Zanzibar

Zanzibar

The PMI has assisted ZMCP with its IRS program since 2006, contributing to the substantial drop in malaria transmission. Between June 2006 and June 2011, RTI in

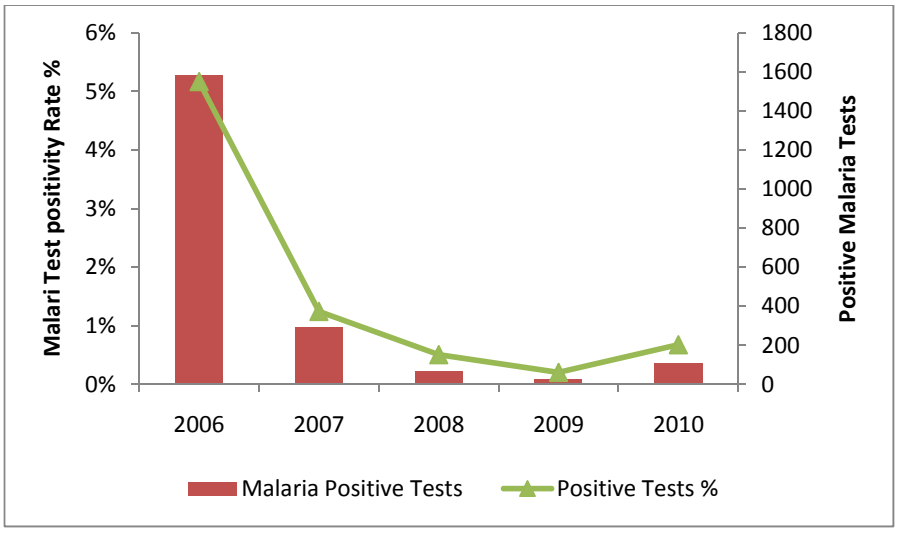
collaboration with ZMCP, conducted IRS in Zanzibar for six rounds (see *Table 1*). About 200,000 house structures were sprayed per round, protecting almost 1.2 million people. The spray coverage was consistently over 90%.

Table 1. Spray performances in Zanzibar 2006–2011

Round	1	2	3	Focal Spray	4	5	6
Year	2006	2007	2007	2008	2008	2010	2011
Unguja							
Central	15,167 (92%)	15,258 (89%)	15,737 (95%)	-	13,897 (94%)	15,046 (89%)	14,883 (94%)
North A	21,729 (98%)	21,575 (96%)	22,961 (100%)	-	22,097 (97%)	18,595 (88%)	21,524 (100%)
North B	11,829 (95%)	10,819 (93%)	11,737 (95%)	4,797	10,562 (93%)	10,397 (89%)	11,480 (97%)
South	8,036 (99%)	8,871 (100%)	9,167 (99%)	-	9,417 (100%)	8,604 (88%)	8,472 (94%)
Urban	25,670 (92%)	23,764 (79%)	25,828 (88%)	-	27,464 (97%)	22,355 (78%)	23,127 (86.7%)
West	41,182 (92%)	37,370 (81%)	47,739 (98%)	-	43,053 (84%)	40,202 (88%)	40,422 (94.9%)
Pemba							
Chakechake	16,211 (99%)	16,829 (100%)	16,637 (99%)	-	16,437 (96%)	16,280 (88%)	16,866 (94%)
Micheweni	21,015 (100%)	20,824 (100%)	20,920 (100%)	-	18,164 (97%)	16,811 (87%)	20,305 (96%)
Mkoani	19,804 (100%)	20,067 (100%)	19,560 (98%)	-	18,653 (98%)	18,224 (98%)	18,267 (100%)
Wete	21,376 (100%)	21,596 (100%)	22,371 (99%)	-	20,987 (98%)	19,532 (90%)	19,462 (93%)
Total	202,019 (96%)	196,973 (91%)	212,657 (97%)	4,797	200,731 (94%)	186,046 (88%)	194,808 (95%)

This massive effort, together with other interventions, has contributed significantly to bringing malaria prevalence to less than 1% and advancing Zanzibar to a pre-elimination phase in malaria control (see *Figure 2*).

Figure 2. Positivity rate in six hospitals in Zanzibar, 2006–2010



Mainland

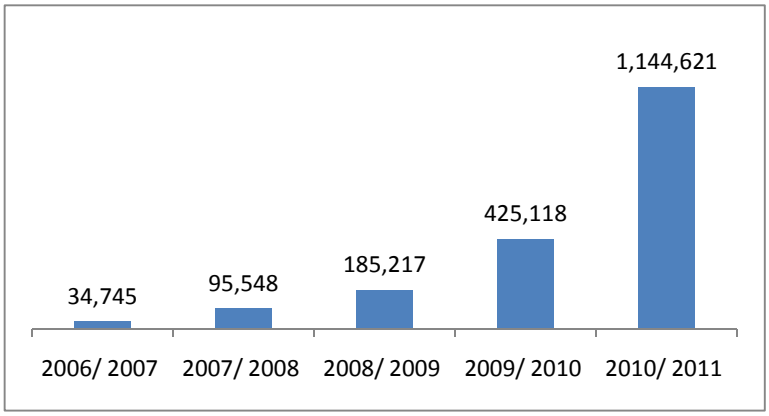
In its 2008–2013 Medium-Term Strategic Plan, the Tanzania National Malaria Control Programme (NMCP) targets IRS scale up from 1 district in 2007 to cover about 60 districts by 2013, protecting 50% of country's population. This will be implemented through Integrated Malaria Vector Control (IMVC), which includes malaria preventive methods such as ITNs and long-lasting insecticide-treated nets (LLINs), larviciding for malaria control in municipals/town councils, and effective environmental management.

PMI began supporting IRS in Mainland Tanzania in 2007. RTI was contracted by PMI to assist the Ministry of Health and Social Welfare (MoHSW) in controlling malaria outbreaks in malaria unstable areas of Karagwe and Muleba districts in Kagera Region. In 2009, IRS operations were scaled up in Kagera to cover the remaining stable and high transmission areas covering the other five districts (Biharamuro, Bukoba Rural, Chato, Misenyi, and Ngara). In 2010, IRS operations were scaled up to cover 11 districts of Mara and Mwanza regions (see *Table 2* and *Figure 3*).

Table 2. Spray performance in Mainland Tanzania, 2007–2011

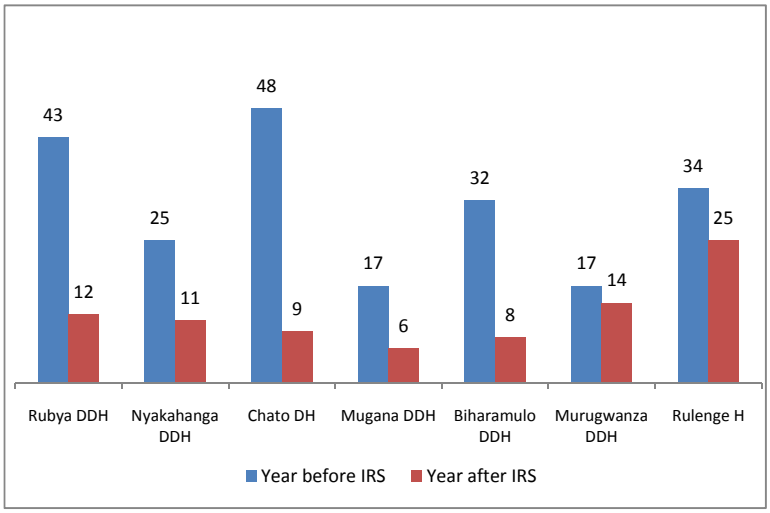
Houses sprayed and coverage %					
Districts	**2006–2007**	**2007–2008**	**2008–2009**	**2009–2010**	**2010–2011**
Kagera Region					
Biharamulo	-	-	-	31,382 (97.3%)	38,032 (94.4%)
Bukoba R	-	-	-	55,183 (95.5%)	60,548 (96.5%)
Chato	-	-	-	56,233 (97.0%)	60,571 (97.2%)
Karagwe	-	59,177 (98.5%)	103,631 (96.8%)	111,047 (99.8%)	115,669 (99.7%)
Missenyi	-	-	-	36,891 (95.2%)	37,698 (93.9%)
Muleba	34,745 (94.9%)	36,371 (98.7%)	81,586 (95.8%)	86,163 (99.8%)	101,394 (99.9%)
Ngara	-	-	-	48,219 (89.1%)	46,264 (84.8%)
Mara Region					
Bunda	-	-	-	-	45,811 (88.6%)
Musoma	-	-	-	-	60,363 (85.5%)
Rorya	-	-	-	-	47,200 (95.7%)
Serengeti	-	-	-	-	58,993 (99.4%)
Tarime	-	-	-	-	53,136 (96.9%)
Mwanza Region					
Geita	-	-	-	-	127,075 (99.7%)
Kwimba	-	-	-	-	52,718 (91.7%)
Magu	-	-	-	-	65,462 (83.1%)
Missungwi	-	-	-	-	38,693 (89.3%)
Sengerema	-	-	-	-	84,558 (97.0%)
Ukerewe	-	-	-	-	50,436 (95.4%)
Total	34,745 (94.9%)	95,548 (98.6%)	185,217 (96.3%)	425,118 (96.2%)	1,144,621 (94.5%)

Figure 3. Mainland Tanzania IRS scale up: Number of house structure sprayed per year (FY)



The impact of IRS has been seen in Kagera Region. All malaria-related indicators (e.g., number of OPD cases, blood transfusion, admissions due to malaria and anemia) decreased consistently (see *Figure 4*). In seven district hospitals, the positivity rate decreased by 61% (ranging from 18% in Murugwanza Hospital to 81% in Chato Hospital).

Figure 4. Positivity rate in seven hospitals in Kagera Region



Building on the successes of the preceding experiences in 2010 PMI decided to further scale up IRS in two other regions of the Lake Zone, Mwanza and Mara.

IRS Strategic Design for Zanzibar and Mainland Tanzania

Mainland Tanzania

In the 2008–2013 NMCP Medium-Term Strategic Plan, IRS is envisaged as being used in various settings in an integrated manner with other vector control

interventions, mainly (LLINs. The current strategic design for IRS is oriented with consideration of the geographic and climatic diversity in Mainland Tanzania (see *Figure 5*) and the consequent variation in the malaria situation, as described in the previous section. The strategic design for IRS will provide a rapid knock-down (generally 1–2 years of blanket spraying) effect on malaria transmission and prevalence. After this initial knock-down phase, IRS will contribute to the maintenance (or "keep-down phase," which involves another 1–2 years of targeted spraying in large geographic areas) of the eventually reached low endemic level. Following the introduction of appropriate surveillance, IRS will be scaled down to cover selected areas (through an additional 2 years of IRS campaigns). Finally, IRS will be implemented to preempt or contain focal transmission in identified hot spots to prevent malaria resurgence (see *Figure 6*). This ultimate step requires establishing effective surveillance and epidemic preparedness and response systems.

Figure 5. Strategic design for IRS implementation in Mainland Tanzania

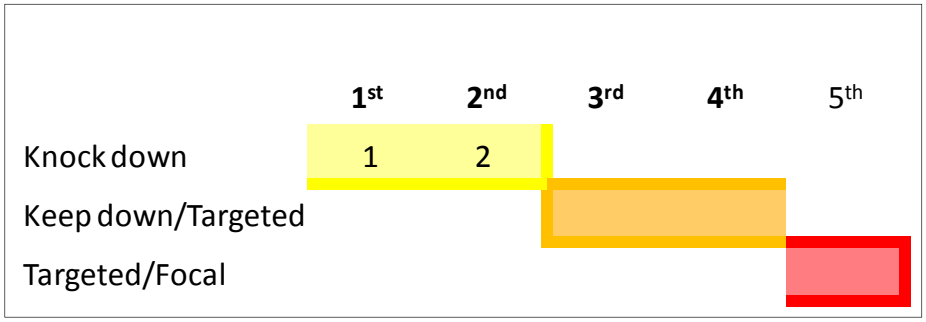
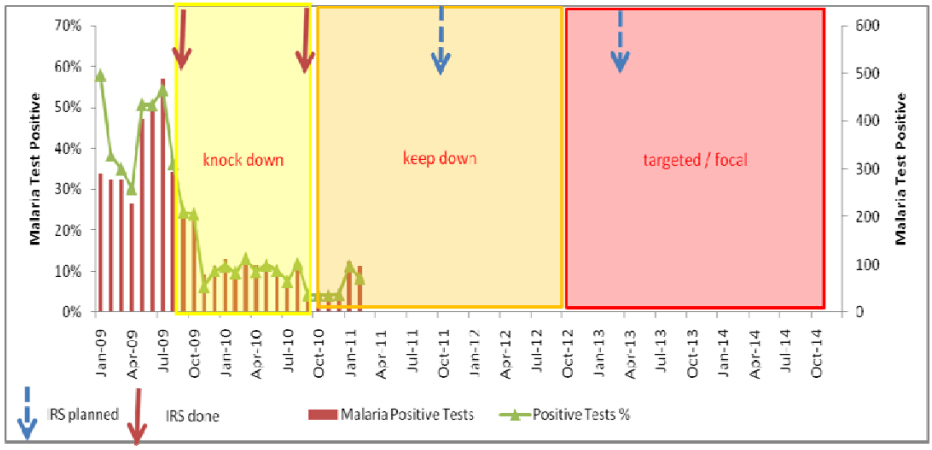


Figure 6. Malaria prevalence over IRS implementation plan in Mainland Tanzania



Zanzibar

After completing the sixth round of blanket spraying in Zanzibar in 2011, the islands will have reached a stage where future IRS applications will only involve targeted spraying. The IRS strategic design will be linked and integrated with the following

initiatives: 1) implementation of targeted IRS to complement completion and consolidation of scale up of universal coverage of LLINs; 2) implementation of focal spraying, beginning in year 3 as a component of malaria epidemic prevention and control, and maintenance of focal spraying; 3) implementation of an aggressive behavior change communication (BCC) campaign that will promote the continuous use of LLINs; 4) consolidation and expansion of the malaria surveillance system, including proactive malaria case detection; and 5) effective use of entomological monitoring as part of surveillance (see *Figures 7* and *8*).

Figure 7. Strategic design for IRS implementation in Zanzibar

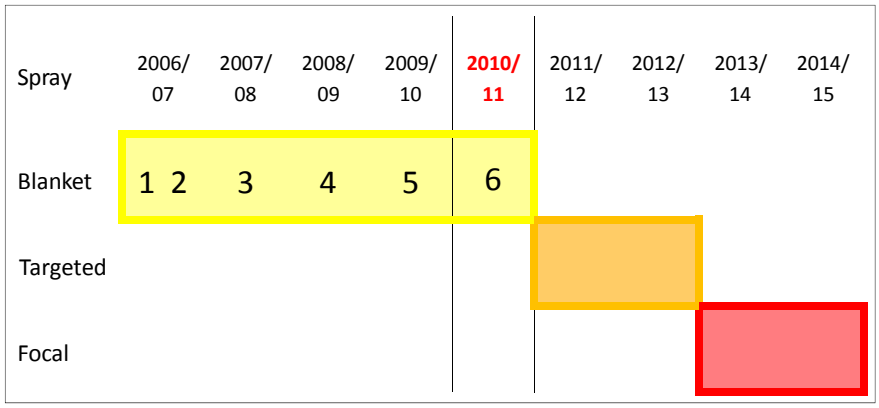
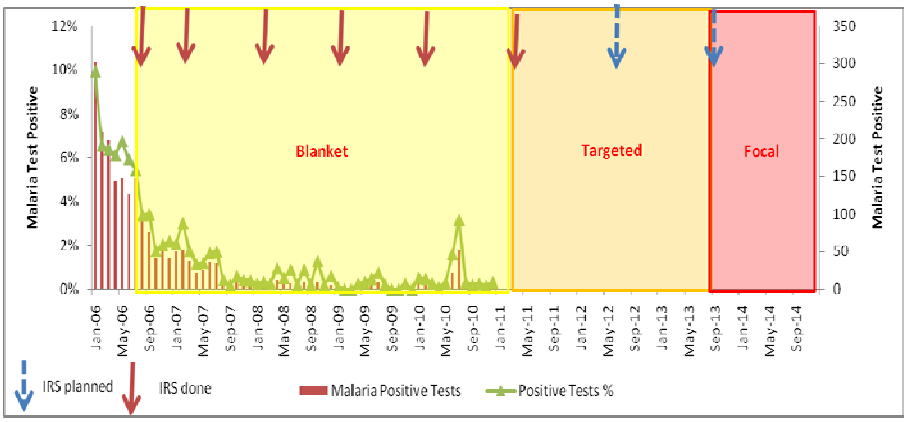


Figure 8. Malaria prevalence over IRS implementation plan in Zanzibar



Selection of Eligible Spray Areas

Mainland Tanzania

The districts were selected on the basis of the current country's strategic approach, which was to give priority to high endemic areas. Since the Lake Zone has the highest burden of malaria in Mainland Tanzania, it was decided in a 2009 PMI consultative meeting to give priority to areas with high malaria burden. Among the four regions of the Lake Zone, three have been selected either to continue (Kagera) or to expand IRS (Mara and Mwanza). The National Strategic Plan 2008–2013 indicates that rural areas

should be targeted. Therefore, the four municipalities of Musoma, Bukoba, Nyamagana, and Ilemela (Mwanza City) were excluded, and a total of 18 districts in the Lake Zone (Kagera Region, seven districts; Mwanza Region, six districts; and Mara Region, five districts) were therefore selected for IRS. In the 18 districts, the main urbanized areas were also excluded for logistic, epidemiological, and entomological reasons.

The other selection criteria for spray eligibility are the implementation of the strategic IRS design described in the previous paragraph. According to this strategic approach, some selected areas in Muleba and Karagwe districts were expected to shift from blanket to targeted spray. Due to the delay in reaching the prerequisites—universal coverage and use of LLINs and set up of a surveillance system—it was decided to include all the original eligible areas in both districts.

Zanzibar

Though it was expected to start the process to shift from blanket to targeted spray in Zanzibar during the 2010–2011 season, ZMCP, in consultation with partners, decided to carry out a further blanket spray. As in the previous rounds, due to logistic reasons, the four *shehias* of Zanzibar's Stone Town were excluded. The main reasons for exclusion included the delay in achieving universal use of LLINs and to provide more time to scale up intensified malaria surveillance. Nevertheless, the process of selecting targeted spray areas, based on entomological; epidemiological; and malaria risks, has been initiated.

IV. 2010–2011 IRS Preliminary Activities: Setting The Scene

Assessing the Environment and Planning Mitigation Options for the Safer Use of Pesticides

Environmental Assessment

RTI in collaboration with NMCP revised the Kagera Region Supplemental Environmental Assessment (SEA) to accommodate the new IRS regions of Mara and Mwanza in fulfillment of 22 CFR 216. The SEA was approved by USAID in July 2010 before the start IRS operations in the two new regions.

RTI in collaboration with the NMCP conducted a Preliminary Environmental Assessment (PEA) for the new IRS regions from August 17 to September 7, 2010, thus fulfilling the Tanzania environmental requirements (EMA Act No. 20: 2004). The PEA report was submitted to the National Environment Management Council (NEMC) on September 17, 2010, for review, but the program was given conditional approval to proceed with the spray operation.

Selection of Appropriate Insecticide

NMCP and ZMCP guidelines indicate that pyrethroid insecticides are to be used in Mainland Tanzania and Zanzibar. Lambda cyhalothrin is the first choice indicated by both programs. The project, following USAID regulations, selected ICON ® 10CS based on: 1) World Health Organization Pesticide Evaluation Scheme (WHOPES) approval; 2) registration by Tropical Pesticide Research Institute (TPRI) in Tanzania; 3) availability of a good profile on vector susceptibility in Tanzania; and 4) expected longer residual duration compared to other pyrethroids hence decreasing the frequency of spray and reducing costs

Insecticide Management and Environmental Mitigation Plan

After setting up a minimum standard for permanent and temporary storage facilities, the program quantified and selected the four levels of storage required: 1) zonal (two permanent warehouses); 2) regional (three warehouses); 3) district (18 temporary stores); and 4) and IRS sites (190 temporary IRS sub-stores). A total of 152 new effluent waste disposal structures and temporary storage and sanitary facilities were constructed, and 38 were inspected and repaired.

Guidelines and standard operating procedures (SOPs) for training of spray operators and pump technicians, including triple rinsing and inspection of pumps for leakage and their general maintenance, as well as disposal of washouts and solid waste, were developed. A training module for health workers on IRS staff safety, resident safety, and emergency preparedness in case of insecticide poisoning was prepared before IRS operations. In addition, a system of stock control—including bin cards, ledgers, issues vouchers, and weekly trackers—was used to manage pesticide stock to prevent pilferage and potential misuse, to promote safer use of pesticide, and to protect the environment and human health.

Pregnancy tests were provided to all female IRS staff prior to operations and medical attendance forms were designed to monitor undesirable and adverse reactions to chemicals for all IRS staff.

TVCSP designed and used insecticide tracking forms to monitor consumption and returned empty sachets.

SOPs for solid waste disposal, including empty sachets, according to best management practices, were developed.

Assessing the IRS Logistics

In March and April 2010, RTI and NMCP staff in collaboration with regional and district authorities conducted a comprehensive logistics assessment in all IRS districts in the Lake Zone. In Zanzibar, this activity was conducted in collaboration with ZMCP and districts authorities in October 2010. The assessment involved collection of information that facilitated the planning, designing, budgeting, implementation, and M&E of IRS operations (see *Figure 9*).

The assessment was carried out in stages —data collection, analysis, forecasting, procurement of goods and services, preliminary report writing, dissemination and

discussion with regional and district authorities, and production of a final report for each district. A logistics assessment report for each IRS districts was then elaborated. The report includes information on quantification and procurement of insecticide, IRS equipment, PPE, consumables of insecticide requirements, IRS selection of areas, spray operation sites, household and eligible house structure registration, human resource needs, and IRS plans and budgets (including activities, timelines, involved stakeholders, and indicators).

Figure 9. Activities included in comprehensive logistics assessment

Data collected by logistics assessment team

- Demographic statistics
- Administrative set up
- Main meteorological indicators
- Maps of the area, main geographical features, and road network
- Epidemiological malaria data
- Estimate of average sprayable surface

Tasks performed by logistics assessment team

- Selection of target rural areas suitable for IRS implementation
- Identification of main warehouse in each district
- Identification of locations to set up IRS sites
- Selection of catchment areas for the respective IRS sub-stations
- Calculation of total insecticide required per district and sub-stations
- Calculation of total insecticide required per district and sub-stations
- Quantification of human resources requirements per district and sub-stations
- Definition of the operational organogram
- Quantification of spraying equipment and PPE
- Set up stakeholders and technical committees and operative teams (e.g., logistic, advocacy and health education, vector control, M&E).
- Meeting with relevant partners/stakeholders; definition of roles and responsibilities
- Plan for entomological and parasitological monitoring
- Definition of a preliminary timeframe for activities
- Tentative budget for the operation
- Minimum requirements for selection of operation sites
- Availability of enough quantity of water (30 liters per operator per day)
- Distance from water source and assessment of water table to avoid contamination by effluent disposal
- Availability of enough storage space
- Access to communication facilities (e.g., road, phone network)

Important considerations for the technique of applying residual insecticides include the number, type, location, and accessibility of the structures and households to be

sprayed. This information is usually obtained by a detailed geographical reconnaissance of the target areas. In the Lake Zone, a large amount of information was collected during the logistic assessment, including number, type, and size of dwellings[2]. Based on these findings, the average surface area of different type of dwellings was calculated so that the total number of square meters of surface to be sprayed, and hence the amount of insecticide to be used, has been determined. Adequate maps were also obtained showing administrative boundaries, roads, location of villages, water points, and other important features. Therefore, due to the limited time and since enough information was obtained during the logistic assessment, the team decided that the geographical reconnaissance was not necessary. Instead, house structure registration for IRS was selected as the most appropriate and functional method to assess the targeted structures.

Selecting the Ideal Period of Spray and Preparing the Operation Plan

Rationale for Selection of Spray Period in Lake Zone and Zanzibar

The rainfall pattern in both the Lake Zone of Mainland Tanzania and Zanzibar is bimodal, with maximum precipitation in the two periods of March–May and September–December. The two relatively dry periods of January–February and June–August are characterized by high mosquito density and high malaria transmission. Assuming an ideal potency of the selected insecticide (ICON ® CS) up to 6 months (over 90% 24-hour mortality) and a progressive but still acceptable (up to 80% 24-hour mortality) decay starting from the sixth to the ninth month—in order to perform one IRS round per annum—the following model has been developed. The maximum potency of insecticide should cover the two expected high mosquito density peaks of January and May, respectively, in order to anticipate the high malaria transmission periods. According to the model, two potential periods of spray were identified—September and January. Since IRS logistics are quite difficult during the rainy period, RTI indicated a range where IRS can be carried out—August-October (first IRS season) and December–February (second IRS season). The interaction between epidemiological, climatic, and entomological cycles, and their relation to the expected residual effect of insecticide is illustrated in *Figures 10* and *11*.

[2] *Census 2002, Vol VII for 18 districts*

Figure 10. Modeling IRS: Precipitation, mosquitoes, and malaria cycles in relation to insecticide duration assuming spray in December

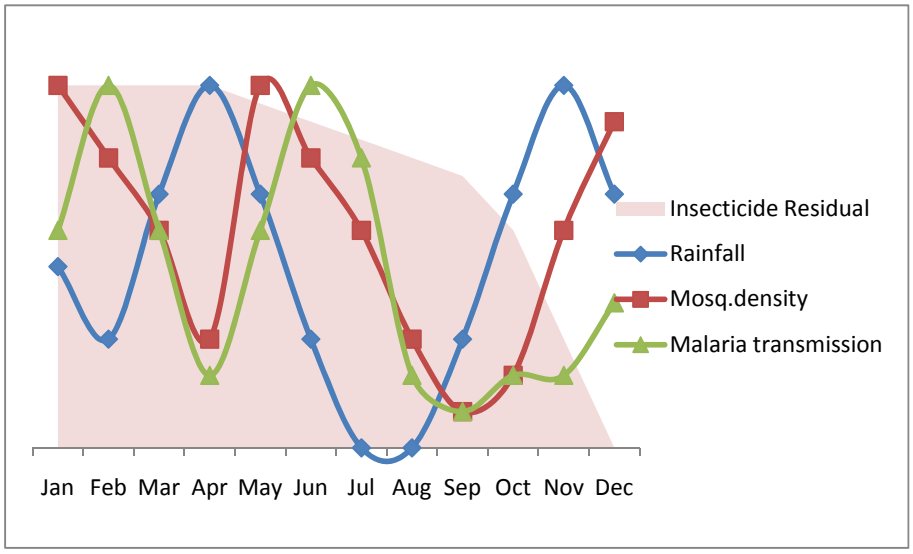
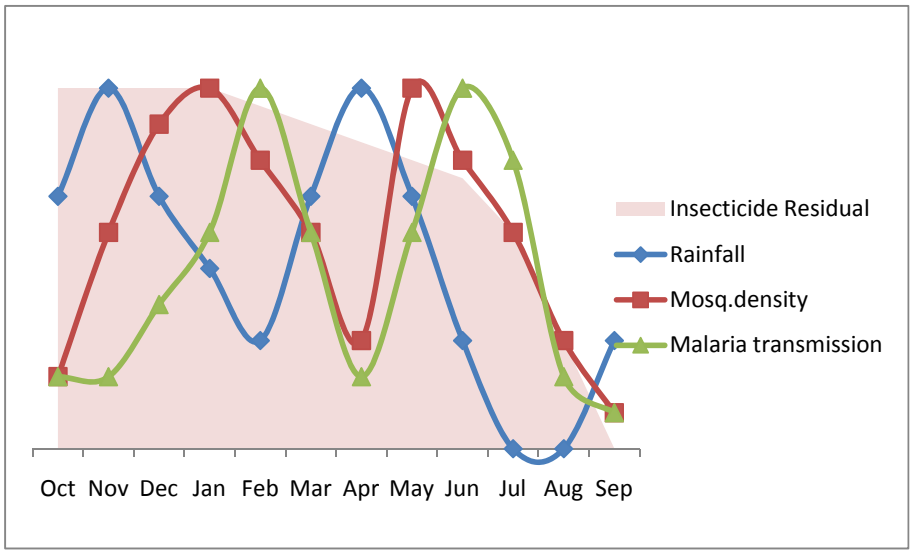


Figure 11. Modeling IRS: Precipitation, mosquitoes, and malaria cycles in relation to insecticide duration assuming spray in September

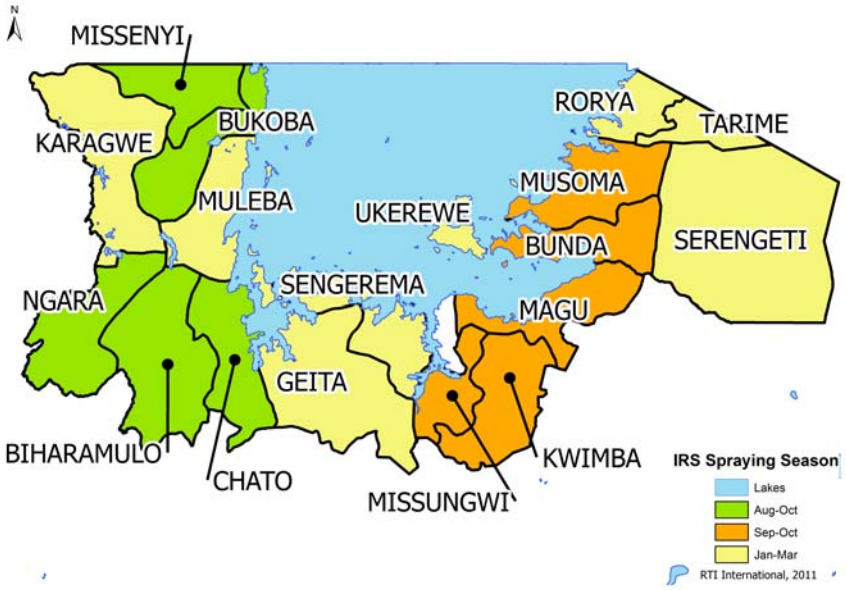


Spray Season

IRS operations in the Lake Zone were conducted in two seasons: 1) September–October, 2010 (season one) and January–March, 2011 (season two).This was essentially determined by precipitation (immediately before the short and long rainy seasons) to 1) provide ideal logistics for the operations (minimal rainy days) and 2) maximize the protection during the transmission peaks, as described in the model in the previous section. Another important reason was to optimize the use of human resources for training and supervision. In Mwanza and Mara, RTI in collaboration

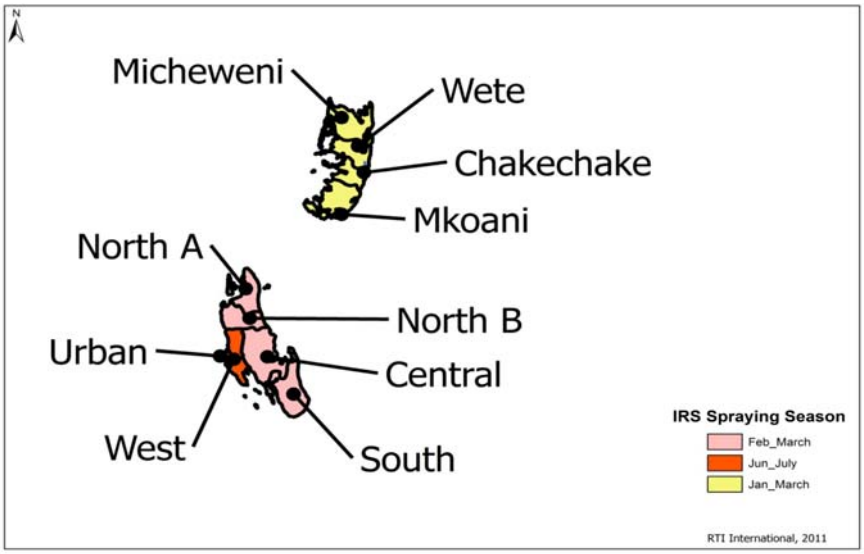
with the NMCP and regional and district authorities, conducted round one blanket spraying. In the first IRS season, between September 23 and October 27, 2010, IRS was conducted in the three districts of Kwimba, Magu, and Missungwi, in Mwanza Region, and the two districts of Bunda and Musoma Rural districts, in Mara Region. In the second IRS season, between January 17 and March 25, 2011, the districts sprayed were Geita, Sengerema, and Ukerewe in Mwanza Region and three districts of Rorya, Serengeti, and Tarime in Mara Region. In Kagera Region, a second round of IRS was conducted during the first season (August to October 2010), covering the five districts of Bukoba, Missenyi, Chato, Biharamulo, and Ngara. Whereas the second season (January–March 2011) covered the districts of Muleba and Karagwe, where IRS was implemented for the fifth and fourth rounds, respectively, in targeted areas and for a third round in the extended areas (see *Figure 12*).

Figure 12. Spray seasons in Mainland Tanzania, August 2010–March 2011



In Zanzibar, RTI in collaboration with ZMCP conducted the sixth round of IRS in all 10 districts. The spray periods were selected according to the same logistic and entomological reasons described above and according to the previous round of implementation to optimize the use of insecticide (see *Figure 13*). Between January and March 2011, a sixth round of blanket spraying in eight districts of Zanzibar was conducted while the spraying in the remaining two districts of Urban and West, as well as Tumbato Island, were conducted in June 2011 due to the delayed implementation of the fifth round (July–August 2010) in these areas.

Figure 13. IRS spray season in Zanzibar



Setting the Targets

In Mainland Tanzania, according to the eligibility criteria, 18 districts, 460 wards, 2,024 villages, 10,912 hamlets, and 1,211,596 house structures were included in the IRS plan (see *Table 3 and Annex A*). In Zanzibar, 10 districts, 335 *shehias*, and 205,892 house structures were eligible for the sixth round of IRS (see *Table 3 and Annex A*).

The targets were established by taking into account the main available statistics up to village and sub-village levels: 1) 2002 population census projections; and 2) data collected in the recent malaria interventions (IRS previous rounds and LLIN distribution campaigns). These data were useful in the planning process, but in some cases, there was significant variation between IRS performance data (actual household registered during IRS) and other data as stated above. To overcome this problem in the second IRS season, a system of household registration for eligibility was introduced. The second reason of undertaking the household registration was to establish a permanent registry at sub-village level (hamlet) with malaria preventive campaign indicators. The approach involved design and printing of household registers, designing of registration protocol, designing of statistical templates for analyzing data, and training of actors. RTI staff trained the district IRS technical team, ward, and village executive officers who in turn trained hamlet leaders. The hamlet leaders conducted the house to house registration. Information captured included name of household head, number of people in the household categorized by sex, and number of sprayable structures. Also, the household register design provides a follow up of a household in the hamlet up to 5 years. The registration was conducted in six districts—Geita, Sengerema, and Ukerewe in Mwanza Region and Tarime, Serengeti, and Rorya in Mara Region. Other districts will be covered soon before performing the next IRS round.

Table 3. Zonal and Regional targets hamlets

Region/zone	Kagera Region	Mara Region	Mwanza Region	Lake Zone	Pemba	Unguja	Zanzibar	Tanzania Total
Eligible households	477,547	285,816	448,233	1,211,596	78,320	127,572	205,892	1,417,488
Population eligible	2,327,112	1,514,738	2,793,904	6,636,706	414,552	678,026	1,092,559	7,729,265
IRS Sites	59	44	70	173	7	11	18	191
Wards or shehia	152	131	177	460	127	208	335	795
Villages	719	533	772	2,024	-	-	-	2,024
Hamlets	3,928	2,616	4,368	10,912	-	-	-	10,912
Wards per district	19.0	26.2	29.5	25.6	-	-	-	-
Villages per ward	4.7	4.1	4.4	4.4	-	-	-	-
Hamlets per village	5.5	4.9	5.7	5.4	-	-	-	-
Houses per hamlet	122	109	103	111	-	-	-	-
Ward (*shehia*) per site	2.6	3.0	2.5	2.7	18.1	18.9	18.6	-
Villages per site	12.2	12.1	11.0	11.7	-	-	-	-
Hamlet p**er site**	66.6	59.5	62.4	63.1	-	-	-	-

Establish District IRS Management

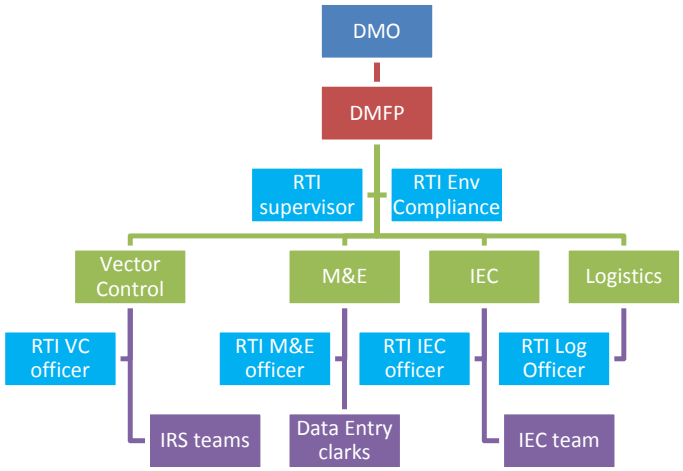
In Mainland Tanzania, the basic IRS management and implementation unit is the District IRS Technical Committee (DITC). A total of 18 DITCs were established, one in each district. In Zanzibar, the functional management and implementation units were located at zonal level in the two ZMCP offices of Zanzibar for Unguja and Wete for Pemba.

The DITC is chaired by the District Medical Officer (DMO) and includes five main staff positions: 1) Malaria IMCI focal person (IRS coordinator); 2) vector control, 3) M&E; 4) logistic officer/storekeeper; and 5) health education focal persons. RTI provided support to the DITC through the initial training and by seconding one or two consultants during the operations for further on job training of the district team and mentoring. An overall RTI supervisor from the RTI zonal or regional office was appointed for each district.

Offices for the 18 DITCs activities have been provided by the health authorities in the proximity of the district temporary IRS warehouse. The offices have been refurbished and equipped by the program with computers and accessories and with communication equipment (modems). The malaria focal persons for the respective districts were the responsible for the day to day office running.

Implementation teams (sub-units) for advocacy and health education, vector control, and M&E (see *Figure 14)* were meeting daily during the IRS operations while the DITC was scheduled to meet weekly.

Figure 14. Organization structures for district IRS implementation



Developing and Organizing the IRS Sites: Standardizing Procedures

Spray Sites Design and Phases

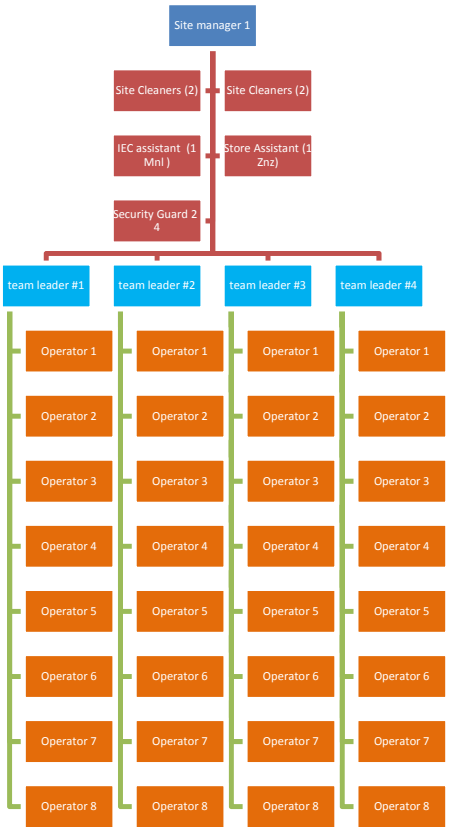
Since 2006 in Zanzibar and Tanzania, RTI promoted a community-based IRS delivery model that involves extensive use of human resources and large deployment of

logistics. The program requires a high degree of organization and capacity (see *Figure 15*).

The IRS design is based on the operation site (OS). Each site has an operation target, ranging from 5,000 to 10,000 houses (excluding hard to reach areas). The OS is provided with adequate infrastructure for effluent waste disposal, sanitary accommodations for operators, and storage facilities. The organizational structure of the OS is led by a site manager and includes an average of four spray teams (range 2–8) and 4–6 site attendants. Time of operation per site, number of operation days, and allocated resources (e.g., human resources, insecticide, equipment, and consumables) are calculated based on targets. An operation time not exceeding 30 days per site has been selected as the cut-off (15 days for bi-phase operation model, see below).

Each IRS team has eight operators, with an average of 32 spray operators per site. Each team is headed by a team leader. The team leaders and spray operators were selected from the targeted communities. The manager for this operation site is assisted by support staff for spray equipment maintenance, suit washing, site cleaning, water fetching, and security. A rate of 10 sprayed houses per operator per day has been used to calculate the daily workload. An average of 30 liters of water per each operator per day has been calculated. In the predominant rural areas, water was provided by using staff fetching water from the nearest source.

Figure 15. IRS teams organizational structure



A total of 172 operation sites in Mainland Tanzania (average of nine sites per district) and 18 in Zanzibar (average of 1.8 sites per district) were used in the 2010–2011 IRS season (see OS location in *Annexes G, I, K,* and *M*). All sites were refurbished/ renovated to comply with international and local environmental impact and mitigation measures for safe pesticide use, storage, and sound effluent waste disposal. The sites therefore comply with WHO/FAO's Pesticide Storage and Stock Control/User Guidelines.

Two different implementation designs have been used in the 2010-2011 campaign—1-phased and 2-phased. In the 1-phased model, all IRS operational sites are run concurrently while in the 2-phased design, the district is divided into two operational areas working in two consecutive phases. Since the total duration of the IRS operations in the districts should not exceed 31 days, the 2-phased design requires a higher number of operators by site working in a short period—approximately 15 days. The advantage of the 2-phased design is that only half of the spray equipment is required since durable items are moved from sites working in the first phase to the ones working in the second phase. More supervision and quality control is expected to be ensured by district overseers in the 2-phased design since sites are working at different times (see *Figures 16 and 17*).

Figure 16. District IRS site structure 1-phased design

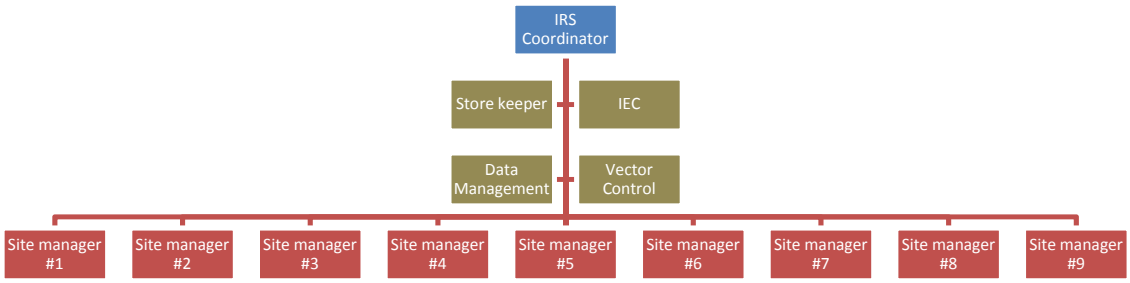
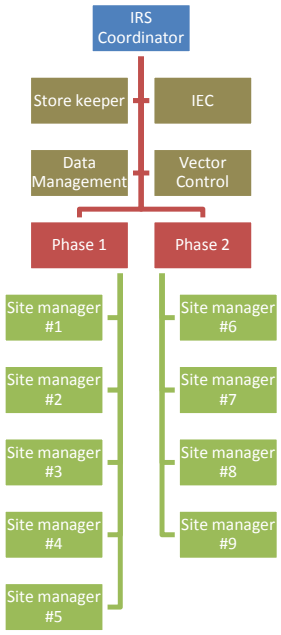


Figure 17. District IRS site structure 2-phased model



Insecticide Quantification, Procurement, Safe Transport, and Storage of Insecticide

The quantification of lambda-cyhalothrin was calculated during the logistic assessment. The following assumptions were adopted for both Zanzibar and Lake Zone: application rate of 0.25 gr. per square mile (sqm) and average sprayable surface of 125 sqm per house structure. The logistics assessment anticipated a total of 1,417,488 structures to be sprayed in Mainland Tanzania and Zanzibar. Based on the above assumptions, a total of 44,297 liters of ICON 10CS was quantified. A new stock of ICON 10CS (36,000 liters) was procured and transported to the ports of entry (Zanzibar and Dar es Salaam), and from there to the zonal warehouses of Zanzibar and Mwanza and added to the existing stock (8,500 liters).

All pesticides, spray operators, PPE, and other equipment were procured according to USAID and RTI policy. Prior to the long-distance transport of the insecticide from the port of entry to the central store and to the district, RTI was responsible for informing the contracted transporter about general issues surrounding the insecticide and how to handle emergency situations (e.g. road accidents). Training included the following information: intended use the insecticide; toxicity of the insecticide; understanding security issues; implications of the insecticide getting into the public; handling an accident or emergency (according to FAO standards); combustibility; and combustion byproducts of insecticide. Insecticide samples received from supplier were sent to an independent WHO-certified[3] laboratory to be analyzed for quality. Results from the analysis indicated an active potency level of the active ingredient of the insecticide. Additional quality assurance analysis was done in-country at TPIR-Arusha.

[3] AgriQ Quest, Netherlands.

Handling Equipment, Materials, and Vehicles

Quantification and procurement of insecticide, IRS equipment, personal protective PPE, and consumables was provided by the central RTI IRS unit. The quantification included the reconciliation of available supplies in the warehouses, further requirements for replacements, and coverage of new areas.

Quantification of vehicles for operator transport for each district and site was also provided by the RTI IRS unit. A total of 463 vehicles and 29 boats were needed to transport operators from IRS operational sites to targeted villages and to the islands of Zanzibar and in Lake Victoria, in Mainland Tanzania. All vehicles were inspected and certified from competent road and marine authorities. All vehicle drivers and boat captain were instructed on environmental mitigation measures during and after the end of spray operations.

Distribution of insecticides and other IRS supplies was done at two levels, from regional/zonal stores to district stores and from district stores to sub-stores at IRS staging sites. Special transport was provided for distribution at those levels.

Managing Human Resources for IRS

IRS operations require a large number of temporary operational IRS field staff and other technical, coordination, and supervisory support staff during IRS operation. RTI in collaboration with district authorizes have recruited 10,417 temporary staff, 9,163 in Mainland Tanzania and 1,254 in Zanzibar, for a period ranging from 6–28 days (see *Table 4*). The selection process was led by local government authorities and supervised by the delegated DITC and RTI personnel (see *Figure 18* for the selection criteria). Broad and equal representation from targeted communities was sought. Mechanisms were set to guarantee a transparent and fair process. Even though gender balance was set as a selection criterion, only a quarter of the temporary laborers selected by the community was female (see *Table 5).*

The selected persons provided personal details, a photograph, bank account details, and a medical certificate of good health. All documents were filed, and an identity card was provided by respective RTI offices. A consent form was also signed. At the IRS operational site level, a file for each temporary staff was opened to include medical attendance form and other personal documents. All female operators were tested for pregnancy prior to enrollment, and those who tested positive were disqualified.

Temporary staff compensation was transferred to personal bank accounts by the RTI finance team at fixed intervals (2 weeks).

Figure 18. Criteria for IRS operators selection

- Age: 18–40 years
- Sex: Either (50% or more women)
- Education: Standard seven and above and efficient in reading and writing Kiswahili
- Have a valid NMB personal account

- Be a community-owned resource persons: village health workers and community development agents
- Accepted in the community
- Healthy enough to carry pumps and walk long distances
- Experience
- Physically and mentally fit
- Resident of the service area

Table 4. Temporary staff recruited to support IRS operation

	Lake	Zanzibar	Total
Spray operators	6,208	897	7,105
Tem leaders	776	121	897
Supervisors	160	-	160
Site managers	172	18	190
Drivers operators cars	398	67	465
Pump technician	245	38	283
Cleaners	172	19	191
Suit washers	344	41	385
Watchmen	344	34	378
Water fetcher	344	-	344
Store keepers	-	6	6
Assistant store keepers	-	13	13
Total IRS staff	9,163	1,254	10,417

Table 5. Temporary staff recruited during IRS by gender

	Staff cadre	Male	Female
IRS field staff	Team leaders and supervisors	77%	23%
	Drivers	100%	0%
	Spray operators and site attendants	73%	27%

	Staff cadre	Male	Female
	IRS teams total	**74%**	**26%**
District staff	Clinician trainer of trainers (TOT)	83%	17%
	Clinician	74%	26%
	Data Management	33%	67%
	DITC	80%	20%
	Master trainers IEC	57%	43%
	Master trainers IRS	83%	17%
	Store management	100%	0%
	District IRS staff total	**76%**	**24%**

Informing and Mobilizing Communities

RTI carried out IEC activities and community mobilization in collaboration with three main partners JHU-CCP, local government authorities, and community-based organizations (CBOs).

IEC Materials Development

JHU-CCP has been subcontracted to provide technical support in the revision of IEC printed materials and development of media spots for IRS. JHU-CCP, in collaboration with RTI and NMCP, revised the existing IEC materials (e.g., leaflets and posters) used in previous IRS rounds and developed additional IEC materials (FAQ and flip charts) that were used during the second spray season (January−March 2011). The IEC materials printed and distributed include 1) informative leaflets and brochures on IRS for communities (751,892 copies); 2) banners displayed on IRS vehicles and IRS operation sites (200); 3) posters placed to public notice boards, streets, markets, and at the health facilities (25,240 copies); 4) IRS fact sheets for community leaders (10,000); 5) FAQ brochures (10,000); 6) flip charts for community sensitizers (1,000); 7) t-shirts (3,000); and 8) fact sheet for communities in Zanzibar (170,000).

Electronic Media Spots Development

JHU-CCP produced three radio spots and one jingle that used humor and drama to engage listeners and to detail the actions that households need to take to prepare for the spray exercise. The spots also debunked certain misconceptions relevant to those communities. These radio spots aired on local FM radio stations, including Lake Victoria FM Radio in Mara Region; Community Radio FM, Living Water FM Radio, and Kwa Neema FM Radio in Mwanza; and Karagwe FM and Kasibante FM in Kagera. JHU-CCP also organized radio discussions on local radio stations; they arranged for IRS experts and people whose households were sprayed previously to

discuss their experiences with IRS on the air and took calls from audience members. These call-in discussions were aired twice a week before and during spray operations.

Advocacy to Local Government Authorities and Community Leaders

Local government authorities (DMOs, district IEC persons, malaria focal persons, ward leaders, and village and hamlet leaders) were identified to inform and support the leadership at the community level in carrying out IEC activities (see *Table 6*). Only 10% of the 6,188 community leaders involved in the program were female, reflecting the gender unbalance in the government administration (see *Table 7*).

Table 6. Advocacy agents by region and zone

	Kagera	Mara	Mwanza	Lake Zone	Pemba	Unguja	Zanzibar	Tanzania
Regional advocacy	22	19	23	64	-	-	-	-
District advocacy	175	125	150	450	60	90	150	600
Village executive officers (VEO)	719	533	772	2,024	-	-	-	2,024
Village chairpersons	719	533	772	2,024	-	-	-	2,024
Ward executive officers (WEO)/sheha[4]	152	131	177	460	130	180	310	770
District councilors	152	131	177	460	130	180	310	770
Total	-	-	-	-	-	-	-	6,188

Table 7. Gender proportion of community leaders involved in IRS advocacy

	Male	Female
Village advocacy	91%	9%
Ward advocacy	93%	7%
District advocacy	83%	17%
Regional advocacy	87%	13%

[4] In Zanzibar, the *sheha* is the government designated executive officer for the *shehia*.

	Male	Female
Advocacy persons total	90%	10%

Establishment of an Interpersonal Communication System

A total of 26 NGO/CBO/FBO and six local health authorities were contracted out by RTI to provide thorough interpersonal communication information and education to the communities. A total of 11 organizations were selected in Mara, 11 in Kagera (six health departments and five CBOs), and 17 in Mwanza (see *Table 8*).

These IEC partners were selected (see *Figure 19*) to carry out advocacy and sensitization of leaders and the community in all districts and wards to secure acceptance, compliance, and contributions from the beneficiary community and leaders. An IEC master training curriculum and package was developed by RTI. The selected IEC partners were trained by RTI on different participatory approaches of IEC/BCC, how to conduct trainings, how to facilitate sensitization meetings, how to monitor activities, and how to conduct effective supervision, planning of activities, time management etc.

The CBO/NGO team was posted to the district wards to mobilize the community members to the hamlets, within the villages. Both the WEOs and VEOs collaborated with the mobilization teams to ensure community preparedness for household indoor residual spraying activity according to spraying schedule.

The IEC partners were able to train just over 10,900 hamlet leaders in all villages of Lake Zone and 930 in all Zanzibar *shehias* (see *Table 9*).

Table 8. Community inter-personal communication agents by region and zone

	Kagera	Mara	Mwanza	Lake Zone	Pemba	Unguja	Zanzibar	Tanzania
Hamlet chairpersons	3,928	2,616	4,368	10,912	-	-	-	10,912
Sheha IEC focal persons (3 per *shehia*)	-	-	-	-	390	540	930	930
Total	5,867	4,088	6,439	16,394	710	990	1,700	18,094

Figure 19. Selection criteria, tasks, and deliverables for IEC partners (CBOs/NGOs and CHMT)

Selection criteria

- Experience in community project intervention, implementation, mobilization, and sensitization.
- Organization capacity in terms of facilities, vehicles, and manpower.
- Experience in program intervention advocacy and sensitization specifically in Malaria intervention
- Ability to provide administrative and financial compliance

Tasks assigned to IEC partners

- Facilitating wards' TOTs trainings
- Facilitating ward-level IRS sensitization meetings/training
- Overseeing village-level IRS sensitization meetings/training
- Ensuring timely, adequate, and appropriate information and education on IRS are communicated to all people at the household level
- Conducting follow up in their catchment areas to make sure they have been sprayed as planned
- Overseeing all mobilization/sensitization meetings in all levels and making sure of the flow of message/information given out is of high quality
- Overseeing the distribution of IEC materials (e.g., posters, brochures, and banners), making sure they reach desired destination and posters are posted in public places (i.e., village centers, hospitals, shops, etc.)
- Conducting random spot-checks while hamlet leaders are visiting households/conducting hamlet meetings.

Deliverables

- Produce a comprehensive activities report about the whole exercise; the report must have the following:
  - Number of IEC materials distributed (e.g., posters, brochures and banners)
  - Number of hamlet reached
  - Number of households reached
  - Number of households visited
  - Challenges encountered and recommendations
- Produce a comprehensive financial report cumulatively and breakdown for each item/activity

Table 9. NGO/CBO/FBO selected to provide IEC for IRS in Lake Zone

Region	District	Organization	IRS site	Ward	Village	Hamlet	Household
Kagera	Biharamulo	CHMT Biharamulo	6	8	79	377	34,631
	Bukoba	CHMT Bukoba	8	20	79	406	48,605

Region	District	Organization	IRS site	Ward	Village	Hamlet	Household
	Bukoba	MF	2	4	16	102	11,713
	Chato	CHMT Chato	10	22	112	536	58,743
	Karagwe	CHMT Karagwe	4	9	46	422	41,858
	Karagwe	WEVIDA	5	9	31	312	31,471
	Karagwe	WOMEDA	5	13	42	422	38,458
	Missenyi	CHMT Missenyi	6	17	76	356	38,971
	Muleba	WAMATA	9	13	63	265	41,909
	Muleba	WEVIDA	6	18	73	340	55,100
	Ngara	CHMT Ngara	7	21	78	390	55,024
Mara	Bunda	TRC	6	12	50	225	25,822
	Bunda	COHESA	6	10	54	208	25,157
	Musoma	COHESA	5	9	36	226	22,173
	Musoma	MDF	5	8	33	222	20,562
	Musoma	VIFAFI	8	10	44	285	25,787
	Rorya	AIC	4	12	39	204	19,220
	Rorya	HUPEMEFU	4	11	43	241	19,584
	Serengeti	COHESA	4	15	57	249	26,649
	Serengeti	IMARA	3	15	59	208	23,156
	Tarime	GRISO	3	18	58	302	27,895
	Tarime	SACHITA	6	20	52	246	22,145
Mwanza	Geita	CODERTORG	5	13	53	222	31,381
	Geita	KILUTHA	5	11	49	198	35,715
	Geita	NERICO	3	11	62	246	21,963
	Geita	TRUST and HOPE	5	12	53	252	32,480
	Kwimba	EAPS	8	13	42	291	21,539
	Kwimba	KWISE	5	7	28	188	12,052
	Kwimba	MAPERECE	7	11	48	256	21,331

Region	District	Organization	IRS site	Ward	Village	Hamlet	Household
	Magu	GRISO	8	10	46	290	27,268
	Magu	HUPEMEFU	9	11	46	270	26,278
	Magu	UPENDO	7	8	36	235	25,651
	Missungwi	ECOT	8	12	47	351	24,252
	Missungwi	TSAEE	6	8	31	329	18,261
	Sengerema	BADILIKA	4	13	56	259	26,911
	Sengerema	EAPS	2	10	41	144	18,182
	Sengerema	HAI	5	14	66	373	47,185
	Ukerewe	KIMEDEUS	8	16	34	234	21,829
	Ukerewe	MF	7	13	34	230	20,729

CHMT: Council health management team; **MF**: Mushemba Foundation; **WEVIDA** :West Victoria Development & Health; **TRC**: Tanzania Red Cross Society; **COHESA**: Community Health Services Agency; **MDF**: Mara Development forum; **VIFAFI**: Victoria Farming & Fishing Organisation; **AIC**: Africa Inland Church Tanzania; **HUPEMEFU**: Huruma Peace Mercy Foundation; **GRISO**: Grassroots Initiatives Support Organization; **SACHITA**: Save the Children of Tanzania, **KILUTHA**: Kirutha Enterprises; **NELICO**: Newilgh Children Center Organization; **EAPS**: Environmental & Agricultural Promotions and Services; **KWISE**: Kwimba Save the Elderly; **MAPERECE**: Magu Poverty Focus on Older people Rehabilitation; **ECOT**: Envirocomet; **TSAEE**: Tanzania Society of Agricultural Education & Extens; **BADILIKA**: Badilika Foundation; **HAI**: Health Action Initiative; **KIMEDEUS**: Kikundi cha Mila na Desturi Ukerewe; **MUSHEMBA**: Mushemba Foundation; **UPENDO**: Upendo Community Based Organization; **WOMEDA** : Women Media Development Association; **WAMATA**: Waliokatika Mapambano na AIDS Tanzania.

Managing Knowledge and Skills

IRS Teams Training

IRS trainings for field IRS teams were conducted in a cascade fashion to manage the large number of trainees scattered in the large area of more than 100km^2 (see *Figure 20*). In the Lake Zone and in Zanzibar, a total of 11,050 (9,796 and 1,254, respectively) persons were trained before IRS operations. Among them 9589 were IRS spray teams while the remaining 1461 were district, and zonal supervisors and technical staff (see *Table 5*).

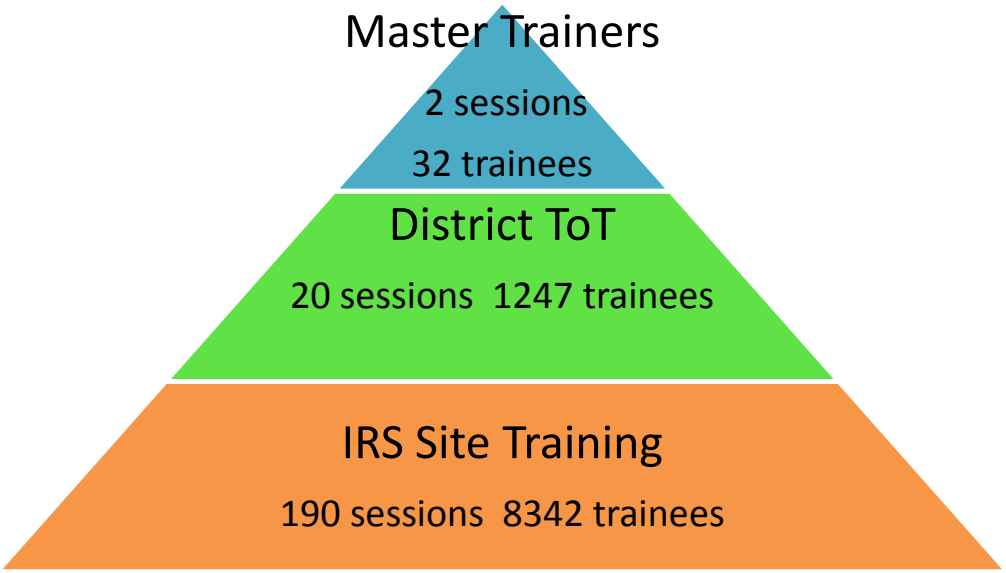
Important aspect of IRS operations training includes: 1) providing skills and ability to perform IRS to all people involved in IRS activities; and 2) strengthening the capacity to implement and supervise the IRS program at the national, regional, and local levels.

A training curriculum and training package, including SOPs, was developed prior to the start of the training. The package consists of the following 10 modules: 1) Basic Knowledge on Malaria; 2) Basic Principles of IRS; 3) Environmental Compliance in IRS and Human Safety; 4) Advocacy and Community Mobilization; 5) Pesticide adverse reaction Management; 6) IRS General Management; 7) IRS Site

Management; 8) Strategic Information Management; 9) Standard Operation Procedure for IRS staff; and 10) Maintenance of Sprayer.

Two different trainings were provided for newcomers and staff involved in previous operation (i.e., refresher training).

Figure 20. Cascade of training for IRS operation



Formal orientation training and several other training opportunities were conducted for the 108 DITC members in the 18 districts of Mainland Tanzania and in 10 districts in Zanzibar.

IRS masters training involved district malaria focal persons and the vector control officers. This training was provided by RTI staff at the zonal level (see *Figure 20*). All site managers, team leaders, and team supervisors were trained by the IRS masters trainers as district ToTs.

Spray teams' training was conducted by district ToTs. The main content of training included spray operation techniques, data collection, equipment maintenance, and decontamination and safety measures.

Other specific training occasions included various staff who provide additional support to the operational site during spray operations, such as clinicians, data clerks, store keepers, and drivers.

Table 10 delineates the total number of training sessions and trainees that underwent training in each of the targeted zones.

Advocacy Training

A 1-day orientation training was delivered to over 6,000 community leaders at different levels (see *Table 11*) to advocate their involvement in the IRS operations. The training was conducted by RTI and IEC partners.

Table 10. Training conducted to technical team during IRS operations

Cadre	Lake Zone			Zanzibar			Total	
	Sessions	Trainees	Trainees per session	Sessions	Trainees	Trainees per session	Sessions	Trainees
RHMT	3	30		-	-	-	3	30
DITC		108	6	-	-	-	18	
IRS master trainers	2	32	16	-	-	-	2	32
IEC master trainers	2	32	16	-	-	-	2	32
District ToT	18	1,108	62	2	139	70	20	1,247
Spray team staff	172	7,313	43	18	1,029	57	190	8,342
Drivers	18	398	22	2	67			465
Data managers	2	19	10	-	-	-	2	19
Store keepers	2	18	9	2	19	10	4	37
Clinicians master trainers	2	18	9	-	-	-	2	18
Clinicians		720	40	-	-	-	18	
Total	257	9,796	38	24	1,254	52	281	11,050

Table 11. Training conducted for advocacy teams during IRS operations

Cadre	Responsible for training	Lake Zone			Zanzibar			Total	
		Sessions	Trainees	Trainees per session	Sessions	Trainees	Trainees per session	Sessions	Trainees
Regional advocacy	RTI	3	64	21	-	-	-	3	64
District advocacy	RTI	18	450	25	2	150	75	20	600
District councilors (WDC)	IEC partner	18	460	26	10	310	31	28	770
VEO	RTI and IEC partner	18	2,024	112	-	-	-	18	2,024
Village chairpersons	RTI and IEC partner	18	2,024	112	-	-		18	2,024
WEO/*sheha*	IEC partner	18	460	26	10	310	31	28	770
Total advocacy	-	93	5,482	59	22	770	35	115	6,252

Community IEC Agents' Training

A 1-day training was delivered to approximately 12,000 community members at the sub-village level in Mainland Tanzania and at the *shehia* level in Zanzibar *(*see *Table 12).* These community members were instructed on household registration and on house to house interpersonal communication. The training was conducted by the IEC partners.

Table 12. Training conducted to community teams during IRS operations

Cadre	Lake Zone			Zanzibar			Total	
	Sessions	Trainees	Trainees per session	Sessions	Trainees		Sessions	Trainees
Hamlet chairpersons	719	10,912	15	-	-	-	719	10,912
Ward/*sheiha* IEC	-	-	-	10	930	93	10	930
Total IEC training	719	10,912	15	10	1,005	101	729	11,917

Monitoring the Process

With IRS going on concurrently in multiple districts, systematic monitoring was established in order to follow up on the inputs, processes, and outputs. Information was collected and then utilized before, during, and after spraying.

More importantly, daily monitoring during the operations was important to ensure processes and outcomes were monitored, thereby allowing timely detection of gaps and constraints in order to trigger adequate responses accordingly.

A comprehensive set of indicators were managed at different levels and times.

To facilitate effective daily monitoring, RTI appointed a focal person in every region, whose responsibility was not only to supervise operations but also to collect IRS data at district offices. They also managed the data management unit, whose job was to enter relevant information on the indicators collected on an electronic IRS database created for each IRS district. The information on the database reflected the information collected on the ground by spray operators, team leaders, supervisors, and site managers. The flow of information was as follows below.

Spray operators collected information on households (e.g., sprayed, visited, not reached), demographics (e.g., high-risk population, children over five years of age), refusals and the associated reasons, and IEC sensitization. This in turn was compiled by their team leader, which was then forwarded to their supervisors, who compiled and sent the data to a higher level—the site manager. The site manager was then responsible for submitting the data to the data management team, who then entered

and generated reports on a daily basis, which were used for interpretation and action by the IRS technical team, along with the districts' team.

The technical team monitored the daily performances up to the site level in IRS districts. Among the numerous information collected, the number of households sprayed (and not sprayed) against the daily target was assessed. Number of households that spray operators were spraying per day was also captured. Insecticide consumption and stock for each day was also captured and monitored. Feedback on performances was periodically relayed to site managers and supervisors, as well as DMOs, to assess progress and respond to gaps, if any, in a timely manner.

In addition, vehicle and fuel usage, equipment and consumable stock, training, quality of spray, and compliance measures were also tracked on a timely basis.

After the completion of IRS, RTI produced summary tables, charts, and maps (as seen in this report) for dissemination to partners and stakeholders on progress and results achieved.

Getting RTI Prepared to Support the Process

RTI established two zonal offices (Zanzibar and Mwanza) and three regional offices (Wete, Bukoba, and Musoma) to provide support to implementing partners (district authority, NGOs/CBOs, communities, and the private sector).

The Mwanza Lake Zone office is equipped with staff in two categories: 1) finance and administration, with accountants, office manager, logistics officer, and store keeper; and; 2) technical area, with the zonal manager, environmental compliance officer, IEC specialist, and data manager. The zonal office provides support to the regional teams. Further, the office has been supplied with vehicles and equipped with computers and communication facilities. The main zonal office functions are: 1) organizing and implementing master training for district trainers and supervisors; 2) zonal management meetings convened every other 2 weeks; and 3) supervisory/support visits to IRS field operations.

The regional offices are organized in the same way, but on the technical side, they have vector control specialists either permanently employed or seasonally hired, especially during active stages of IRS implementation. These offices are as well supplied with transport and IT facilities (e.g., computers, Internet, and printers). Their main management functions are: support training of TOTs in collaboration with district trainers, weekly meetings with DITCs, field supervision, and HR management.

In each district, RTI appointed a focal person with appreciable experience in IRS to provide technical support to the established district IRS technical teams, and, where necessary, RTI contracted a vector control expert to provide supervision on the quality of spray and adherence to environmental regulations.

The RTI IRS unit in collaboration with NMCP provides supportive supervision to zones, regions, and district levels. The team is composed of IRS field technical specialists, environmental specialists, and IEC specialists.

Other initiatives spearheaded by RTI to support IRS implementation monitoring insecticide susceptibility and insecticide decay through bioassay (activity is implemented by NIMR) and monitoring malaria trends in selected health facilities.

V. Implementation of IRS Activities

IRS Implementation and Supervision

A total of 10,417 temporary spray staff were involved in 2010–2011 spray operations. The IRS spray operators were organized into 893 spray teams based in 191 IRS operations sites *(*see *Table 13* and *Annex B* for more details*).*

Table 13. Human resources for IRS structure over IRS operation sites

		Lake Zone	Zanzibar	Total
IRS operations sites	Number of sites	173	18	191
	New sites developed	144	8	152
Human resources	Number of teams	776	117	893
	IRS staff	9,163	1254	10,417
	District IRS staff	109	28	137
	Total IRS staff	9,272	1,282	10,554

For operational reasons, in the Lake Zone, 12 districts conducted IRS operations in two phases: 1) six sites operating at different times in two contiguous periods (bimodal); and 2) six sites operating in one phase, with all sites operating at the same time (unimodal). The average duration of operation per site lasted 16 days in the 2-phase districts compared with 21 days in the 1-phased districts. The average duration of the operations was very close in the bimodal and unimodal implementation districts (32 and 33 operation days, respectively). The number of operators enrolled in the two different modes is also very similar, with an average of 347 and 341 operators, respectively. In the 2-phase operational mode, the amount of spray equipment and PPE used is half of that compared with the 1-phase operational mode, due to reuse of equipment in the different spray phases. The average number of sites required for each operational model is quite similar—9.7 and 9.3, respectively, for 2-phased and 1-phased districts. Though, in the 2-phased model, an average of 4–5 sites operated at the same time. This arrangement allowed larger time periods for supervision and support from an overstretched district team. The analysis of the operational costs per structure in the two different models should be pursued in order to verify if there is a significant effectiveness gain. Theoretically, the operational costs are the same but the

investment in terms of durable equipment is reduced by half by using the 2-phase model[5].

In Zanzibar, operations were conducted in two different periods. The eight predominantly rural districts were sprayed at the same time (approximately 130,000 structures) in January–February 2011 while the two more urbanized districts of Mjini and Magharibi (approximately 64,000 structures) were sprayed in a second phase in June 2011. This arrangement, introduced in round six, allowed halving the length of spray compared to the previous rounds by enrolling more staff in each phase and by using the same amount of equipment. The average length of operations in the 10 districts of Zanzibar in the 2-phased model introduced in the sixth round was 30.3 days compared to the over 56 days used in the previous rounds. To achieve this significant reduction in the duration of spray, more staff had to be enlisted: A total of 897 operators were employed in the last round compared to 550–600 operators in the previous rounds (see *Table 14*).

Table 14. Operation summary by IRS design and zone statistics

	Lake Zone		Zanzibar
	2-phase districts	**1-phase districts**	**1-phase districts**
Number of districts	12	6	10
Average number of sites per district	9.7	9.3	1.8
Average number of sites operating simultaneously	4.5	9.3	13 phase 1; 5 phase 2
Average days of operation per site	18	21	30.3
Average duration of spray per district	32	33	30.3
Average number of operators per district	347	361	89.7
Average number of operators employed at the same time	173	361	407 phase 2 490 phase 1
Average number of houses sprayed per day	10.3	7.1	-
Supervisees/supervisor ratio	42	84	45

[5] Theoretically the operational costs are the same but the investment in term of durable equipment is halved by using the 2-phased model.

Quality Control of IRS

While implementing IRS, monitoring and supervision was provided to ensure quality of spraying, compliance with environmental requirements, technical support, and timely problem-solving. This was done by ZMCP/NMCP and RTI regional/zonal and national offices staff. Other supervisors were from district and regional authorities. RTI employed 1–2 consultants to support the DITC in each of the 11 newly involved districts in Mara and Mwanza regions.

Supervision and quality control of spray operations in the sites was ensured by the district, regional, and zonal levels. In the Lake Zone, 109 supervisors were temporarily employed while in Zanzibar there were 28. The ratio of supervisee (IRS site staff) to supervisors was significantly different in the two areas: 84 supervisees to 1 supervisor in the districts implementing the 1-phasde model in the Lake Zone compared to 45 and 42 supervisees to 1 supervisor in Zanzibar and in 2-phased model districts in Lake Zone, respectively.

Monitoring Performances of Spray Teams and Use of Insecticide

The daily performance and output of every spray operator, team leader, and supervisor were tracked daily using data sheets (e.g., daily spray cards, team leader and supervisor cards).

This recorded the number of structures sprayed per sachets of insecticide used. Through this method, the monitoring teams were able to detect operational problems, and recommendations were put in place immediately to support the spray operations and to improve the quality of data on the IRS project.

The average houses sprayed per operators per day was 10.3 and 7.1 in the Lake Zone and Zanzibar, respectively.

The insecticide used was usually monitored by store keepers at site store, district, regional, and zonal level, with close collaboration with the environmental officers. The insecticides used were tracked by insecticide control books and forms. Other IRS supplies and equipments were tracked using books, such as a store ledger.

Environmental Monitoring and Mitigation Activities

Environmental monitoring and environmental compliance inspections were carried out by the RTI environmental team in collaboration with district environmental officers during the spraying campaign to the operational sites.

During the two spraying seasons (September−October 2010 and January−March 2011) in the Lake Zone and Zanzibar, pre-, mid-, and post-spray environmental compliance inspections were conducted by the RTI environmental team and RTI's regional senior environmental inspector in collaboration with district environmental officers. A total of 135 inspections were conducted at different stages of the operations.

Logistics

Storage of Insecticide and Other Supplies

Insecticide and other IRS supplies are stored at the rented warehouses at the zonal and regional level. Other temporary stores at the district- and site-level are provided by district authorities. Most of the structures provided by the district did not comply with required standards in terms of design and quality. This compelled RTI to provide preliminary rehabilitation and maintenance of the structures to meet the standards. Zonal and regional storage sites are managed by RTI staff while district and sub-site stores are managed by temporary hired staff, who work as district store keepers and site managers for the site sub-stores.

RTI operated two permanent zonal warehouses (Mwanza and Zanzibar), three permanent regional warehouses (Wete, Butiama/Mugumu, and Rubya), 18 temporarily district warehouses (all in the Lake Zone), and 190 temporarily IRS site sub-stores, of which 152 were developed during the reporting period.

Distribution of Insecticides and Other IRS supplies

The transportation and distribution of insecticides and other IRS supplies, such as Hudson pumps that are sourced outside the country, starts from the port in Dar es Salaam. Together with domestic supplies, they are then delivered to the zonal store for distribution to regional stores, then to district stores, and finally to IRS sub-store. During transportation of bulky insecticides, special trucks, as recommended by WHO and FAO, are used.

Provision of Transport for Operators and Supervisors

During IRS, numerous cars of varying models are hired for transportation of operators and supervisors from the national, regional, and district levels. The operators were transported by vans and, and where not feasible, 4-wheel drive vehicles or trucks are used. In the islands, both operators and supervisors were transported daily by hired boats. Operators were transported from IRS operational sites to targeted villages located 5 to 15 km away. Efficient transportation arrangements increase the operation effectiveness by reducing travel time. This also provides the ideal controlled situation for transporting spray equipment and insecticide. Transportation for supervisors (average two per district) was provided to allow them to reach daily the different areas with ongoing IRS operations. *Table 15* indicates the number of cars and boats hired during the last IRS round.

Table15. Vehicles hired during IRS operations

		Lake Zone	Zanzibar	Total
Vehicles	Operators cars	398	65	463
	Supervisor cars	36	11	47
	Boats	22	7	29

		Lake Zone	Zanzibar	Total
	Total vehicles	456	83	539

End of Spray Activities

Post-spray Environmental Compliance Inspections and Site Decontamination and Decommissioning

Post-spray environmental compliance inspections were conducted in all IRS sites of Kagera, Mara, Mwanza, and Zanzibar. IRS site decontamination and decommissioning was carried out by making sites and storages areas safe for the surrounding community and handing them over to the local authorities for safe custody until the next IRS operation.

Solid Waste Disposal

Two steel mill plants, Sayona and Nyakato, both located in Mwanza, were identified as the closest incinerating facilities that met international disposal requirements for contaminated pesticide waste, as recommended by NEMC. IRS waste was transported from the main warehouse in sealed plastic barrels following all of the environmental and logistical procedures under the escort of RTI's environmental officer to the incineration facility. In July 2010, RTI was able to incinerate the 3.7 tons of empty sachets at Nyakato Steel Mills that resulted from previous rounds of IRS in Kagera. In February 2011, an additional 1.75 tons of empty sachets generated in the last IRS round in Kagera, Mara, and Mwanza were incinerated at Sayona Steel Mill. To date, no final waste disposal was carried out in Zanzibar due to the lack of appropriate incineration facilities.

End of Spray Inventory in Storage Facilities

End of spray inventory was conducted at three levels—site sub-store, district, and regional/zonal stores. The inventory process guides the tasks of equipment maintenance and repair, accounting for losses, and forecasts for procurement for the following round.

Post-spray Verification of Eligible Structures, Targets, and Performances

A quick post-spray follow up was conducted to assess the quality of registration data, used to set household targets, that were completed by hamlet leaders, as well as to judge the performance data captured by spray operators during their visit to households in targeted villages.

Overall, the registration and performance data were accurate. One or two operational gaps were identified during this assessment, which will be addressed in the coming round, as part of lessons learned.

VI. IRS Results

Population and House Structures

House Characteristics and Population Profile

In Mainland Tanzania, out of 1,211,596 eligible house structures in the Lake Zone, 1,177,022 were identified (97.1%). All eligible houses in Zanzibar (205,892) were visited. Wall characteristics of houses were only captured for Mainland Tanzania, where over 80% of houses were mud-walled, with the remaining consisting of cement and other type of walls. On average, the size of houses in Zanzibar were larger compared to the Lake Zone (see *Table 16).*

Table 17 presents the population breakdown of households visited in both Mainland Tanzania and Zanzibar. In total, 7,547,582 people were recorded, of which 24% were high-risk groups, and the remaining 76% comprising of five years and above.

A summary of household characteristics and population by district, region, and zone is presented in *Annex C*.

Table 16. Visited household characteristics

		Lake Zone	Zanzibar	Total
House structures found		1,177,022	205,892	1,382,914
Wall materials	Mud wall houses (%)	82%	-	-
	Bricks wall houses (%)	15%	-	-
	Other wall materials (%)	3%	-	-
Average # of rooms per house structure		3.5	5.3	-

Table 17. Population recorded during spray in visited households

		Lake Zone	Zanzibar	Total
Population	Total	6,452,577	1,095,005	7,547,582
Average Family size		5.5	5.3	-
Risk group	Under five years of age (%)	1,408,536 (21.8%)	191,369 (17.5%)	1,599,905 (21.2%)

		Lake Zone	Zanzibar	Total
	Pregnant women (%)	188,941 (2.9%)	24,801 (2.3%)	213,742 (2.8%)
Five years and above	Male (%)	2,431,013 (37.6%)	439,201 (40.1%)	2,870,214 (38.1%)
	Female (%)	2,424,088 (37.5%)	439,634 (40.1%)	2,863,722 (37.9%)

Spraying Results

Main Spray Indicators

In Mainland Tanzania, out of the eligible households, 97% were visited by spray operators. "Visited" is defined as those houses that spray operators were able to reach, which are made up of sprayed and unsprayed houses. The remaining houses from the eligible were unreached, which the operators could not get to. On the other hand, all eligible houses were visited in Zanzibar.

The spray coverage reflects those houses that were visited and sprayed out of the targeted (i.e., eligible). Nearly 95% spray coverage was attained in Tanzania as illustrated in *Table 18*. *Figure 21* and *22* list spray coverage by districts in Mainland Tanzania and Zanzibar, respectively.

Summary of spray indicators by district region and zone are reported in *Annex D.* For spray indicators details by sites (see *Annexes H, J, L,* and *N*).

Table 18. Main spray indicators by zone

House structures	Lake Zone	Zanzibar	Total
Eligible	1,211,596	205,892	1,417,488
Visited	1,177,022	205,892	1,382,914
Visited %	97%	100%	98%
Sprayed	1,144,621	194,808	1,339,429
Visited and not sprayed	32,401	11,084	43,485
Not reached	34,574	-	34,574
Spray coverage	94.5%	94.6%	94.5%

Figure 21. Spraying coverage in districts of Lake Zone

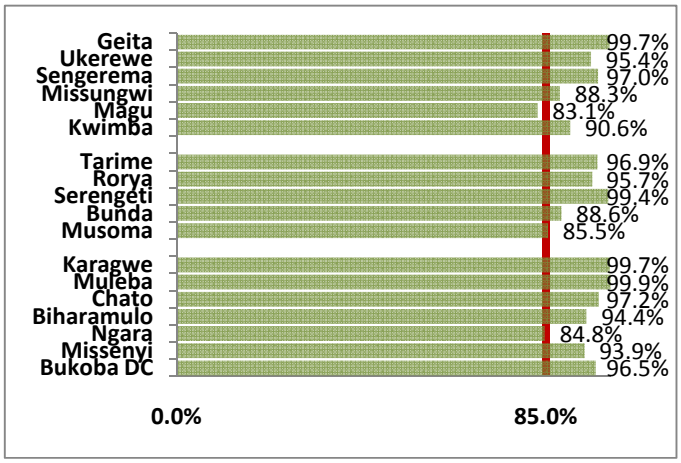
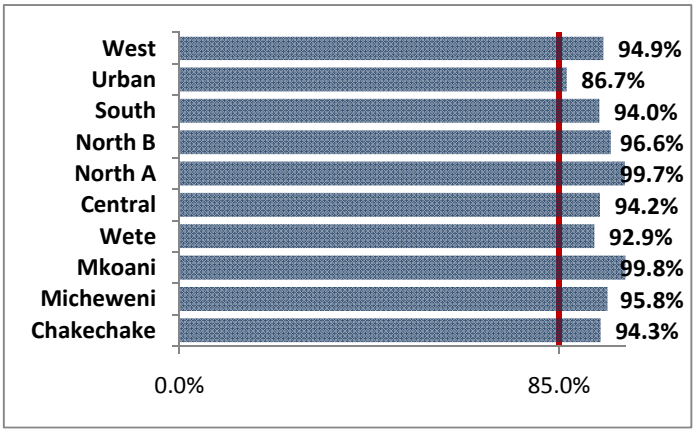


Figure 22. Spraying coverage in districts of Zanzibar



Reason for Refusal

A total of 32,401 house structures in the Lake Zone were visited but not sprayed, which represent 2.7% of eligible house structures. This is due to a combination of reasons, e.g., funeral ceremonies, a very sick person in a house, stored crop inside the structure eligible for spray. A consistent percentage of refusals was due to other reasons (such as beliefs, myths, and misconceptions about IRS in general). Almost 1/3 of non sprayed houses were closed at the time of the visit. The interpretation of this event is difficult: silent refusal or being uninformed about the operation (see *Table 19 and for district data Annex O*).

Table 19. Reasons for nonspray

	Kagera Region		Mara Region		Mwanza Region		Lake Zone	
Crops Inside	854	22.9%	2,795	16.5%	6,016	24.9%	9,665	21.6%
Funeral	46	1.2%	299	1.8%	359	1.5%	704	1.6%
Sick Person	223	6.0%	1,056	6.2%	1,295	5.4%	2,574	5.7%
House Closed	1,759	47.1%	4,329	25.6%	7,883	32.6%	13,971	31.2%
Refused	684	18.3%	6,417	37.9%	6,187	25.6%	13,288	29.7%
Other Reasons	165	4.4%	2,028	12.0%	2,417	10.0%	4,610	10.3%

Use of Insecticides

A total of **580,052** sachets of insecticide were used to spray a total of 1,339,429 house structures at a ratio of 0.43 sachets per house structure. An average of 8.6 rooms was sprayed per sachet (see *Table 20* for details by zone and *Annex D*).

A total of 36,703 liters of ICON 10CS were used and 450 liters are left unused. After the spray operations, 98.8% of stock available at the start of the spray season was used. The remaining stock will be used in the next spray round in Mainland Tanzania. (see *Table 21*).

Table 20. Use of insecticide ICON 10CS

	Lake Zone	Zanzibar	Tanzania
Sachets used	492,811	87,241	580,052
Liters	30,801	5,453	36,253
Sachets per house structure	0.43	0.45	0.43
Number of rooms sprayed per sachet	8.6	-	-

Table 21. ICON movements

	Sachets	Liters	
Initial	587,252	36,703	-
Used	580,052	36,253	98.8%
Remaining	7,200	450	1.2%

Population Protected

A total of 6,095,891 people in the Lake Zone and Zanzibar were protected with IRS out of 6,636,706 targeted eligible populations. The estimated number of pregnant women and children under the age of five protected by IRS[6] was 178,497 and 1,330,674, respectively (see *Table 22* and *Annex E).*

Table 22. Population protected by spray zone

Population protected	Lake	Zanzibar	Total
Underfives	1,330,674	180,995	1,511,669
Pregnant women	178,497	23,458	201,954
Five years and above male	2,296,631	-	-
Five years and above female	2,290,088	-	-
Five years and above all	4,586,720	-	-
All	6,095,891	1,033,742	7,129,633
Eligible	6,636,706	1,092,559	7,729,265
Percent	91.9%	94.6%	92.2%

Community Sensitization Results

Source of Information

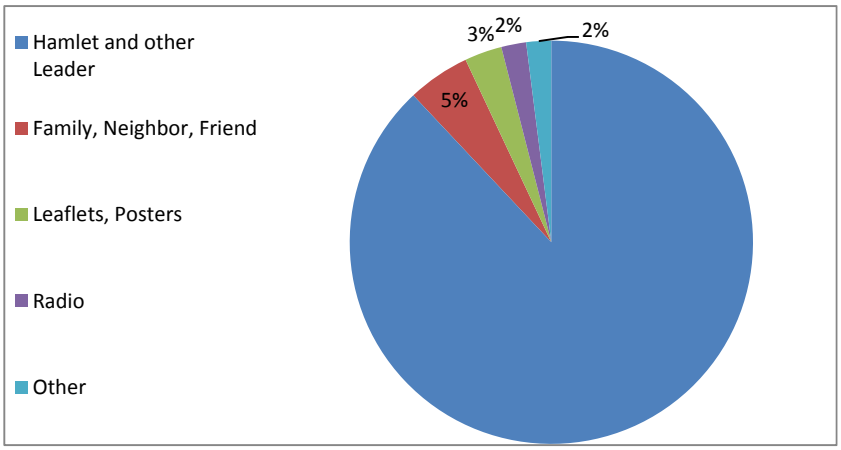
A large proportion (94.7%) of households (1,112,229) received information prior to an IRS operator's visit to the respective houses. In the Lake Zone, a total of 4,602,162 people, above five years of age, were reached with IEC messages for IRS (2,305,199 males and 2,296,963 females). Interpersonal communication from community leaders and other members was by far the largest source of information (92.4%). Other sources of information are reported in *Table 23 and Figure 23*.

[6] As per PMI definition the protected risk groups are the ones living in houses that have been sprayed

Table 23. IRS information and source by administrative level

	Kagera Region		Mara Region		Mwanza Region		Lake Zone	
Information on IRS not Received	35,050	7.6%	12,372	4.5%	15,287	3.5%	62,709	5.3%
Information on IRS Received	42,7654	92.4%	264,779	95.5%	420,906	96.5%	1,113,339	94.7%
Source of information								
Interpersonal communication (community leaders and others)	40,8484	95.3%	24,8713	90.0%	397,206	91.0%	1,054,403	92.4%
Printed media (leaflets, posters)	4,407	1.0%	11,134	4.0%	11,727.5	2.7%	27,268.5	2.4%
Electronic media (radio, TV)	13,718	3.2%	7,988	2.9%	10,807.5	2.5%	32,513.5	2.8%
Other sources	2,120	0.5%	8,512	3.1%	16,519.5	3.8%	2,7151.5	2.4%
Total answers	428,729	-	276,347	-	436,260.5	-	1,141,336.5	-
No answer	844	0.2%	928	0.3%	663	0.2%	2435	0.2%
Total	429,573	-	277,275	-	436,923.5	-	1,143,771.5	-

Figure 23. Source of Information of IRS



Perceived Advantages and Disadvantages from Previous IRS Rounds

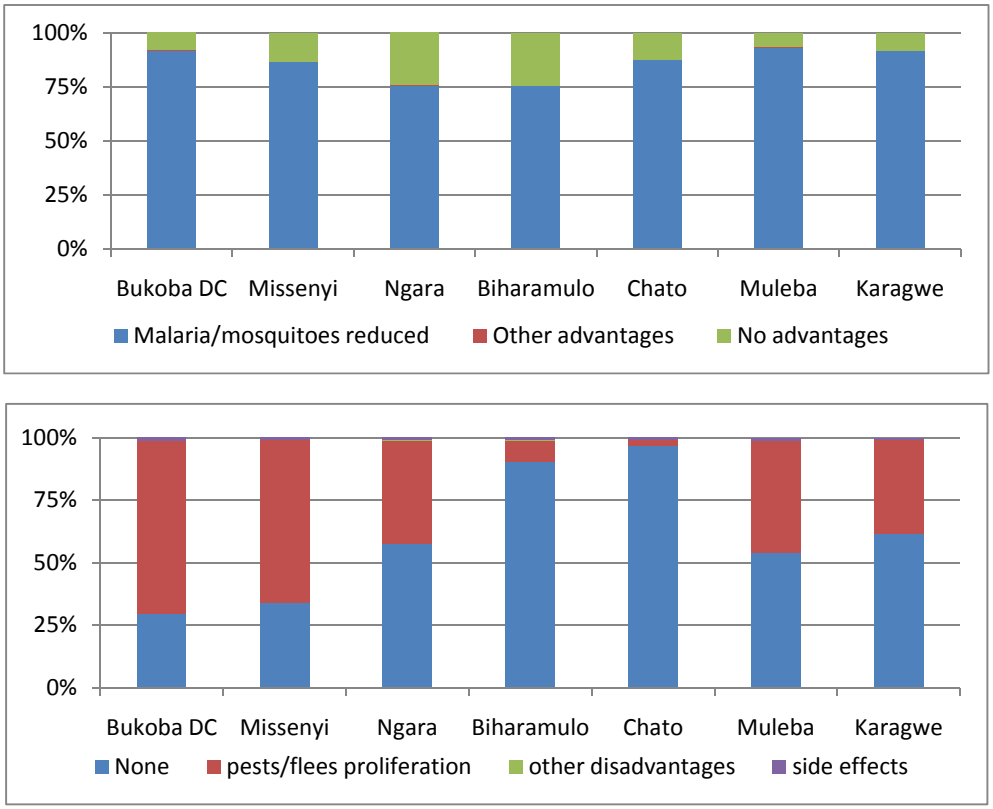
Information for this indicator was specifically collected for Kagera Region only, where more than one round of IRS has been conducted. The response rate was over 99% (see table 24). Nearly 88% of respondents felt the main advantages of IRS were to reduce malaria as well as the number of mosquitoes. About 66% of the respondents did not perceive any negative effect of IRS. Table 24 illustrates extensive breakdown of the perceived advantages and disadvantages. In some districts of Kagera, respondents complained about proliferation of pests especially fleas (see *Table 24* and figure 24). This finding did not affect the acceptance of IRS as demonstrated by the high spray coverage in the same districts (see *Annex P* for details).

Table 24. Advantages and disadvantages after IRS by administrative level

	Frequency	Percent
Perceived Advantages from previous IRS		
Malaria/mosquitoes reduced	373,570	87.8%
Other advantages	937	0.2%
No advantages	50,803	11.9%
Total answer	425,310	-
No answer	1,668	0.4%
Total	426,978	-
Perceived Disadvantages from previous IRS		
None	243,670	59.4%
Pest proliferation	161,611	39.4%

	Frequency	Percent
Other disadvantages	706	0.2%
Side effects	4,086	1.0%
Total answer	410,073	-
No answer	1,429	0.3%
Total	411,502	-

Figure 24. Perceived advantages (upper chart) and disadvantages (lower chart) of previous IRS in Kagera region by district



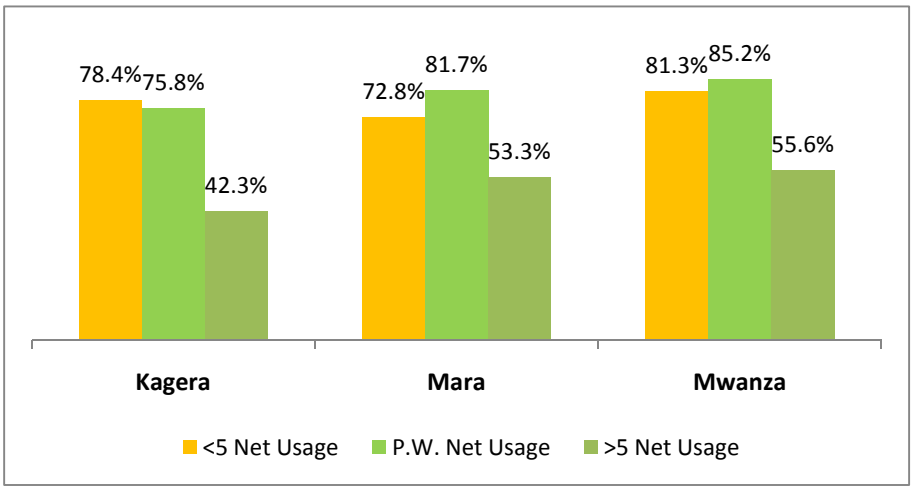
Usage of ITNs

In Lake Zone, about 153,821 (81.4%) of pregnant woman and 1,102,499 (78.3%) of children under five years of age were declared to have slept under ITNs the previous night in the house structure visited during this reporting period (see *Table 25;* for district breakdown in *Annex F*). *Figure 25* shows ITN usage in the three regions of the Lake Zone among pregnant women, children under five years of age, and the population above five years of age.

Table 25. Main LLIN indicators collected during IRS by zone

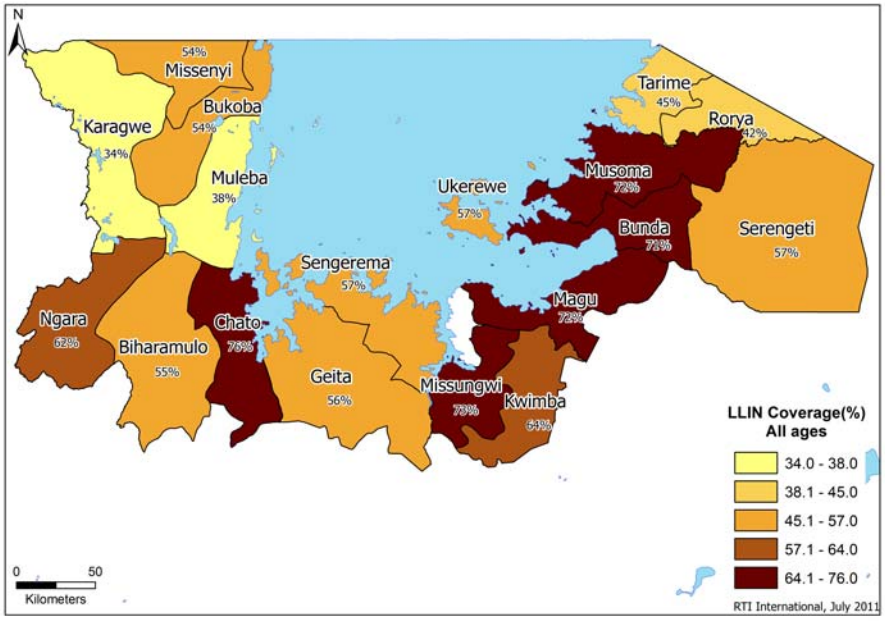
Group		Lake	Zanzibar	Total
Under Five years	Slept under LLIN/ITN the previous night	1,102,499	146,465	1,248,964
	Net usage %	79%	81%	79%
Pregnant Women	Slept under LLIN/ITN the previous night	152,591	18,082	170,673
	Net usage %	81%	77%	81%
Five years and above	Slept under LLIN/ITN the previous night	2,413,391	541,236	2,954,627
	Net usage %	50%	66%	52%

Figure 25. Net usage in pregnant women and children under five years



The results showed that overall net usage in the Lake Zone is 81.4% and 78.3% for pregnant woman and children under five years of age, respectively. This is slightly lower than the PMI's target of 85%. The universal LLIN coverage was 57%. It should be noted that LLIN universal coverage campaign has been carried out after IRS in April 2011.

Figure 26. Universal net usage by district (before LLIN universal coverage campaign)



VII. Challenges

- IRS is indeed a logistically complex operation. IRS requires multiple partnerships, a large quantity of equipment and materials to be handled, and a large number of temporary staff to be managed. A number of challenges are related to this complex operation. For example, transportation of IRS operators and equipment has to be provided on time on every day of operations to the most remote areas. It also involves training of a large number of staff and ensuring their timely wage payments. These requirements overstretch the TVCP's administration and finance department during IRS operations.
- Lack of adequate incineration facilities in Tanzania compelled the program to rely temporarily on commercial incineration facilities (steel mill furnaces) as indicated by the National Environment Management Council (NEMC). Reliance on a few available commercial facilities is making the process slow and cumbersome. In Zanzibar, there is no incineration facility that meets the disposal requirements. All the IRS-contaminated wastes are transported from district storage facilities to the main IRS warehouses of Zanzibar and Mwanza. RTI is in the process of procuring two suitable incineration facilities that will rectify the situation.
- In terms of the planning for spray operations, determining counts of eligible households for IRS is an important exercise, which helps quantify and allocate spray and personnel needs, as well as scheduling spray activities in targeted villages. It also determines the spray coverage and its impact over the long run. Traditionally, establishing targets was done using population census

projections data; where applicable, data from previous IRS rounds, as well as household information from other sources such as mass campaign for nets, etc. However, it was observed that this approach was not always the best one since the houses visited during actual spray operations in some districts yielded a higher count (or lower) than what was initially targeted. This is possible with the influx (or efflux) of settlements in some areas that can only be confirmed at ground level and not from such sources.

VIII. Achievements/Lessons Learned

- RTI promoted a large partnership among different implementing entities: local government, district health management, community leaders, nongovernmental and faith-based organizations, the private sector, and research institutions.
- A relatively small RTI technical team provided support at the same time to a large number of implementing partners.
- The TVCSP team largely contributed to developing capacity of the implementing partners, principally the DITC and NGOs/CBOs. Local government employees, such as district IMCI; malaria focal persons; and VCOs, involved in previous IRS operations were successfully deployed to mentor their peers in the newly involved districts. The DITCs supported by RTI focal persons provided guidance on the day to day implementation.
- The involvement of community leaders greatly contributed to the high acceptance rates for IRS. Both in Zanzibar and in the Lake Zone, leaders from all levels, from hamlet to regional and zonal level, worked to facilitate IRS and promote not only awareness of the project but acceptance and understanding.
- RTI was able to provide technical expertise and guidelines for implementation, but the operation relied heavily on community leaders to take ownership of the IRS initiative to ensure local compliance and project sustainability.
- IRS operations attained a high level of compliance in terms of environmental regulations and mitigating the potential harmful effects caused by using a large amount of insecticides.

IX. Recommendations

- After six round of IRS in Zanzibar, it is recommended to start a scaling down process, provided that the following preconditions are reached: universal LLIN coverage; promotion of LLIN usage; and surveillance widely implemented.

- The recent reported resistance to pyrethroids in Zanzibar (Pemba Island) requires the immediate development of an insecticide resistance mitigation plan.
- An IRS cost analysis should be done at the end of each implementation year to evaluate the expected efficiency gain after IRS scale up and after the complete development of infrastructures.
- Efficient implementation design should be pursued to make IRS more cost-effective and competitive with other vector control initiatives.
- Integrated malaria vector control modeling should be introduced to indicate the most effective ways to integrate IRS and LLIN to decrease malaria burden and to keep it low.
- The government, through their responsible ministries, should encourage current and future partners to take part in the IRS operations by helping them see the resulting benefits for the country.
- Efforts to maintain the reached level of community acceptance on IRS, as demonstrated by the high spray coverage, should be maintained with the maximum involvement of local government and CBOs.
- Gender equality needs be promoted in the implementation of IRS. This can be within RTI and among the implementing partners. Where expertise is not a limiting factor, employment opportunity should be 50% equal or more women being considered. This is possible for the operators. Information, education and communication approaches should be designed to ensure women have equal opportunity of being informed.
- Training packages need to be developed and standardized for various types and levels of training. Improvements can be made of the development of knowledge on the subject matter to bridge the gaps as they are realized along the course of implementation.
- Registration of households should be a prerequisite for proper planning of IRS. This emanates from the fact that most of household sources of data could not give a precise denominator.
- The beneficiary communities needs be prepared for IRS sustainability. This has been achieved in the aspect of capacity building in regard to human resource and infrastructures. The area that needs attention is resource mobilization, especially at the district level.

X. IRS in Action

Spray operators ready to head out to house structures for IRS operations.

A spray operator fills his pump with insecticide in preparation for IRS.

A spray operator in action.

Spray operators discuss recent IRS activity with technical advisors from RTI.

After spraying, a team leader (right) ensures the accuracy of the data collection process as a spray operator (center) interviews the head of the household (left).

Spray operators line up to clean their equipment at the end of daily operation.

Spray operators, supervisors, and other IRS personnel gather at one of the sites to discuss the challenges and achievements of the IRS operations.

Washed PPE hang over soak-pit to dry, which has been fenced and secured to keep out children and animals.

IRS site with effluent waste disposal structures (soak pit) ensuring compliance with environmental standards.

At the end of each day, empty sachets are returned and accounted for to ensure that none are missing.

After the empty sachets are accounted for, they are stored in barrels at IRS warehouses until they can be properly incinerated at an NEMC-approved facility.