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President's Malaria Initiative



INNOVATIONS

in Indoor Residual Spraying



Photo credit: © Jessica Scranton

The Africa Indoor Residual Spraying project (AIRS) is funded by the President's Malaria Initiative (PMI) and led by Abt Associates. PMI through the AIRS project is protecting millions of people from malaria by supporting IRS and entomological monitoring in 15 countries in Africa.

Innovation is
the central
issue in
economic
prosperity.

—**Michael Porter**, Harvard Business School



Beneficiaries of the PMI IRS program, Ghana. Photo credit: Erin Schiavone

Insectary-in-a-box Solves Entomological Dilemma

Some of the best inventions are inspired by necessity.

When the Malian military overthrew the central government in March 2012, the Africa Indoor Residual Spraying project (AIRS), funded by the President's Malaria Initiative (PMI), quickly had to improvise a new way to monitor the effectiveness of insecticides used to prevent malaria.

After the coup, PMI was not allowed to work with the new Malian administration. This left the AIRS project without the government partner it typically relied upon to carry out entomological testing during IRS campaigns. This entomological testing is necessary to gauge if the insecticide used in the IRS campaign was indeed killing malaria-transmitting mosquitoes. The testing requires a mosquito breeding facility, called an insectary, with laboratory equipment.

The AIRS team had less than a month to build an insectary that would enable the campaign to begin as scheduled. They devised a novel solution. The project purchased a 40-by-8-foot shipping container locally, had it moved to the project compound, and, in three weeks, turned it into an insectary equipped for breeding, rearing, and testing mosquitoes. By not incurring the expense of buying land and renovating a building, the insectary-in-a-box cost less than US\$20,000.

According to Dereje Dengela, an entomologist and AIRS technical director, the insectary-in-a-box functions just as well as insectaries in regular buildings. In fact, he added, "it is becoming a model for countries that don't have a functioning insectary."

The insectary-in-a-box is divided into three rooms equipped for keeping adult mosquitoes, rearing mosquitoes from larvae, and completing morphological identification, dissection, and susceptibility testing. Dengela said the project was able to ensure the insecticide was at least 97 percent effective in all locations in Mali.

The AIRS team is replicating the insectary-in-a-box in Angola and Liberia.

"I want to congratulate Abt for the new insectary-in-a-box model. It will make it easy to do entomological monitoring in Angola."

—**Jules Mihigo**, resident advisor, PMI Mali and former resident advisor, PMI Angola



A top view of the insectary-in-a-box, which serves as a laboratory for entomologists on the AIRS Mali project.

Mobile Application Strengthens Environmental Compliance

Before an IRS campaign can begin, environmental compliance staff must inspect dozens of operational sites in remote and other difficult-to-access locations. They must ensure that insecticide is kept in a secure and safe place, the store has adequate safety equipment for workers, and waste disposal areas meet environmental compliance standards.

With PMI funding, AIRS has developed a mobile application that makes environmental compliance assessments fast and easy. The site assessment checklist is pre-loaded onto a smartphone to ensure that all environmental compliance aspects of each operational site are inspected. The app will not allow the user to skip any required steps. The smartphone's geographic positioning system records the operational site location to validate that the inspection has been completed. The assessment prompts the user to take photographs of the operational site, which provide managers with evidence that the site meets environmental compliance standards.

Once collected, data are uploaded to an online database. Results of inspections are immediately available to management staff in country offices and in the U.S. home office. The system automatically generates a work list of repairs that need to be made to prepare the operational site for the IRS campaign. The work list is emailed to the AIRS team so they can begin making improvements. Shortly before the start of spraying, a final assessment is done to confirm that all necessary repairs have been completed.

The mobile data collection system is more efficient than a paper-based assessment and allows data to be shared among managers more easily. Time saved on manual data entry can be spent implementing work list recommendations to get operational sites ready for an environmentally safe IRS campaign.



The AIRS Rwanda environmental compliance officer uses the smartphone assessment to check that work sites meet environmental compliance standards. Results are uploaded to an online database.

Ethiopia Pilots Community-based Indoor Residual Spraying

“I am proud of the role I played in coordinating and leading the spray operation as a squad leader. With the community-based IRS, I believe that the quality, efficiency, and effectiveness of the IRS operation was better.”

—**Tigist Legesse**, health extension worker,
Kersa District, Ethiopia



Health extension worker Tigist Legesse meets with a family to prepare their home for indoor residual spraying.

In 2012, PMI piloted a new approach to IRS in Ethiopia—instead of leading operations at the district level, the AIRS project trained 39 women health extension workers from 20 villages in Kersa district to lead IRS from their community health posts. Health extension workers have already received one year of training from the government and are highly regarded in their communities. Using what they learned in the IRS training, health extension workers recruited and trained spray operators and planned and implemented IRS in their villages.

Traditional district-based IRS teams consist of approximately 40 spray operators. They camp at the district health center and travel to houses targeted for IRS in vehicles. Community-based teams are smaller, usually made up of five people. They do not need to camp since they live in the community where they spray. Community-based spray teams walk from house to house.

Utilizing trained health extension workers to lead community spray teams has resulted in several benefits. Recruiting spray operators from the village where they live resulted in strong feelings of ownership by spray operators, close supervision by village leaders, and high acceptance of IRS by the community. Community-based IRS is expected to cost less than district-based IRS since vehicles are not needed to transport spray operators from village to village and camping accommodations are not required. Based on the promising results of this pilot, PMI is testing community-based IRS in six districts in 2013.



These young girls are protected from malaria through the PMI-funded IRS campaign, Rwanda. Photo credit: Erin Schiavone

South-South Exchanges Build Local Capacity

When tasked with implementing sustainable IRS operations in Angola, AIRS Chief of Party Lourdes Loch sought to hire skilled, local staff. However, during Angola's 27-year civil war, many young people emigrated, seeking education and job opportunities abroad. This often leaves local businesses with few qualified job applicants. After eight months of searching for an experienced environmental compliance officer, Loch decided it was time for a new strategy.

AIRS Angola hired Deolindo Manuel Dungula as the project's environmental compliance officer. His technical experience was limited but he demonstrated a good work ethic, solid professional work experience, and the capacity to learn through intensive on-the-job training.

AIRS called on Williams Abilla, a seasoned environmental compliance officer working for AIRS Ghana, to travel to Angola and train Dungula.



Williams Abilla (right), environmental compliance officer for AIRS Ghana, traveled to Angola to train staff.

“I felt humbled to extend my technical expertise to the AIRS Angola team. Being able to share knowledge and resources from AIRS Ghana makes me proud that we all belong to one team.

—**Williams Abilla**, environmental compliance officer, AIRS Ghana

Abilla trained Dungula on theoretical and practical aspects of environmental compliance based on PMI's *Best Management Practices in Indoor Residual Spraying*. Abilla visited all three IRS operational sites with Dungula and carried out an environmental assessment to help Dungula identify problems that had to be fixed before the IRS campaign could start.

As a result of the assessment, the AIRS Angola team rehabilitated warehouses and operational sites to meet environmental compliance standards and prepare for the 2012 IRS campaign. Dungula is leading environmental compliance for the 2013 IRS campaign without additional in-person training.

Leveraging the presence of skilled colleagues across Africa, PMI is able to maintain its commitment to developing a cadre of local staff with the capacity to implement malaria control programs. Through the AIRS project, PMI has sponsored eight South-South technical exchanges across nine countries over two years.

Recycling Gives Insecticide Bottles New Use



AIRS Ghana recycled plastic insecticide bottles, and they were turned into pavement blocks.

It's important to track and properly dispose of all contaminated IRS materials, particularly insecticide packaging. Litter from the packaging could potentially contaminate the water supply, harming the environment and possibly causing people to get sick. Traditionally, insecticide is packaged in paper sachets. Empty sachets are incinerated at the end of the spray campaign.

In Ghana, PMI started using a new insecticide packaged in a plastic bottle, so the AIRS project decided to recycle the bottles. Incinerating the plastic bottles would have been hazardous to the environment and burying bottles in a landfill would increase the risk that people could dig them up for household use.

In Africa, recycling is not commonplace. Identifying a recycling center able to handle hazardous materials proved even more challenging. However, AIRS found a willing local partner in Cyclus Elmina Recycling Center.

At the end of the IRS campaign in Ghana, all plastic insecticide bottles were collected, rinsed and transported to the recycling center. The bottles were crushed, washed, and mixed with sand to create cement that was used to make paving blocks. More than 43,000 insecticide bottles have been recycled, creating 8,600 paving bricks.

IRS implementers in Liberia and Benin are also using insecticide packed in plastic bottles but do not have recycling centers in country. They are sending their empty insecticide bottles to the recycling center in Ghana.



AIRS protected more than 1.5 million people from malaria in Ethiopia in 2012. Photo credit: © Jessica Scranton

Strong M&E System Improves Data Quality

PMI measures its IRS performance in part by collecting data on the number of structures sprayed, pregnant women and children under five protected from malaria, seasonal staff trained, and several other indicators. AIRS collects data from millions of households across 13 countries in Africa.

Spray operators and team leaders record much of this information on paper by hand in the field. But data entry errors, such as missing numbers and arithmetic errors, limit the quality of the data. Data clerks spend considerable time correcting these mistakes.

AIRS has developed a monitoring and evaluation (M&E) system to improve data quality. New M&E tools help country staff to prevent and correct common errors that occur while collecting data in the field and entering data into the database. Approximately three months after the IRS campaign, the Post-spray Data Quality Audit is used to verify the quality of spray data. These quality assurance mechanisms help PMI to have an accurate measure of IRS program results.

NUMBERING ERRORS FOR IRS CARD HOUSEHOLD ID COLUMN

Name of Head of Household	Serial No. of Eligible Structure	
	IRS Card Household ID	01, 02, 03, etc.
Musa Ahmadu	002015	- 01, 02, 03
Adamu Shehu	002016	- 01
Sani Isa	002017	- 02
Ismaila Usman	002018	- 0011
Amadu Tanko		- 01
Ernest Oboyo	02020	- 01
Ernest Oboyo	02020	- 02
Fatima Umar	002021	-
Total	Total number of Eligible structures	- 24

Error: The IRS Card Household ID number only has 5 digits; in this example, the correct format is a 6 digit number (#####).

Error: IRS Card Household ID is missing for this entry; without this, the data cannot be entered into the database.

CORRECT NUMBERING FOR IRS CARD HOUSEHOLD ID COLUMN

Name of Head of Household	Serial No. of Eligible Structure	
	IRS Card Household ID	01, 02, 03, etc.
Musa Ahmadu	002015	- 01
Musa Ahmadu	002015	- 02
Musa Ahmadu	002015	- 03
Adamu Shehu	002016	- 01
Sani Isa	002017	- 01
Ismaila Usman	002018	- 01
Amadu Tanko	002019	- 01
Ernest Oboyo	002020	- 01
Ernest Oboyo	002020	- 02
Fatima Umar	002021	- 01
Total	Total number of Eligible structures	10

Correction: All IRS Card Household IDs have the correct number of digits; in this example, 6 digits.

Correction: Notice that there are no blank cells in the table; this is a complete table.

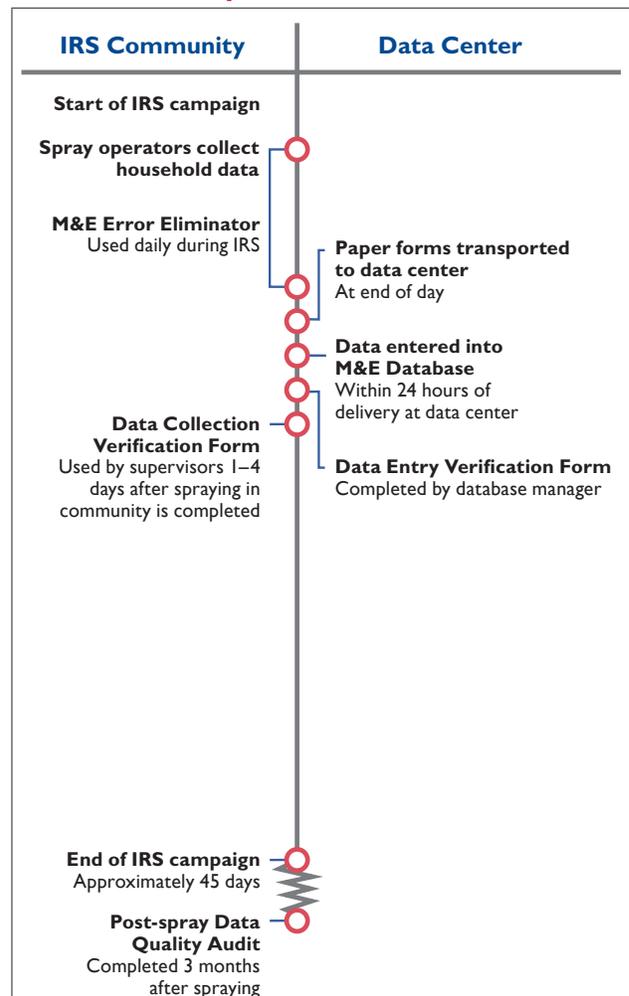
The M&E Error Eliminator helps prevent common data entry errors.

M&E Error Eliminator

Nigeria M&E specialists Joseph Okeke and Funto Adejuwon created the M&E Error Eliminator. The tool helps supervisors spot common data collection errors and systematically verify that each data point was recorded accurately.

All staff helping to implement or supervise the collection of data are trained to use the M&E Error Eliminator. Before leaving the field every day, team leaders and

Journey of a Spray Form through the AIRS M&E System



Note: This process is repeated in each IRS community.



A family in Rwanda displays its household spray card. Photo credit: Erin Schiavone

“The Data Entry Verification Form not only identifies human error that the database doesn’t always pick up, but it also serves as an accountability check to monitor and assess data clerk performance.”

—**Bertille Onambele**, M&E manager, AIRS Benin

supervisors randomly check several data collection forms with the M&E Error Eliminator. If they see that data are entered incorrectly, they notify the spray operator and make him or her return to the household to get the correct information.

“The principle behind this is that IRS field workers are from the start introduced to these common errors and also instructed on how to avoid them,” Okeke said.

The M&E Error Eliminator has proven so useful that it is being implemented in all 13 countries where PMI conducts IRS through the AIRS project.

M&E Data Collection Verification Form

A few days after a village has been sprayed, an M&E supervisor visits a random sample of homes to spot check data recorded by spray operators. During their visits, supervisors interview residents and check their IRS Household Card, which documents the date of spray and the unique household identification number. Supervisors record information provided by the household on the Data Collection Verification Form and compare it to data recorded by spray operators.

The Data Collection Verification Form helps the M&E team validate that the information collected by spray operators is accurate. If supervisors identify discrepancies between the information provided by the household and the data collected by spray operators, they retrain staff to reinforce proper data collection practices. With this tool, AIRS has increased confidence that the data recorded in the database accurately reflects the reality on the ground.

Data Entry Verification Form

After data are collected and transmitted to the data centers, data clerks are required to enter data from paper forms into the AIRS database within 24 hours of receiving them. Thus, data clerks are tasked with entering a high volume of data both quickly and accurately.

To assist data clerks, the database is equipped with automated logic checks that prevent them from entering



AIRS staff collects data from people who had their homes sprayed, Ghana.
Photo credit: Erin Schiavone

unreasonable data. For example, if a household was documented as having 5 family members it would be impossible for the household to have 6 children under five years of age. Once data are entered, database and M&E managers use the Data Entry Verification Form to correct data entry errors not caught by the database checks. The Data Entry Verification Form systematically prompts them to verify data from the paper-based spray forms with the data entered into the database by data clerks.

When inconsistencies are identified, the database manager reconciles the data and notifies data clerks in order to avoid repeating mistakes. The Data Entry Verification Form serves as one of the last steps in a series of data quality checks before data are ready for final cleaning and analysis.

Post-spray Data Quality Audit

After the IRS campaign is completed, AIRS conducts an internal data audit using the Post-spray Data Quality Audit (PSDQA) tool. This “self-check” institutes an innovative and transparent data quality assurance measure as part of the project’s M&E system.

In 2012, AIRS mobilized teams after the spray campaign ended to randomly survey a representative sample of areas

“The post-spray audit measures the performance of the AIRS project, providing information on the quality of the data collected and allowing us to validate and improve the performance of our M&E system.”

—Moussa Bagayako, database manager, AIRS Mali

targeted for IRS to validate the spray coverage. In each of the four countries where this has been completed, audit results confirmed that AIRS met the project goal of 85 percent spray coverage, as reported during the campaigns. For example in Nigeria, the audit found 97.5 percent spray coverage compared to the 99.1 percent coverage reported from the actual spray campaign.

The PSDQA also identified data collection inconsistencies that could affect coverage rates in future spray rounds. As a result, AIRS incorporated M&E system improvements across all countries to reduce data collection and data entry errors in upcoming spray campaigns. AIRS is expanding the PSDQA to six additional countries in 2013, and seven countries in 2014 so that all countries have been audited at least once during the three-year project.

Systematic M&E improvements implemented by the AIRS team ensure that data errors are anticipated and reduced, data are spot checked in the field and at the data center, and data are audited and verified after the IRS campaign is complete. Higher quality data will enable PMI to know the true impact that IRS is having on communities.



Photo credit: © Jessica Scranton

