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**THE PMI AIRS PROJECT  
SEMI ANNUAL REPORT  
APRIL 1, 2016 – SEPTEMBER 30, 2016**

**Recommended Citation:** The PMI Africa Indoor Residual Spraying (AIRS) Project. Semi-Annual Report: April 1, 2016 – September 30, 2016. Bethesda, MD. The PMI AIRS Project, Abt Associates Inc.

**Contract:** GHN-I-00-09-00013-00

**Task Order:** AID-OAA-TO-11-00039

**Submitted to:** United States Agency for International Development/PMI



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# ACRONYMS

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<b>AIRS</b>	Africa Indoor Residual Spraying Project
<b>CDC</b>	Centers for Disease Control and Prevention
<b>COR</b>	Contracting Officer's Representative
<b>DDT</b>	Dichlorodiphenyltrichloroethane
<b>EC</b>	Environmental Compliance
<b>ECO</b>	Environmental Compliance Officer
<b>FMOH</b>	Federal Ministry of Health
<b>HLC</b>	Human Landing Catch
<b>IEC</b>	Information, Education, and Communication
<b>IRS</b>	Indoor Residual Spraying
<b>kdr</b>	Knockdown resistance
<b>IVCC</b>	Innovative Vector Control Consortium
<b>LLIN</b>	Long-lasting insecticide-treated nets
<b>LT</b>	Light Trap
<b>M&amp;E</b>	Monitoring and Evaluation
<b>NMCP</b>	National Malaria Control Program
<b>NIMR</b>	National Institute for Medical Research
<b>PAMCA</b>	Pan African Mosquito Control Association
<b>PMI</b>	President's Malaria Initiative
<b>PMT</b>	Performance Management Tracker
<b>PPE</b>	Personal Protective Equipment
<b>PSC</b>	Pyrethrum Spray Catch
<b>PSECA</b>	Pre-Spray Environmental Compliance Assessment
<b>SEA</b>	Supplemental Environmental Assessment
<b>SMS</b>	Short Message Service
<b>SOP</b>	Spray Operator
<b>USAID</b>	United States Agency for International Development
<b>USG</b>	United States Government
<b>WHO</b>	World Health Organization
<b>WHOPES</b>	World Health Organization Pesticide Evaluation Scheme
<b>ZAMEP</b>	Zanzibar Malaria Elimination Programme



# EXECUTIVE SUMMARY

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During this reporting period (April 1, 2016, through September 30, 2016), the President's Malaria Initiative (PMI) Africa Indoor Residual Spraying (AIRS) Project, funded by the United States Agency for International Development, continued implementation under Task Order 6. The Project implemented indoor residual spraying (IRS) campaigns in Benin, Ethiopia, Ghana, Madagascar, Mali, Rwanda, Senegal, and Tanzania. The PMI AIRS Project covered an average of 93.4% of targeted structures, protecting more than 7.2 million people from malaria. Details regarding all monitoring and evaluation (M&E) outcomes by country are reported in Annex A.

## TOP-LINE RESULTS FROM IRS CAMPAIGNS, APRIL-SEPT 2016

- 1,881,009 structures sprayed<sup>1</sup>
- 96.0 percent average spray coverage
- 5,756,390 people protected from malaria including:
  - 153,884 pregnant women
  - 918,327 children under 5 years of age
- 8,720 people trained with United States Government funds to deliver IRS.

Highlights from this reporting period are listed below.

- Launched the NGenIRS project in partnership with UNITAID and the Innovative Vector Control Consortium (IVCC) to expand the use of new long-lasting, non-pyrethroid insecticides.
- Held capacity building trainings on essential aspects of malaria entomology in Dakar, Senegal, and Harare, Zimbabwe. Testing showed participants' knowledge increased on average by 15%.
- Conducted environmental compliance (EC) capacity building and staff training in Senegal for all AIRS Environmental Compliance Officers and government representatives from each AIRS country.
- Rolled out mHealth tools to all IRS countries and piloted an e-inventory system in Madagascar.
- Designed an operational research study in Zambia to understand the correlations of resistance intensity of pyrethroid insecticides with the performance of LLINs in an experimental hut setting, and the use of organophosphate IRS to mitigate pyrethroid resistance.
- Developed a concept note and protocol for operational research on pirimiphos-methyl efficacy in experimental huts when sprayed on half the usual surface area against natural populations of *Anopheles gambiae* in Ghana.
- Submitted six manuscripts to PMI, three of which were published.
- Presented three abstracts and led a symposium on vector surveillance at the 3rd annual Pan African Mosquito Control Association (PAMCA) conference in Lagos, Nigeria from September 6-8, 2016.

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<sup>1</sup> This does not include Rwanda as the campaign was not fully completed before the end of this reporting period.



# I. COUNTRY HIGHLIGHTS

## I.1 ANGOLA

### PROGRAM HIGHLIGHTS

AIRS Angola conducted bimonthly entomological monitoring activities in two sentinel sites, namely Huambo and Malanje, from April 2016 to September 2016, using Centers for Disease Control and Prevention (CDC) light traps (LT), Prokopack aspirators, and Pyrethrum Spray Catch (PSC) sampling methods. Activities stopped August 31, 2016, following the decision to close the AIRS Angola program.

## I.2 BENIN

**TABLE I: AIRS BENIN AT A GLANCE**

Number of communes sprayed by PMI-supported IRS	9 communes: Boukoubé, Cobly, Kérou, Kouandé, Matéri, Natitingou, Péhunco, Tanguiéta, and Toucountouna
Insecticide	OP (Actellic CS)
Number of structures found by SOPs	296,409
Number of structures sprayed by SOPs	269,179
Spray coverage	90.8%
Population protected by PMI-supported IRS	Total population – 858,113 Pregnant women – 36,088 Children under 5 years – 167,041
Dates of PMI-supported IRS campaign	May 3 – May 27, 2016
Length of campaign	22 days
Number of people trained with USG funds to deliver IRS*	1,372

\*This is based on the PMI indicator definition. It includes only spray staff such as spray operators, team leaders, supervisors, and clinicians. It excludes data clerks, IEC mobilizers, drivers, washers, porters, pump technicians, and security guards.

### PROGRAM HIGHLIGHTS

- See results in Table 1 on AIRS Benin’s spray campaign. Based on a 95% confidence interval, the Post-Spray Data Quality Audit conducted from July 7-16, 2016, confirmed data recorded in the End-of-Spray Report on spray and mobilization coverage.
- 46,632 empty insecticide bottles were crushed and transformed into paving stones.
- In anticipation of PMI’s withdrawal of IRS from Atacora, AIRS Benin began working on a contingency plan to mitigate the impact this may have on the epidemiology of malaria in the region.
- Participated in the development of the FY 2017 Benin MOP.
- With respect to spray quality assurance: after 24 hours (h), all mosquitoes exposed on cement walls died in Natitingou as well as in Tanguiéta. On mud walls, mortality rates at 24h were 99.38% and 99.66 % in Natitingou and Tanguiéta, respectively. The observed mortality at 30 minutes post-exposure was relatively low. For the control group, the mortality rate was consistently less than 5%.

## 1.3 BURUNDI

### PROGRAM HIGHLIGHTS

- From April 11-28, 2016, an entomological survey trip took place in the sentinel sites of Mpanda, Mabayi, Kiremba, Vumbi, Cankuzo, Matana, Gihofi, and Nyanza-Lac.
- 928 mosquitoes were captured by PSC. *An. gambiae* represented the highest number of mosquitoes captured at 82.4%, while *An. funestus* represented 12.9%. This data shows high abundance of *An. gambiae*, particularly in Vumbi and Cankuzo.
- 1,524 *Anopheles* (*An. gambiae* and *An. funestus*) were collected by HLC. Data shows that in the sentinel sites of Gihofi, Nyanza-Lac, Cankuzo and Mpanda, the human biting rate (HBR) per night was the highest, estimated at respectively, 57, 54, 30, and 25 bites per person per night.
- 5,943 mosquitoes were collected by CDC LT, of which 73.14% were caught in Mpanga and Gihofi. *An. gambiae* and *An. funestus* represent respectively 35.5% and 3.9% of the total collection.
- Victoria Gellis, USAID Country Representative in Burundi, visited the insectary September 28, 2016.
- Entomologist Renaud Govoetchan left Burundi and was replaced by Virgile Gnanguenon.

## 1.4 DEMOCRATIC REPUBLIC OF THE CONGO

### PROGRAM HIGHLIGHTS

- AIRS Democratic Republic of the Congo (DRC), through the National Institute of Biomedical Research (INRB), implemented entomological monitoring activities in seven sentinel sites, namely: Lodja, Kabondo, Kalemie, Kapolowe, Katana, Kingasani, and Mikalayi. Activities included PSC and HLC collections and insecticide susceptibility testing.
- Between January-March 2016, *An. gambiae* s.l. was the main malaria vector recorded in Kabondo, Kalemie, and Kingasani. In Mikalayi, *An. funestus* s.l. was the major vector present, while in Katana, Kapolowe, and Lodja, there were mixed populations of *An. gambiae* s.l. and *An. funestus* s.l.
- Peak indoor biting times of *An. gambiae* s.l. and *An. funestus* s.l. in most sites were late at night, often between midnight and 4:00 a.m. In several sites, biting rates of *An. gambiae* s.l. were similar indoors and outdoors. *An. paludis* was caught frequently biting outdoors during the early evening in Lodja. Results of molecular testing at University of Notre Dame, USA, indicate that there are likely to be more than one species in the complex currently known as *An. paludis*.
- High proportions of hybrid *An. gambiae/coluzzii* were reported from laboratory species ID testing at INRB. Samples have been sent to University of Notre Dame, USA for quality assurance.

## 1.5 ETHIOPIA

**TABLE 2: AIRS ETHIOPIA AT A GLANCE**

<b>Number of districts sprayed by PMI-supported IRS</b>	<b>36</b>
Insecticide	OP (Actellic CS)
Number of structures found by SOPs	717,396
Number of structures sprayed by SOPs	715,541
Spray coverage	99.7%
Population protected by PMI-supported IRS	Total: 1,688,745

	Pregnant women: 23,011 Children under five years: 230,690
Dates of PMI-supported IRS campaign	June 28 – August 5, 2016
Length of campaign	32 days
Number of people trained with USG funds to deliver IRS*	2,749

\*This is based on the PMI indicator definition. It includes only spray staff such as spray operators, team leaders, supervisors, and clinicians. It excludes data clerks, IEC mobilizers, drivers, washers, porters, pump technicians, and security guards.

## PROGRAM HIGHLIGHTS

- As part of the NgenIRS partnership, AIRS Ethiopia switched all 36 PMI AIRS districts to Actellic.
- Strengthened the capacity of the Federal Ministry of Health (FMOH) to manage IRS implementation and conduct supervision through a training of master trainers, boot camp training and training of trainers focused on spray techniques. 45 FMHO staff were trained as well as three Oromia Regional Health Bureau staff and nine AIRS staff.
- Implemented a supervision plan in which IRS supervisors were assigned a cluster of districts and focused on SOP training quality, spray techniques, mobilization and community participation on house preparation, and Directly Observed Spraying (DOS) as part of spray quality enhancement.
- 101,600 kg of DDT collected from 47 district and zonal stores was incinerated in Poland in July 2016.
- 26 participants from six universities (Addis Ababa, Arbaminch, Gondar, Jigjiga, Jimma and Mekelle) were trained on basic entomology to help them collect good quality data.
- Conducted entomological monitoring activities in nine sites in collaboration with six universities.
- Studied the decay rate of different insecticides (pirimiphos-methyl, bendiocarb and propoxur) in experimental huts in two sites in collaboration with Jimma and Addis Ababa Universities.
- Assessed the susceptibility of the main malaria vector, *An. gambiae* s.l., in four sites using the World Health Organization (WHO) tube test.

## 1.6 GHANA

**TABLE 3: AIRS GHANA AT A GLANCE**

Number of districts sprayed by PMI-supported IRS	5 districts: Bunkpurugu Yunyoo, East Mamprusi, Kumbungu, Mamprusi Moaduri, West Mamprusi
Insecticide	OP (Actellic CS)
Number of structures found by SOPs	227,857
Number of structures sprayed by SOPs	211,283
Spray coverage	92.7%
Population protected by PMI-supported IRS in 2016	Total: 570,871 Pregnant women: 10,881 Children under five years old : 96,150
Dates of PMI-supported IRS campaign in 2016	April 22 to May 26, 2016
Length of campaign	30 days
Number of people trained with USG funds to deliver IRS*	694

\*This is based on the PMI indicator definition. It includes only spray staff such as spray operators, team leaders, supervisors, and clinicians. It excludes data clerks, IEC mobilizers, drivers, washers, porters, pump technicians, and security guards.

## PROGRAM HIGHLIGHTS

- Introduced three new initiatives: DOS, weekly nozzle tip testing, and spray team health checks.
- Continued interpersonal and mass media communication strategies to keep the refusal rate low. For the first time, Peace Corps volunteers worked alongside spray teams to mobilize their communities.
- Completed all EC inspections using smartphones. Eleven mobile soak pits were piloted. Solid waste was disposed by Zoil Service Limited-Takoradi under supervision of ECO and EPA representatives. 47,135 Actellic CS bottles were recycled. All other insecticide-contaminated waste was incinerated.
- Increased the number of females in supervisory roles from 27 in 2015 to 33 in 2016. Gender focus groups were conducted to find out if the gender of an SOP or spray team can affect IRS acceptance.
- The team produced an internal IRS country capacity assessment for a review with national partners.
- Completed wall bioassay tests to assess the quality of spraying during the campaign and the residual life of the insecticide after spraying. Results indicated high-quality spraying and strong performance of the insecticide. Monthly wall bioassay tests through September 2016 showed that the mortality rate of exposed mosquitoes was still greater than 80% five months spraying.
- Entomological surveys assessed the impact of IRS on entomological indices of malaria transmission across five sentinel districts, including two IRS withdrawn districts and one never sprayed.
- Noguchi Memorial Institute for Medical Research (NMIMR) is conducting analysis for PCR species identification, infection rate and mechanisms involved in insecticide resistance.
- AIRS Ghana supports the National Insecticide Resistance Monitoring Partnership to generate and monitor IR data. In 2016 AIRS Ghana provided funds to collect IR data from 10 sentinel sites. NMIMR collected data from six sentinel sites. Lab work and data analysis are underway.
- The team developed a concept note and protocol for operational research (OR) on outdoor transmission in Northern Ghana. The PMI OR committee cleared the study. The protocol was submitted to the NMIMR IRB committee for review and recently approved.

## 1.7 KENYA

### PROGRAM HIGHLIGHTS

- In April 2016, AIRS Kenya led an IRS training of trainers (TOT) and provided technical assistance to NMCP for an anticipated GoK-led IRS campaign in 2016 in Migori County. Following the cancellation of the 2016 GoK-led IRS campaign, AIRS Kenya received 12,780 bottles of Actellic CS donated by NMCP. AIRS Kenya will use these bottles for IRS in February 2017.
- AIRS Kenya's Operations Manager provided short-term technical assistance to AIRS Rwanda, supporting the IRS campaign's introduction of Actellic CS while simultaneously documenting best practices and lessons learned to implement in AIRS Kenya's 2017 IRS campaign.
- Recruited and hired seven new staff in the scale up for 2017 IRS: ECO, M&E Manager, Procurement Officer, County Coordinator, IEC/BCC Coordinator, IT Specialist and Driver.
- Conducted entomological surveillance at eight sentinel sites in western Kenya: four intervention areas and four control sites in Migori County. Entomological monitoring activities included monthly indoor biting rates, resistance testing and mosquito behavior monitoring.
- Collected mosquitoes using PSC, CDC LT and HLC methods. Project consultants conducted morphological and molecular analysis on all collected mosquitoes.

- Submitted the 2016-2017 work plan, which includes monitoring of sprayed and unsprayed sentinel sites to determine the impact of IRS with Actellic® CS.

## 1.8 LIBERIA

- Vector monitoring surveillance was conducted in the two sentinel sites: Tomato Camp (Bong County) & Frank Town (Montserrado County). Entomological monitoring was conducted in two new sentinel sites: Jeneta (Margibi County) and Bokay Town (Grand Bassa County). PSC, CDC LT and HLC were used for mosquito collections.
- Using CDC LT, the abundance of *An. gambiae* s.l. was: Tomato Camp (4.71 per trap per night), Frank Town (2.30 per trap per night), Jeneta (0.48 per trap per night) and Bokay Town (0.13 per trap per night). HLC and CDC collections from both sites showed *An. gambiae* s.l. bite almost equally indoors and outdoors, with lower biting rate in Bokay Town.
- Four classes of insecticides were tested against *An. gambiae* s.l.: pyrethroid (deltamethrin 0.05% and alpha-cypermethrin 0.05%), carbamate (bendiocarb 0.1%), organophosphate (pirimiphos-methyl 0.1%), and organochlorine (DDT 4%). To assess the susceptibility of *An. gambiae* s.l. to these insecticides, the tests were conducted using WHO techniques in five counties: Sinoe, River Gee, Monteserrado, Lofa and River Cess. Tested *An. gambiae* s.l. mosquitoes were resistant to alpha-cypermethrin, deltamethrin and DDT. They were fully susceptible to pirimiphos-methyl. However, a probable resistance to bendiocarb was observed and needs to be investigated for confirmation.

## 1.9 MADAGASCAR

**TABLE 4: AIRS MADAGASCAR AT A GLANCE**

	Southeast Coast	East Coast	Total
Number of districts sprayed by PMI-supported IRS	2 (Farafangana and Vohipeno)	3 (Brickaville, Tamatave II and Fenerive Est)	5
Insecticide	OP (Actellic CS)	OP (Actellic CS)	-
Number of structures found by SOPs	130,706	198,689	329,395
Number of structures sprayed by SOPs	119,959	190,467	310,426
Spray coverage	91.8%	95.9%	94.2%
Total population protected by PMI-supported IRS	552,764	704,272	1,257,036
Pregnant women protected	21,280	26,228	47,508
Children under 5 protected	100,482	84,445	184,927
Dates of PMI-supported IRS campaign	July 25 – August 22	Sept 5 – Oct 1	-
Length of Campaign	24 days	24 days	48 days
Number of people trained with USG funds to deliver IRS*	667	913	1,580

\*This is based on the PMI indicator definition. It includes only spray staff such as spray operators, team leaders, supervisors, and clinicians. It excludes data clerks, IEC mobilizers, drivers, washers, porters, pump technicians, and security guards.

## PROGRAM HIGHLIGHTS

- This was the first year that Vohipeno in the Southeast Coast received IRS, so AIRS Madagascar concentrated extra energy and resources to ensure high coverage rates in this district.
- AIRS Madagascar has been working with Adonis Environment and the Malagasy Ministry of Environment (ONE) to obtain approval to incinerate 3,020 expired bottles of Actellic insecticide.
- Entomological data collected indicates that *An. gambiae* s.l., *An. funestus*, and *An. mascariensis* were

present at different prevalence in various sentinel sites. The most abundant vector species were *An. gambiae* s.l., which constituted 25.7% of the total anopheline mosquitoes collected.

- The results of the vector susceptibility tests indicate susceptibility of *An. gambiae* s.l. to bendiocarb and pirimiphos-methyl in all spray areas. *An. gambiae* s.l. phenotypic resistance to DDT is widespread followed by resistance to permethrin (a type-I pyrethroid). Resistance to type-II pyrethroids (deltamethrin, lambda-cyhalothrin, and alpha-cypermethrin) was limited. *An. funestus* and *An. mascariensis* were fully susceptible to the insecticides tested, organophosphate (pirimiphos-methyl) and pyrethroids (deltamethrin and permethrin).
- Cone bioassay test collected during the first week of the IRS campaign indicated that the quality of spraying in the Southeast Coast and East Coast was good with test mortality rates of 100 percent for all structures sampled and used for the testing within 24 hours and one month after structures were sprayed. The monthly monitoring of the insecticide decay rate, for the insecticide used (Actellic® CS 300) showed pirimiphos-methyl lasted seven months on all sprayed surface types.

## 1.10 MALI

**TABLE 5: AIRS MALI AT A GLANCE**

Number of districts covered by PMI-supported IRS	3 districts: Baroueli, Koulikoro and Fana
Insecticide	OP (Actellic CS)
Number of structures found by SOPs	235,394
Number of structures sprayed by SOPs	228,672
Spray coverage	97.14%
Population protected by PMI-supported IRS in 2016	Total: 788,922 Pregnant Women: 20,813 Children under 5: 135,754
Dates of PMI-supported IRS campaign	July 9–August 12, 2016
Length of campaign (operational days)	30 days
Number of people trained with USG funds to deliver IRS*	1,216

\*This is based on the PMI indicator definition. It includes only spray staff such as spray operators, team leaders, supervisors, and clinicians. It excludes data clerks, IEC mobilizers, drivers, washers, porters, pump technicians, and security guards.

## PROGRAM HIGHLIGHTS

- Conducted in April 2016 geographical reconnaissance and enumeration work in Fana District.
- Implemented IRS campaigns in three districts from July 9-August 12, 2016, in collaboration with the NMCP. Mali was one of the four Year One countries for the NgenIRS partnership. Because of the insecticide copayment through the partnership, the country team was able to expand to Fana District.
- Piloted a new IRS approach, Villages and Neighborhoods, in three health areas. The approach is a variation of community-based IRS with four to five SOPs hired to spray their own village in a two-day period. One field supervisor and one team leader supervised the village SOP teams in each health area as the team moved from village to village in one taxini, carrying a mobile soak pit with them. The approach contributed to increased household awareness of and preparedness for IRS; a higher number of women involved in IRS; and reduced transportation costs. The approach also shortened the duration of the spray and simplified mobilization. However, preliminary calculations indicated that obtained savings were used to pay the wages of the increased number of SOPs hired for the pilot. AIRS Mali will not use approach in 2017 due to relocation of IRS in new areas.

- ECO carried out EC assessments to ensure IRS campaign was in compliance with the United States Government and Government of Mali environmental safety standards.
- Spray supervision was prioritized and rapidly reported using two mHealth tools. Team Leaders used the Performance Management Tracker (PMT) to report daily spray data through Short Message Service, which helped to identify and reach underperforming teams promptly. Mobile supervisory forms were used by site supervisors, government supervisors and AIRS staff. The data was uploaded through a cloud system and disseminated by email to designated project recipients to monitor daily compliance with established operational and environmental standards.
- After campaign completion, AIRS Mali held stakeholder and campaign results restitution meetings.
- A new Entomological Coordinator was hired in August to implement project activities.
- Completed wall bioassay tests to assess quality of spraying during the first two weeks of IRS in three districts. Bioassays were performed one to two days after IRS, following WHO procedures and measured at three different heights of the walls (top, middle and bottom) in 19 structures in each district. Average mortality was 99.1% with the range from 97.8% (top) to 100% (middle). One month after spraying, mortality rates were 94.9% in Fana, 90.1% in Baroueli, and 100% in Koulikoro.
- Prior to the IRS campaign, AIRS Mali conducted baseline entomological data collection in seven health areas. The collectors used HLC and CDC LTs to determine HBRs. They also used PSC inside houses to assess indoor resting densities of malaria vectors. The results showed that *An. gambiae* s.l. is the predominant species complex captured in all surveyed sites.
- In August, at the start of the rainy season, data from HLC indicated *An. gambiae* s.l. biting rates in Koulikoro, an IRS site, increased by five times outdoors, but stayed the same indoors as compared to baseline. In Kati (control site), the *An. gambiae* s.l. biting rate was extremely high at 59.5 b/m/n indoors and 52.3 b/m/n outdoors, a fivefold increase indoors and outdoors compared to the baseline.
- Finalized the two-year analysis of the study on the “Impact of New Combination LLIN Products on Entomological Measures of Malaria Transmission in Southern Mali.”
- Received acceptance for one oral and two poster presentations at the 2016 ASTMH Conference.

## 1.11 MOZAMBIQUE

### PROGRAM HIGHLIGHTS

- Conducted an IRS Boot Camp in Namaacha District, Maputo Province. It was a two-part workshop, namely, Managing IRS Operations: Workshop for IRS Project Managers at District and Provincial Levels (July 11–14), and Coaching and Training to Improve Spray Operator Performance (July 15–August 8). Participants came from 12 provinces (39 districts) representing IRS implementation funded by PMI, Global Fund, Government of Mozambique (GoM) and the Private Sector.
- Supported NMCP’s IRS Planning Committee in preparation of the GoM’s 2016 spray campaigns.
- Introduced the Disease Data Management System (DDMS) in Mozambique. Trained 11 people (including three women). Trainees included AIRS Mozambique’s Ento Coordinator, Insectary & Entomology Technician, Senior Entomologist and Database Manager, and three Zambezia Provincial Health Directorate entomology technicians, three NMCP entomologists, and one entomologist from the Institute of Public Health.
- Hired a Senior Medical Entomologist seconded to the National Malaria Control Program (NMCP), an Operations Manager, Communications Manager, Warehouse & Logistics Officer, five District Coordinators and a Procurement Manager.

- Carried out the pre-spray environmental assessment (PSECA) in all seven IRS districts in Zambezia; rehabilitated 27 operational sites.
- Led a two-day microplanning meeting in August in preparation for Zambezia’s 2016 spray campaign.
- Conducted PSC, CDC LT and HCL collections in four sentinel sites. Milange, Morrumbala, Mocuba were in intervention areas and Maganja da Costa was in a comparable non-intervention district.
- Conducted susceptibility testing in September 2016 with collection of larvae from Magana. The insecticides tested were pirimiphos -methyl 0.25%; alpha-cypermethrin 0.5%, permethrin 0.75%, DDT 4% and bendiocarb 0.1%. The 24h mortality was 100%, 97%, 79%, 98% and 95%, respectively.
- Expanded the entomological surveillance to the district in September 2016, and conducted a baseline study through CDC LT and HLCs, ahead of the spray campaign scheduled to begin in October 2016.
- Provided financial support to the NMCP for resistance monitoring, using PSCs and cone bioassays to evaluate the quality of IRS operations and decay rate of insecticides sprayed in seven provinces: Niassa, Tete, Manica, Sofala, Inhambane, Maputo, and Gaza.

## 1.12 NIGERIA

### PROGRAM HIGHLIGHTS

- The National Malaria Elimination Program (NMEP) in collaboration with the State Ministries of Health and the project completed the transition to all PMI-supported states of Bauchi, Oyo, Akwa Ibom, Ebonyi, Sokoto and Nassarawa, representing all ecological zones of Nigeria. NMEP with support from AIRS Nigeria organized the National Entomology Review Meeting in Keffi in May.
- Study teams from all six sentinel sites used baited CDC LTs and PSC sampling methods to collect 11,672 *Anopheles* mosquitoes, of which 49.78% were caught using the PSC method; 50.22% were caught using CDC LTs, 64.41% were caught indoors and 35.59% were caught outdoors. Surveys show a predominance of *An. gambiae* s.l. (in all sentinel sites) compared to other *Anopheles* species, which is in agreement with previous findings in similar locations. Important minor species such as *An. funestus*, *An. coustani*, and *An. squamosus* were observed.

## 1.13 RWANDA

**TABLE 6: AIRS RWANDA AT A GLANCE**

Number of districts covered by PMI-supported IRS	2 districts (Nyagatare and Kirehe)
Insecticide	OP (Actellic CS)
Number of structures covered by SOPs	198,970
Number of structures targeted by SOPs	200,278
Spray coverage	99.3%
Population protected by PMI-supported IRS	Total: 812,714 Pregnant women: 13,718 Children under five years: 118,913
Dates of PMI-supported IRS campaign	September 19 - October 11, 2016
Length of campaign	20 days
Number of people trained with USG funds to deliver IRS*	1,833

\*This is based on the PMI indicator definition. It includes only spray staff such as spray operators, team leaders, supervisors, and clinicians. It excludes data clerks, IEC mobilizers, drivers, washers, porters, pump technicians, and security guards.

## PROGRAM HIGHLIGHTS

- The UNITAID copayment was applied to the procurement of the organophosphate insecticide for the September spray campaign.
- The SMS job aids component was used during the spray campaign as the program was able to tailor daily SMS reminders/job aides to seasonal workers based on issues and audiences. In close collaboration with the Malaria and Other Parasitic Diseases Division and District authorities, supervision was enhanced based on lessons learned in past IRS campaigns.
- Distributed female hygiene pads ‘Afripads’ to all female seasonal workers.
- Hosted delegates attending NGenIRS launch to a field visit in Kirehe to observe IRS activities.
- Following the February 2016 spray campaign in which AIRS Rwanda used a carbamate (bendiocarb 80WP) monthly wall bioassays were conducted. During the fourth month (June 2016) post-IRS assay mortality of over 80% was observed on all three surface types in the two districts.
- Cone bioassays were conducted within the first week of spraying. In all test cones, 100% mortality of susceptible *An. gambiae* s.s. was recorded.
- PSC and HLC were conducted during the reporting period; vector density (average *An. gambiae* s.l./house/day) was highest in Nyagatare relative to the other IRS districts.

## 1.14 SENEGAL

**TABLE 7: AIRS SENEGAL AT A GLANCE**

Number of districts covered by PMI-supported IRS	4: Koumpentoum, Koungheul, Malem Hoddar, and Nioro
Insecticide	OP (Actellic CS)
Number of structures found by SOPs	128,185
Number of structures sprayed by SOPs	124,757
Spray coverage	97.3%
Population protected by 2016 IRS campaign	Total: 496,728 Pregnant Women: 9,951 Children under 5: 82,768
Dates of PMI-Supported IRS Campaign	July 11 – August 2, 2016 (Koumpentoum, Koungheul, and Nioro) July 21 – 26, 2016 (Malem Hoddar)
Length of Campaign	20 days (Koumpentoum, Koungheul, and Nioro) 6 days (Malem Hoddar)
Number of people trained with USG funds to deliver IRS *	793

\*This is based on the PMI indicator definition. It includes only spray staff such as spray operators, team leaders, supervisors, and clinicians. It excludes data clerks, IEC mobilizers, drivers, washers, porters, pump technicians, and security guards.

## PROGRAM HIGHLIGHTS

- Under the NMCP’s leadership, AIRS Senegal organized the National IRS Planning Workshop from April 28-29, 2016. District microplanning sessions were conducted in May with local leaders and stakeholders to validate spray calendar and communication plans and to find consensus on IRS

activities to be implemented during the campaign.

- Conducted a series of trainings for various IRS components prior to the campaign. In total, 1,034 persons were trained among which 303 were women, representing 29%.
- Community-based IRS was piloted in Malem Hoddar to reduce IRS cost and build country capacity to lead IRS implementation. Local authorities provided horse-tracked carts and lodging for SOPs. The average rate of structures sprayed in Malem per day per SOP was 19.5 compared to 15.9 in 2015.
- Campaign evaluation meetings at the site, district, and national level were held with stakeholders and authorities to identify strengths and limitations of the 2016 spray campaign. Continuation of IRS and an external evaluation for future expansion of community-based IRS were strongly recommended.
- The project demobilized commodities, rehabilitated sites and moved leftover insecticide, equipment, and PPE from the 24 operational sites to the three district-level warehouses. Leftover active charcoal, empty insecticide bottles and solid waste were transferred to the main warehouse in Kaolack.
- Worked with Université Cheikh Anta Diop de Dakar in the target districts and unsprayed areas.
- Cone bioassay tests were conducted shortly after spraying and indicated that spraying was of an acceptable quality, with mortality between 95-100% at all sites.
- Collected data on species composition, vector biting rates and vector behavior in 24 sentinel sites.

## 1.15 TANZANIA

**TABLE 8: AIRS TANZANIA AT A GLANCE**

Number of districts covered by PMI-supported IRS	1- Geita TC
Insecticide	OP (Actellic CS)
Number of structures targeted by PMI-supported IRS	20,000
Number of structures found by SOPs	23,772
Number of structures sprayed by SOPs	21,151
Spray coverage	89%
Population protected by PMI-supported IRS	Total: 95,975 Pregnant women 5,632 Children under 5: 20,997
Dates of PMI-supported IRS campaign	June 15-27, 2016 August 22 - September 1, 2016
Length of Campaign	22
Number of people trained with USG funds to deliver IRS*	316

\*This is based on the PMI indicator definition. It includes only spray staff such as spray operators, team leaders, supervisors, and clinicians. It excludes data clerks, IEC mobilizers, drivers, washers, porters, pump technicians, and security guards.

### PROGRAM HIGHLIGHTS

- As part of a Public Private Partnership, AIRS Tanzania and Geita Town Council and Geita Gold Mines (GGM) conducted a 22-day spray campaign (June 15-27 and August 22- September 1, 2016) in Geita Town Council, covering the 10 communal wards and the GGM staff quarters.
- Storekeepers used the PMT and daily SMS with mobile phones, to report daily spray data for decision

making. The feedback helped to identify and reach underperforming teams for prompt support. In addition, supervisors and AIRS staff used mHealth tools for supervision activities. Reports from the mHealth tools were disseminated to supervisors, government supervisors, and AIRS staff.

- A Mwanza-based plastic recycling company certified by the National Environmental Management Council was contracted to recycle empty Actellic bottles and convert them into waste water pipes. AIRS Tanzania identified a company to recycle cardboard cartons and is working with the National Environmental Management Council to secure approval for this activity.
- Entomological surveillance for AIRS Tanzania was subcontracted to the Mwanza and Amani Centers of the National Institute for Medical Research (NIMR).
- Spray quality assurance cone bioassays produced mortality of 97.8-100%, indicating satisfactory spraying. In June (three months post spraying), 24-hour mortality was still >80 percent at all sites.
- Conducted susceptibility testing with *An. gambiae* s.l. between April and August at 11 sentinel sites.

## 1.16 ZAMBIA

### PROGRAM HIGHLIGHTS

- AIRS Zambia coordinated closely with Zambia government staff to conduct microplanning and created a staggered spray schedule for 35 targeted districts. The team completed all trainings, emphasizing spray quality, direct observation, and on-the-spot coaching to improve spray quality.
- All operational sites were assessed and improvements were made, if needed, including ensuring that soak pits were ready to use before the campaign began.
- To improve supervision and reporting, the country team worked with the home office team to migrate the supervisory forms from the Abt-managed cloud system to Dimagi's cloud-based system, CommCare. The IRS database went through some modifications to capture changes made to the team leader form. This included adding the DOS information that will be collected daily by supervisors.
- The M&E and Operations team worked with its partner, Akros, to prepare and improve their mSpray mHealth data collection tool. AIRS Zambia hired data entry clerks, whose sole responsibility will be to collect and enter in the data on the tablets. Team leaders will focus on traditional responsibilities, including on the spot spray quality supervision and coaching, as well as problem solving.
- The IRS campaign scheduled for September 26 - November 25, 2016, targets 542,184 eligible structures in 35 districts in four provinces, protecting 2,448,701 people.
- AIRS Zambia continued monthly entomological monitoring across all 10 sentinel sites in six districts. Baseline entomological monitoring for the 2016 campaign was carried out in August and September.
- WHO cone bioassay tests were conducted monthly from November 2015 to April 2016 following the October 2015 IRS campaign. Pirimiphos-methyl was effective on both mud and cement sprayed walls in March 2016, five months after spraying in two districts (Mwense and Isoka), and for cement walls in Kasama and Katete. The mortality at all sites in April, six months after spraying, was below 80%. Residual life of pirimiphos-methyl at all sites was shorter than the expected six months.
- Collected baseline data for the operational research project on resistance intensity. The Rapid Resistance Intensity Diagnostic test (I-RDT) was performed from March to May 2016.

## 1.17 ZIMBABWE

### PROGRAM HIGHLIGHTS

- Expanded IRS operations to carry out blanket spraying in four PMI-supported districts, covering an additional 21 wards during the 2016 IRS campaign scheduled for October-November. Operational days were reduced from 35 to 30 days.
- Assessed the impact on malaria burden following the shift of insecticides from pyrethroids to organophosphates in four PMI-supported districts in Manicaland Province. The team submitted a report with preliminary results to PMI for review and feedback.
- Provided technical contributions to NMCP during the Malaria Program Review process and the development of the Insecticide Resistance Monitoring and Management Plan for Malaria Vectors in Zimbabwe (2016-2020) and Pre-elimination Guidelines, and the gap analysis for the Global Fund project.
- In collaboration with Environmental Health Directorate of MOHCC and Environmental Management Agency of Zimbabwe, incinerated 1,940 kg of solid IRS waste from the 2015 project IRS operations in Chegutu. A South African-based company, through a Zimbabwe-based agent Go Green, recycled the empty OP bottles and cardboard boxes.
- Procured spray supplies and equipment for the 2016 IRS campaign. The team completed pre-spray assessments of 19 operational sites and established 22 latrines with bathing facilities at 11 strategically-selected camp sites to ensure privacy.
- Completed monthly cone bioassay tests to determine the decay rate of pirimiphos-methyl through March at Burma Valley (Mutare District) and through April at Chakohwa (Chimanimani District).
- In May, the team conducted Refresher Entomological training for 27 Insectary Managers, eight Provincial Field Officers and one District Environmental Health Officer.
- The Technical Manager/Entomologist and Entomological Coordinator attended the Foreign Researcher Registration Sensitization Consultative Workshop hosted by the Research Council of Zimbabwe in July 2016. The team sent 161 preserved *Anopheles* specimens to Notre Dame University for sequencing at the end of September.
- The entomologist to be seconded to NMCP started work in August and will be stationed at NIHR.

## 2. CORE

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### 2.1 CAPACITY BUILDING

Two capacity building workshops (boot camp) for district IRS leaders were conducted in Ethiopia (April 4-7, 2016) and Mozambique (July 11-18). The training, primarily facilitated by the AIRS Director of Operations and a consultant representing EnCompass, included: Managing IRS Operations and Coaching & Training to Improve Spray Operator Performance. See country sections for more information.

### 2.2 OPERATIONS RESEARCH

#### **Zambia Operational Research Study**

The study aims to understand correlations of resistance intensity of pyrethroid insecticides with the performance of LLINs in an experimental hut setting, and the use of organophosphate IRS to mitigate pyrethroid resistance. Follow-up insecticide resistance intensity assays were conducted in Samfya and Milenge Districts of Luapula Province, to check stability of insecticide resistance intensity. Intensity assays were done on multiple pyrethroids (deltamethrin, permethrin, and alpha-cypermethrin) to select appropriate villages for the experimental hut studies. Insecticide resistance intensity assays were carried out using the standard CDC bottle bioassay method in villages of the proposed transect of *An. funestus*. At 10x the diagnostic dose for deltamethrin, Shitambulli has a significantly lower mortality rate than each of Chinkula-Yatema, Fumpa Kulusa, and Johny-Nkumba. No other difference in mortality rates between villages was found. At 5x the diagnostic dose for deltamethrin, Chinkula-Yatema has statistically higher mortality rate than Fumpa Kulusa. At 2x the diagnostic dose for alpha-cypermethrin and at 1x the diagnostic dose for permethrin and alpha-cypermethrin, Chinkula-Yatema has statistically higher mortality rate than Shitambulli. No other difference in mortality rates between villages was found at the 1x and 2x doses for the two pyrethroids. Based on data on insecticide resistance intensity of the three pyrethroid insecticides, we chose Chinkula-Yatema as the low intensity village and Shitambulli as the high intensity. The study protocol was submitted to the USAID operational research committee.

#### **Ghana Operational Research Study**

A concept note and protocol were developed for operational research on “The evaluation of pirimiphos-methyl efficacy in experimental huts when sprayed on half the usual surface area against natural populations of *Anopheles gambiae* in Ghana.” This study aims to determine whether the amount of insecticide sprayed and its operational cost can be reduced without compromising the efficacy of IRS. The study will evaluate different spraying scenarios by spraying only the top or bottom half of the walls with and without spraying the ceilings. Both the concept note and protocol were recently approved by the operational research committee. Preparations are currently underway for the construction of experimental huts at Kulaa community near Tamale in Northern Ghana.

### 2.3 MHEALTH

The project used the three mobile tools (Performance Monitoring Tracker, Supervisory Forms, SMS Job Aid) in Benin, Ethiopia, Ghana, Madagascar, Mali, Mozambique, Rwanda, Senegal, and Zambia. Mozambique started spraying outside of the reporting period but preparation work occurred within the reporting period. Each country required alterations of the tools and close follow up with setup, training,

and implementation of the tools. Dimagi led all configuration changes and directly guided in-country teams on the use, roll-out, and management of the tools.

AIRS Madagascar replicated and improved an e-inventory system that the AIRS Mali team designed earlier to track their stock of insecticide and other supplies on a daily basis. The improved version includes automated data entry into the e-inventory database from SMS data submitted by warehouse managers, instant stock tallying with automated red flag warnings when various stocks are running low in any of the warehouses, and an online access portal for the e-inventory system. The portal allows multiple users to access and view the data simultaneously and is less labor intensive. Red flag warnings prompt the logistician and central warehouse manager to send needed supplies to local warehouses before supplies run out or to transfer supplies between warehouses if needed.

Akros continued implementing the mobile data collection and decision-making system called mSpray in Zambia. The cloud-based system allows for the electronic collection of spray data and GPS coordinates from specific structures via handheld tablets. Improved Open Map Kit layers provided mSpray team leaders with better maps that increased the functionality of the mSpray tool for real-time decision making.

To optimize the mSpray teams, the project created a new position of team leader assistants for the 2016 campaign. This assistant is solely responsible for data collection on tablets, allowing mSpray team leaders to effectively supervise their team of SOPs. Previously, team leaders were responsible for conducting data collection on tablets. To increase the speed and ease of data verification and cleaning on the back end, the M&E team incorporated a unique spray form ID code on the SOP data collection form.

The mHealth working group submitted abstracts for a panel and an oral presentation at the Global Digital Health Forum held annually in Washington, DC, in December 2016. Both abstracts were accepted.

## **2.4 DISEASE DATA MANAGEMENT SYSTEM (DDMS)**

The DDMS manages entomology data in Ethiopia, Ghana, Madagascar, Mali, Mozambique, Zambia and Zimbabwe. Teams in Mozambique and Madagascar were trained on the set up and use of DDMS and are at an early stage of implementation. Other countries are at a more advanced stage of implementation. The project, in partnership with the Liverpool School of Tropical Medicine, developed an automatic report generator for all entomology outcome measures being collected to help produce reports that are in line with the entomological monitoring reporting template developed by PMI AIRS COR team.

## **2.5 COST EFFICIENCY**

AIRS continued the implementation of a series of cost-efficiency initiatives in several countries where feasible. The impact of these initiatives was observed mostly on an operational level. Actions taken by individual countries included: reducing the number of spray campaign days; minimizing the number of district warehouses; regularly maintaining soak pits and site offices during non-spray period, which subsequently reduced high renovation costs; assigning the mobilization and supervision components to the local government; decreasing the number of mobilizers; staggering spray starts each day to reduce vehicle rental; negotiating lower costs with local suppliers; acquiring free operational sites from local authorities; reproducing in-house most of the items that were previously outsourced to printing companies; reducing the number of printed manuals and IEC tools by using previous year's documents; giving database ownership to countries thereby limiting the use of the Client Technology Center; and minimizing external reliability on partners/subcontractors.

## **2.6 GENDER**

AIRS Rwanda and AIRS Ghana piloted the distribution of menstrual hygiene products to seasonal workers to address concerns that some women were not able to attend work while menstruating due to a lack of sanitary products. Results from these pilots will help the project understand how access to hygiene products impacts absenteeism during spray campaigns.

The project completed a qualitative study in Ghana to better understand the interactions between gender norms and acceptance of IRS and continued with the gender norms survey in Zimbabwe, Ethiopia, Madagascar and Rwanda. The project produced a report summarizing the findings of the first year of survey data as well as a technical brief describing the breadth of the project's work on gender.

## 2.7 PROJECT-WIDE ENTOMOLOGY TRAINING

During this reporting period, 44 participants from 19 countries were trained on essential aspects of malaria entomology. Trainings were conducted in Dakar, Senegal (May 23-28, 2016) and Harare, Zimbabwe (June 27 to July 2). To assess the impact of this training, pre- and post-tests were given to the participants (Table 9). The results clearly indicated that participants gained knowledge from the training. The mean test result increased on average by 15%. The participants also acquired hands-on experience in entomological monitoring in efforts to further improve the quality of entomological data collected and strengthen working relationships between the project and NMCP entomologists.

**TABLE 9: PRE AND POST-TEST RESULTS**

Host Country	Variable	No of participants	Mean	Min	Max	Std. Dev.	Std. Err.	95% CI	P-value
Senegal	Pre-test	15	50.2	35.29	70.59	11.47	2.96	43.84-56.55	0.0004
	Post- test	15	63.7	47.06	82.35	11.04	2.85	57.61-69.84	
Zimbabwe	Pre-test	25	56.25	16.66	80	15.09	3.02	50.01-62.48	<0.0001
	Post- test	25	71.03	20	100	18.03	3.6	63.60-78.50	

## 2.8 ENVIRONMENTAL COMPLIANCE AND SAFETY

AIRS prepared and presented the Pan-African Environmental Compliance Capacity Building and Staff Training in Senegal April 6-8. The training was attended by all 11 AIRS Environmental Compliance Officers (ECOs), as well as a government representative (MOH or MOE) from each AIRS country with spray operations. Additional government representatives from Senegal attended as well as USAID West African environmental personnel and the Global Health Bureau Environmental Officer.

AIRS developed a protocol to use wet wipes for PPE cleaning and piloted the use of Tyvek suits in Senegal, Mali, and Madagascar. The operators cited the ability to take mid-day hydration breaks and the light weight of the suit as advantages, but in general felt that the suits were hotter to wear.

AIRS presented to the Global Health Bureau on recycling waste from IRS operations. It was noted that AIRS had surpassed one million bottles recycled, and over 32 tons of cardboard.

Supplemental Environmental Assessments were completed for Benin and Mali, and Letter Reports were submitted for Ethiopia, Senegal, Madagascar, Rwanda, Zambia, Mozambique, and Zimbabwe.

## 2.9 PAMCA

The third annual conference of the Pan African Mosquito Control Association was held in Lagos, Nigeria from September 6-8, 2016. The project presented on the following topics:

- Enhanced vector surveillance and insecticide resistance monitoring in lake endemic regions of western Kenya;
- Monitoring of *Anopheles gambiae* s.l. population variations in two sentinel sites in Liberia: Tomato Camp and Frank Town;
- Insecticide Resistance Frequency, intensity and mechanism in *Anopheles gambiae* s.l. populations in

five ecological zones of Nigeria (Petrus Inyama); and

- Vector surveillance, focusing on insecticide resistance and malaria vectors species composition in Nigeria and the public health importance of malaria vectors surveillance.

## 2.10 ZIKA

On September 2, 2016, the PMI AIRS Project was modified to expand its scope to vector-borne diseases worldwide, extending the period of performance of the overall award to September 25, 2018 and increasing the ceiling cost by \$60 million. The new activities, under the name the Zika AIRS Project (ZAP), include entomological monitoring and vector control activities in five focus countries (Dominican Republic, El Salvador, Guatemala, Haiti, and Honduras) and additional light touch countries throughout Latin America and the Caribbean. All activities are focused on an emergency response to the Zika virus.

## 2.11 JOURNAL ARTICLES

Seven manuscripts were submitted to PMI during this reporting period. Three were published and one was submitted to a journal. Comments/inputs have been received on the other two. Manuscripts include:

- “Short Persistence of Bendiocarb Sprayed on Pervious Walls and Its Implication for the Indoor Residual Spray Program in Ethiopia” – published in *Parasites & Vectors* in May.
- “Feasibility and Efficacy of mHealth: A Case Study of Mobile Messaging in Mali”- published in the *Global Health: Science and Practice* in June 2016.
- “Mobile Soak Pits Improve Spray Team Productivity and Environmental Compliance of Malaria Control Program” published in *Journal of Environmental Management* in June.
- “Community-Based Indoor Residual Spraying: An innovative approach to deliver effective, cost-efficient, and sustainable malaria prevention in Ethiopia” – finalized.
- “Multi-Country Assessment of Residual Bio-efficacy of Insecticides Used for Indoor Residual Spraying in Malaria Control on Different Surface Types: Results from Program Monitoring in 15 PMI/USAID-supported IRS Countries” – under revision.
- “Equal opportunity, equal work: Increasing women’s participation in the U.S. President’s Malaria Initiative (PMI) Africa Indoor Residual Spray (AIRS) program to prevent malaria” – written and under revision for final approval and submission in December 2016.
- “Insecticide Resistance Profile of Malaria Vectors in Madagascar” – written and approved.

## 2.12 COMMUNICATIONS

Nine success stories and one Malaria Fighter profile were written, posted on the project and PMI websites and distributed via the AIRS quarterly e-letter. AIRS distributed two e-letters (June/September) and one e-alert (April) to more than 3,700 global health professionals. The editorial *The Next Malaria Threat: Insecticide Resistance* was shared on the Abt Associates blog and PMI and project websites. The video *Equal Work, Equal Opportunity*, which focused on the project’s gender initiatives, was finalized and shared widely. The video *Tackling Malaria: Entomology is the Key* was produced and publicized. The project produced a video for NBA Player Stephen Curry’s Call Your Shot Campaign. A Tech Talk on “New IRS Training Curricula” was held with the Chiefs of Party in June.

## 2.13 NEW EMPLOYEES

Emily MacDonald, M&E Specialist, supports the AIRS M&E teams in Benin, Madagascar, and Zimbabwe as well as the mHealth Technical Working Group with managing the subcontractor, Dimagi, and the Gender Technical Working Group. Leslie Miles, M&E Specialist, supports AIRS Rwanda.

Associate Finance & Contract Analyst Abigail Connors supports the AIRS Finance & Contract management team and Finance & Contract teams in DRC, Burkina Faso, and Haiti.

## 2.14 FINANCE

AIRS home office and country finance teams traveled to Dar es Salaam, Tanzania, for a participatory training from June 22-24, 2016. The training focused on proper financial management, ethics and compliance, and the division of responsibilities between various members of site staff offices. The training provided assistance in making implementation compliant, efficient, and timelier; and introduced new management and implementation strategies such as fully electronic Remote Office Vouchers or ROVs (the monthly reporting of field costs for home office review) and Mobile Payments.

## 2.15 UNITAID

NGenIRS is a UNITAID-funded partnership between the Innovative Vector Control Consortium (IVCC), PMI, and its IRS implementing partners Abt Associates Inc., Global Fund (GF), PATH/Malaria Control and Elimination Partnership in Africa, and NMCPs. The objective is to accelerate and expand access and affordability of new, third generation formulations of IRS insecticides (3GIRS) for malaria vector control to mitigate insecticide resistance and increase the effective susceptible lifetime of IRS insecticides. Ethiopia, Mali, Rwanda and Zambia benefited from the UNITAID co-payment through NGenIRS. Draft work plans for the countries expected to benefit from the co-payment in Year 2 (Benin, Ghana, Kenya, Madagascar, Mozambique, Tanzania, and Zimbabwe) were submitted in August. Below are summary results of Ethiopia and Mali, the countries that completed spray campaigns during the period in review. In Mali, a total of 95,145 additional structures were sprayed in 2016 as a direct benefit from the copayment. In Ethiopia, an additional 24 districts made the transition from carbamates to Actellic 300CS, a more effective and longer-lasting insecticide, resulting in an increase of 6,998,400 in person months protected.

**TABLE 10: UNITAID SUMMARY RESULTS**

	2015					2016				
	Number of bottles of Actellic procured	Number of bottles of Actellic used	Structures sprayed with Actellic	Population covered by Actellic	Number of person months of protection	Number of bottles of Actellic procured	Number of bottles of Actellic used	Structures sprayed with Actellic	Population covered by Actellic	Number of person months of protection
Mali	54,287	58,472	133,527	494,205	2,965,230	89,703	84,571	228,672	788,922	4,733,532
Ethiopia	87,372	80,836	195,978	522,345	3,134,070	286,000	271,196	715,541	1,688,745	10,132,470

Note: Bottles used in Mali in 2015 is more than procured due to remaining stock from 2014

Note: In Ethiopia, only 8 districts received Actellic in 2015. In 2016, AIRS Ethiopia purchased Actellic for all 36 districts.

Note: We used a 6 month residual life for Actellic to calculate the number of person months of protection (i.e. # of people protected \* 6 months)

# ANNEX A: M&E RESULTS SUMMARY

Country	# Structures Sprayed	Spray Coverage	Total Population Protected	Children Under Five Protected	Pregnant Women Protected	# People Trained*
Benin	269,179	99.91%	858,113	167,041	36,088	3,104
Ethiopia**	715,541	99.74%	1,688,745	230,690	23,011	2,749
Ghana	205,935	91.69%	553,954	98,525	11,676	698
Mali**	228,672	97.14%	788,922	135,754	20,813	1,216
Senegal**	124,757	97.33%	496,728	82,768	9,951	793
Tanzania (GGM)	21151	88.97%	108,043	20,997	5,632	265
<b>AIRS TOTAL</b>	<b>1,565,235</b>	<b>97.90%</b>	<b>4,494,505</b>	<b>735,775</b>	<b>107,171</b>	<b>8,825</b>

\*This is based on the PMI indicator definition. It includes only spray staff such as spray operators, team leaders, supervisors, and clinicians. It excludes data clerks, IEC mobilizers, drivers, washers, porters, pump technicians, and security guards.

\*\*Data have been cleaned and finalized, but the EOSR has not yet been approved.

# ANNEX B: INSECTICIDE AND EQUIPMENT PROCUREMENT

Commodity	Country	Description	Total Cost	Order/PO Date	Delivery Date
Hudson Sprayers & Parts	Zambia	Nozzles, Spare Parts	\$25,238.15	May, 2016	*Pending
Hudson Sprayers & Parts	Zimbabwe	Nozzles, Spare Parts	\$50,124.40	Sep, 2016	*Pending
Hudson Sprayers & Parts	Mozambique	Nozzles, Spare Parts	\$2,507.00	Sep, 2016	*Pending
Insecticides	Madagascar	Organophosphates	\$1,103,508.36	Apr, 2016	June, 2016
Insecticides	Zimbabwe	Organophosphates	\$1,910,220.00	Apr, 2016	Sep, 2016
Insecticides	Zimbabwe	Organophosphates	\$943,715.50	Sep, 2016	*Pending
Insecticides	Rwanda	Organophosphates	\$2,800,692	Apr, 2016	Aug, 2016
Insecticides	Zambia	Organophosphates	\$2,143,783	Apr, 2016	Aug, 2016
Goizper Sprayers & Parts	Mali	Valves, Spare Parts	\$8,025.00	Apr, 2016	June, 2016
Goizper Sprayers & Parts	Ghana	Valves, Spare Parts	\$2,416.84	Apr, 2016	June, 2016
Goizper Sprayers & Parts	Senegal	Valves, Spare Parts	\$11,823.8	May, 2016	Sep, 2016
Goizper Sprayers & Parts	Zambia	Valves, Spare Parts	\$36,357.08	May, 2016	Aug, 2016
Micron Spare Parts	Mozambique	Spare Parts	\$1,789.25	Sep, 2016	Nov, 2016
Personal Protective Equipment	Ethiopia	PPE	\$161,517.60	Apr, 2016	May, 2016
Personal Protective Equipment	Zambia	PPE	\$34,808.00	Aug, 2016	Sep, 2016
Personal Protective Equipment	Rwanda	PPE	\$8,235.00	Sep, 2016	Aug, 2016
Personal Protective Equipment	Rwanda	PPE	\$30,197.30	May, 2016	Aug, 2016
Personal Protective Equipment	Mozambique	PPE	\$161,517.60	Aug, 2016	Sep, 2016
Entomology Supplies	DRC	Impregnated Papers	\$797.12	May, 2016	June 2016
Entomology Supplies	Mozambique	Impregnated Papers	\$3,361.26	July ,2016	Sep, 2016
Entomology Supplies	Zimbabwe	Impregnated Papers	\$1,121.48	Aug, 2016	Sep, 2016
Entomology Supplies	Mali	Impregnated Papers	\$498.20	Sep, 2016	Sep, 2016
EC Supplies	Madagascar	Activated Carbon/Filatech	\$1,645.00	May, 2015	June, 2016

EC Supplies	Senegal	Activated Carbon/Filatech	\$364.00	Apr, 2016	May, 2016
Entomology Supplies	Burundi	Entomology Monitoring Supplies	\$15,271	Aug, 2016	*Pending
Entomology Supplies	DRC	Entomology Monitoring Supplies	\$18,145	June, 2016	Nov, 2016
Entomology Supplies	Ethiopia	Bio Monitoring Supplies	\$17,107	May, 2016	Nov, 2016
Entomology Supplies	Ethiopia	Light traps, batteries, charger	\$5,530	Apr, 2016	Nov, 2016
Entomology Supplies	Ghana	Entomology Monitoring Supplies	\$3,072	Apr, 2016	July, 2016
Entomology Supplies	Liberia	Entomology Monitoring Supplies	\$706.00	Aug, 2016	May, 2016
Entomology Supplies	Mali	Entomology Monitoring Supplies	\$1,794	July, 2016	Sep, 2016
Entomology Supplies	Mali	Light traps, batteries, charger, aspirators	\$6,993	Jul, 2016	Sep, 2016
Entomology Supplies	Mali	Bio Monitoring Supplies	\$1,076	Apr, 2016	May, 2016
EC Supplies	Mali	Activated Carbon/Filatech	\$189.00	Apr, 2016	May, 2016
Entomology Supplies	Mozambique	Entomology Monitoring Supplies	\$7,952	Aug, 2016	Sep, 2016
Entomology Supplies	Mozambique	Light traps, batteries, charger	\$40,496	Sep, 2016	Sep, 2016
Entomology Supplies	Nigeria	Bio Monitoring Supplies	\$ \$1,404	Apr, 2016	July, 2016
Entomology Supplies	Senegal	Bio Monitoring Supplies	\$ \$15,872	June, 2016	July, 2016
Entomology Supplies	Senegal	Bio Monitoring Supplies	\$6,916	June, 2016	July, 2016
Entomology Supplies	Senegal	Bio Monitoring Supplies	\$ \$10,697	June, 2016	July, 2016
Entomology Supplies	Senegal	Impregnated Papers	\$2,442.24	July, 2016	Aug, 2016
Entomology Supplies	Tanzania	Bio Monitoring Supplies	\$30,330	Aug, 2016	Nov, 2016
Entomology Supplies	Tanzania	Bio Monitoring Supplies	\$ \$2,410	Aug, 2016	Nov, 2016
Entomology Supplies	Zambia	Entomology Monitoring Supplies	\$7,330	Aug, 2016	Nov, 2016
Entomology Supplies	Zambia	Entomology Monitoring Supplies	\$855	June, 2016	Nov, 2016
Entomology Supplies	Zambia	Impregnated Papers	\$ 1,320.76	June, 2016	Sep, 2016
Entomology Supplies	Zimbabwe	Entomology Monitoring Supplies	\$716.00	July, 2016	Sep, 2016