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THE PMI VECTORLINK PROJECT ANNUAL REPORT OCTOBER 1, 2019 – SEPTEMBER 30, 2020

Recommended Citation: The PMI VectorLink Project. November 2020. *The PMI VectorLink Project Annual Report: October 1, 2019 - September 30, 2020*. Rockville, Maryland: The PMI VectorLink Project, Abt Associates Inc.

Contract: AID-OAA-I-17-00008

Task Order: AID-OAA-TO-17-00027

Submitted to: United States Agency for International Development/PMI

Submitted: November 13, 2020

Approved: December 16, 2020

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ACRONYMS

ANC	Antenatal Care
CDC	U.S. Centers for Disease Control and Prevention
DDT	Dichlorodiphenyltrichloroethane
DHO	District Health Office
DFID	Department for International Development UK
DHIS2	District Health Information Software 2
ELISA	Enzyme-linked immunosorbent assay
GHSC-PSM	Global Health Supply Chain -Procurement and Supply Management Project
HMIS	Health Management Information System
IEC	Information, Education, and Communication
INRB	National Institute of Biomedical Research
IRM	Insecticide Resistance Management
IRS	Indoor Residual Spraying
ITN	Insecticide-treated Nets
MAC	Malaria Alert Centre
MOH	Ministry of Health
MOPDD	Malaria and Other Parasitic Diseases Division
M&E	Monitoring and Evaluation
NGenIRS	Next Generation Indoor Residual Spray
NMCP	National Malaria Control Program
NMEP	National Malaria Elimination Program
PBO	Piperonyl butoxide
PMI	President's Malaria Initiative
PPE	Personal Protective Equipment
PSECA	Pre-spray Environmental Compliance Assessment
PSI	Population Services International
SEA	Supplemental Environmental Assessment
SOP	Spray Operator
USAID	United States Agency for International Development
VCTWG	Vector Control Technical Working Group
WHO	World Health Organization
WVI	World Vision International
ZAMEP	Zanzibar Malaria Elimination Program

EXECUTIVE SUMMARY

The U.S. President's Malaria Initiative (PMI) VectorLink Project is funded by the United States Agency for International Development (USAID), through PMI, and was awarded to Abt Associates on September 30, 2017. The PMI VectorLink Project builds on the indoor residual spraying (IRS) campaigns and entomological monitoring activities implemented under the predecessor PMI Africa Indoor Residual Spraying (AIRS) Project. New scopes of work under PMI VectorLink include a variety of activities to support insecticide-treated nets (ITNs) in many countries in addition to IRS under a broader vector control mandate. In addition, new data analytics and data visualization are being used to support vector control decisions and measure their impact. These activities are being supported by Abt's core subcontract partners Population Services International (PSI) and PATH. Other technical sub-contractors include BAO Systems (supporting VectorLink Collect, VectorLink's monitoring and evaluation (M&E) platform based on District Health Information Software 2 (DHIS2)), Dimagi Inc. (supporting IRS supervision and reporting tools), and the Malaria Consortium (supporting National Malaria Control Programs (NMCPs) to develop insecticide resistance management (IRM) plans, and integrated vector control strategies (IVCS) as well as an IVCS framework).

During this reporting period (Oct. 1, 2019–Sept. 30, 2020), PMI VectorLink conducted successful IRS campaigns in 16 countries (Benin, Burkina Faso, Côte d'Ivoire, Ethiopia, Ghana, Kenya, Madagascar, Malawi, Mali, Mozambique, Rwanda, Senegal, Tanzania, Uganda, Zambia, and Zimbabwe). The Côte d'Ivoire 2020 spray campaign was the first ever carried out in that country, while the Senegal campaign was the first completed since 2017, when PMI last sprayed there. The project also restarted PMI-supported entomology activities in Angola. Through core partner PSI, this year PMI VectorLink managed the direct distribution of ITNs in two countries (Tanzania and Malawi), and provided technical assistance to local government ITN efforts in Cameroon, Ghana, Senegal, and Zambia..

TOP-LINE RESULTS FROM VECTOR CONTROL ACTIVITIES, OCT 2019-SEPT 2020

- **5,718,989** structures were sprayed, protecting **21,017,687** people from malaria with IRS
  - **3,281,767** children under 5 years of age protected from malaria with IRS
  - **606,569** pregnant women protected from malaria with IRS
- **30,238** people were trained to deliver IRS with U.S. Government funds
- **5,688,359** insecticide treated nets (ITNs) were distributed by PMI VectorLink, protecting approximately **10,239,046** people from malaria

HIGHLIGHTS FROM THIS REPORTING PERIOD

- PMI VectorLink successfully managed the significant operational and technical challenges of continuing implementation in the context of COVID-19. The project adopted strict measures for both prevention and response to COVID-19, which allowed the project to sustain the scale of its life-saving malaria vector control activities during the pandemic.
- PMI VectorLink conducted important capacity-building efforts despite COVID-19 limitations. The project transitioned several planned regional training activities that included participants from multiple countries to be held in a fully virtual format, including two regional environmental compliance trainings that focused heavily on capacity building for country government counterparts across 9 countries, with 51 country government stakeholders participating. VectorLink also adapted two regional trainings on entomological data management to virtual approaches, reaching over 40 participants across 12 countries.
- PMI VectorLink completed the roll-out of its global DHIS2-based VectorLink Collect system for IRS data management. The project conducted a final regional training on VectorLink Collect for IRS in January 2020, and the system was used in all 16 PMI-supported IRS countries this year. In addition, the system was again used to manage government-led IRS data in Rwanda, and Global Fund-supported

IRS data in Malawi. The project supported an additional country, Uganda, to design an IRS program in its national DHIS2 system.

- PMI VectorLink also finalized and rolled out five new programs for entomological data management in the DHIS2-based VectorLink Collect system. During this FY, VectorLink trained teams and began using these programs in 12 countries to manage vector bionomics, insecticide resistance, and residual efficacy data (Angola, Burkina Faso, Cameroon, Cote D'Ivoire, Democratic Republic of Congo, Ethiopia, Ghana, Mali, Rwanda, Sierra Leone, Zambia, and Zimbabwe).
- PMI VectorLink conducted net durability monitoring studies in nine countries (Burundi, Burkina Faso, Ghana, Kenya, Liberia, Madagascar, Niger, Rwanda, and Sierra Leone).
- Through core partner PATH, PMI VectorLink supported program M&E of IRS and ITN activities in eight countries and broader vector control planning with development of integrated and interactive data dashboards in two countries (Mali and Zambia).
- PMI VectorLink facilitated insecticide rotation discussions to mitigate resistance resulting in fourteen PMI VectorLink countries spraying Fludora Fusion, 12 spraying SumiShield, and eight spraying Actellic. Out of 16 IRS country programs, six used two different insecticides, six used all three insecticides, and only four countries used one insecticide.
- During the months of April-July 2020, PMI VectorLink suspended entomological surveillance activities across the project following PMI's recommendation, due to the COVID pandemic. These activities resumed over time as the COVID context improved, as follows: Rwanda in May 2020, Burkina Faso, Sierra Leone, Burundi, Nigeria, Ethiopia and Ghana in June 2020, and all others in either July or August 2020.

1. COUNTRY HIGHLIGHTS

1.1 ANGOLA

1.1.1 PROGRAM HIGHLIGHTS

- Re-started PMI-supported entomological monitoring, conducting one month of entomological surveillance in two sites—one in Huambo Province and the other in Lunda Sul Province—to determine species composition, vector behavior, and vector susceptibility to different insecticides. Key activities, preliminary data, and the results of capacity building efforts for each province were summarized in a monthly summary report which was translated into Portuguese and disseminated to national and local officials.
- Hired a full-time Entomology Coordinator, who facilitated preparations for data collection, including meeting with central, provincial, and district leadership, and obtaining local approval from the *Direcção Nacional de Saúde Publica* (DNSP) and *Instituto Nacional de Investigação em Saúde* (INIS).
- Trained 15 people, including eight provincial mosquito brigade members, five technicians, a Field Epidemiology Training Program fellow, and the Entomology Coordinator, on adult and larval mosquito collection methods and morphological species identification.
- Supported Angola's entomological capacity/infrastructure by converting an existing structure at INIS in Luanda into an insectary, which will be fully established in the coming year. VectorLink will partner with PMI to train INIS technicians on molecular techniques to improve the sustainability of entomological monitoring over the long term.
- Led the advocacy effort to re-initiate the multisector and inter-ministerial Vector Control Working Group and contributed to the development of the updated National Malaria Strategic Plan.

1.2 BENIN

TABLE 1: VECTORLINK BENIN VECTOR CONTROL AT A GLANCE

IRS	**Dates and length of PMI-supported IRS campaign**	April 13, 2020 to May 05, 2020 16 operational days		
	Number of districts covered by PMI-supported IRS	7 (Gogounou, Kandi, Segbana, Copargo, Djougou, Ouaké, and Kouandé)		
	Insecticide(s)	Fludora Fusion WP-SB (58,255 units) and Actellic 300CS (1,018 units)		
	IRS results	Structures Sprayed: 350,349	Structures Found: 375,131	Spray Coverage: 93.4 %
	Population protected by PMI-supported IRS	Total 1,104,928	Pregnant Women 44,046	Children < 5 199,200
	Number of people trained with U.S. govt funds to deliver IRS[1]	2,128		

[1] Throughout this report, this indicator is based on the PMI indicator definition, and includes only spray staff such as spray operators, team leaders, and supervisors. It excludes clinicians, data clerks, IEC mobilizers, drivers, washers, porters, pump technicians, and security guards

1.2.1 PROGRAM HIGHLIGHTS

- Conducted IRS over 16 operational days in seven districts in collaboration with the primary partner, the NMCP, which was involved in all of the main IRS activities and directly supervised the implementation of IRS. Carried out several activities in anticipation of the 2020 IRS campaign, including: geographical reconnaissance using satellite imagery to ensure better coverage of the IRS targeted areas, updating of data on the enumeration of structures, identification of operations site locations, assessment of needs, procurement of local and international equipment and materials, organization of the information visit to the health and politico-administrative authorities, and organization of planning meetings at all levels.
- Updated the Benin Supplemental Environmental Assessment (SEA), which will be valid through 2025.
- Collaborated with the Entomological Research Center of Cotonou, who conducted wall bioassays to assess the quality of spraying in the target districts. Test mortality results were 100% within two weeks of spraying, indicating quality of spraying was satisfactory.
- Implemented mobile data collection for the first time with smartphones at the primary point of collection through all spray operators (SOPs) to facilitate reporting and operational decision making.
- Developed, in collaboration with the NMCP, a contingency plan for IRS implementation in the context of the COVID-19 pandemic. The contingency plan outlined detailed mitigation measures that would ensure the safe implementation of spray activities for all spray personnel and beneficiaries.

1.3 BURKINA FASO

TABLE 2: VECTORLINK BURKINA FASO VECTOR CONTROL AT A GLANCE

IRS	**Dates and length of PMI-supported IRS campaign**	June 01, 2020 to June 26, 2020 20 operational days		
	Number of districts covered by PMI-supported IRS	2 (Kampti and Solenzo)		
	Insecticide(s)	SumiShield 50WG (31,029 units) in Solenzo, and Fludora Fusion WP-SB (6,099 units) in Kampti		
	IRS results	Structures Sprayed: 162,037	Structures Found: 171,276	Spray Coverage: 94.60%
	Population protected by PMI-supported IRS	Total 508,017	Pregnant Women 21,103	Children < 5 95,445
	Number of people trained with U.S. govt funds to deliver IRS	1,493		

1.3.1 PROGRAM HIGHLIGHTS

- Conducted IRS in two districts. The selection of IRS districts in 2020 was based on epidemiological data from the health management information system (HMIS) and the entomological monitoring activities conducted in the South West, North West, and Center.
- Sprayed a reduced number of structures, as Kongoussi district was dropped from the spray targets due to security concerns. The original 2020 target was to spray 220,482 structures with a goal of protecting 770,000 people; with the exclusion of Kongoussi district (due to security reasons), this target was reduced to 135,141 structures in Kampti and Solenzo districts. The team conducted a daily check-in with the local security forces (gendarmerie, police) in both districts to assess whether conditions were safe for the spray teams to be deployed.
- Continued the implementation of mobile data collection during the 2020 spray campaign to improve data quality and availability in a timely manner for rapid decision-making purposes.
- Conducted wall bioassays through the Institute of Research on Health Sciences (IRSS) in houses sprayed with SumiShield 50WG and Fludora Fusion WP-SB. Results showed 100% mortality two

weeks after spraying and >98% mortality three months after spraying (in September 2020, testing ongoing).

- Re-started monthly entomological monitoring in June 2020 in eight districts, including the IRS districts of Kampti and Solenzo, their adjacent control sites (Gaoua and Nouna), the former IRS district of Kongoussi (and neighboring Seguenega), plus Soumousso and Karangasso where piperonyl butoxide (PBO) and pyrethroid ITN campaigns have taken place.
- Developed a contingency plan in collaboration with the NMCP related to IRS implementation in the context of the COVID-19 pandemic. The contingency plan outlined detailed mitigation measures that would ensure the safe implementation of spray activities for all spray personnel and beneficiaries.
- Developed an IRM plan, which includes rotation schedules for organophosphate and neonicotinoid insecticides used for IRS in different districts, to be used for insecticide procurement planning. The IRM plan provides the guiding principles for targeting different types of ITNs, provides plans for entomological monitoring and guidance on the use of resistance and other relevant data for decision making, and presents the main IRM strategies and situations for their deployment for sustainable and effective vector control in the country.
- Completed training and data collection for the baseline and 12-month follow-up rounds of durability monitoring. The activity is monitoring Interceptor ITNs in Gaoua health district, PermaNet 3.0 ITNs in Orodara health district, and Interceptor G2 (IG2) ITNs in Banfora health district. Household survey analysis, laboratory analysis, and reporting for the 12-month round are all in process.
- Completed baseline bioassay testing of standard pyrethroid, PBO synergist, and dual active ingredient IG2 ITNs. Bioassay results with pyrethroid-resistant mosquitoes indicated that after <6 months use in the field, mortality levels for PermaNet 3.0 nets had already decreased (presumably due to loss of PBO) compared to new nets. Results comparing new and baseline IG2 nets indicated no decrease in efficacy of IG2 nets after <6 months of field use.
- Reviewed the malaria case data in the national HMIS to assess its suitability for use in evaluating the 2018 and 2019 IRS campaigns. PMI and stakeholders determined that VectorLink should continue with an evaluation of only the 2018 IRS campaign, given gaps in the data due to a health workers' strike in 2019. The project is supporting an ongoing evaluation of IRS in Burkina Faso.

1.4 BURUNDI

1.4.1 PROGRAM HIGHLIGHTS

- Provided technical assistance to the NMCP to conduct IRS (supported by Global Fund). The technical assistance included IRS operations planning, environmental compliance, spray quality assessment, and insecticide decay monitoring on walls in Kiremba and Muyinga districts.
- Organized a workshop in collaboration with the NMCP and World Health Organization (WHO) on November 7-8, 2019 to launch the first Burundi national strategic plan for vector control and IRM plan. VectorLink substantially contributed to the development of documents and provided evidence needed to define the national vector control strategies.
- Aired radio spots on entomological monitoring through local radio stations from December 27, 2019 through January 5, 2020 aimed at expanding the community's knowledge and awareness of malaria vectors and appropriate methods to prevent mosquito bites.
- Conducted longitudinal entomological monitoring activities in nine sentinel sites: Cankuzo, Gihofi, Kiremba, Mabayi, Matana, Mpanda, Mutaho, Nyanza-Lac, and Vumbi. The team conducted insecticide resistance monitoring in the nine other provinces (Bujumbura Rural, Bujumbura Mairie, Karusi, Kayanza, Muyinga, Mwaro, Muramvya, Ruyigi, and Rumonge) in order to have a full profile of insecticide resistance in the country. These nine other sites will be rotated every two years with the first nine sites. The project continued the tests in sentinel sites where PBO nets will be distributed or IRS will be conducted using new insecticides (clothianidin and clothianidin+deltamethrin).
- Found in monitoring results that *An. gambiae* s.l. was the predominant malaria vector (>80% of *Anopheles* mosquitoes collected) in all nine sentinel sites followed by *An. funestus* s.l. (>15% of *Anopheles*

mosquitoes collected). Human biting rates of malaria vectors decreased following distribution of PBO nets at Vumbi but continued to increase or remained at the same level after distribution of standard nets in Cankuzo, Gihofi, Mabayi, Mpanda, Mutaho, and Nyanza-Lac; however, the observed biting rates in these sites were generally lower than the year before mass distribution. At all sites where tests were conducted, the vector is susceptible (100% mortality) to clothianidin+deltamethrin, clothianidin, pirimiphos-methyl, and bendiocarb.

- Conducted the baseline study of ITN durability monitoring in August 2020 following the mass distribution of ITNs in December 2019. This was delayed by one to two months from the recommended within six months post distribution due to COVID-19. The study was conducted in two sites (Vumbi: PBO ITN PermaNet 3.0 and Gashoho: Standard deltamethrin ITN Yorkool). A master training for six participants was conducted virtually, followed by a fieldworker training by 20 participants before data collection began. Three NMCP technicians received training at Gihanga and conducted ITN bio-efficacy tests.
- Conducted national Environmental Compliance Boot Camp training on September 22-24 for 17 participants from the NMCP and their partners to synchronize procedures and technical approaches for environmental compliance in IRS operations.
- Worked with the NMCP and other partners on the Global Fund concept note.

1.5 CAMBODIA

1.5.1 PROGRAM HIGHLIGHTS

- Signed a Memorandum of Understanding with the National Center for Parasitology and Malaria Control (CNM) on October 7, 2019 as a pre-requisite to the start of any technical activities. Sentinel site selection took place in Mondulkiri Province on November 20-23, 2019, and Pu Til village and the nearby fringe forest (5-7 km from the village) in Pichreada District was selected. In July 2020, the project selected Ou Chay village and forest nearby (again, 5-7 km from the village) of Siem Pang District as the sentinel sites for Stung Treng Province.
- Restructured VectorLink Cambodia staff after the Chief of Party resigned in January 2020. Vector Link Cambodia recruited a local Chief of Party to provide project and stakeholder management leadership, as well as a technical manager who is an entomologist. The technical manager's arrival in Cambodia has been delayed by international travel restrictions due to the COVID-19 pandemic. In addition, the project hired a second entomology technician, a replacement finance and administration manager, and a driver.
- Conducted an in-class training in collaboration with CNM on September 7-10, 2020, on 'Mosquito Surveillance and Vector Species Identification.' The classroom training, held in Phnom Penh, was followed by practical field training in Stung Treng from September 21-28, 2020. Seven classroom training participants came from CNM and the Mondulkiri and Stung Treng provincial health departments (PHDs) and 13 participants from CNM, the PHDs, District Health Centers, and VectorLink staff attended the field training. In the absence of the VectorLink technical manager, Mr. Didot Prasetyo, Entomology Manager at the U.S. Naval Medical Research Unit (NAMRU-2) Phnom Penh, Cambodia led the training.

1.6 CAMEROON

TABLE 3: VECTORLINK CAMEROON VECTOR CONTROL AT A GLANCE

ITN	**VectorLink technical assistance to ITN distribution channel(s) and dates of distribution**	Distribution channel: Free ITN Mass Distribution to households through distribution points (schools, health facilities, traditional chiefdoms) Phase 1: September 19, 2019 to September 26, 2019 Phase 2: November 22, 2019 to November 26, 2019 Continuous distribution: ANC visits
	Number of districts included in distribution	30 districts in the Far North Region: Phase 1: 14 health districts (Bogo, Bourha, Guidiguis, Kaele, Makary, Maroua1, Maroua2, Maroua3, Mindif, Mogodé, Mokolo, Mora, Roua, Yagoua) Phase 2: 16 health districts (Gazawa, Goulfey, Guéré, Hina, Karhay, Kolofata, Kousseri, Koza, Mada, Maga, Méri, Moulvoudaye, Moutourwa, Petté, Tokombéré, Vélé)
	Number of ITNs distributed	Distributed by partners with VectorLink support*: Mass campaign – distributed by the PNLP with support from VectorLink and PSM (Phase 1 ITNs were distributed before this reporting period) Phase 2: 1,329,189
	Type and brand of ITNs distributed	Standard pyrethroid-only (Deltamethrin): TanaNet (Polyester) Standard pyrethroid-only (Permethrin): Olyset (Polyethylene)

* VectorLink Cameroon provided *technical support* for ITN distribution to health facilities but did not manage direct distribution of these ITNs. This figure does *not* count toward VectorLink Monitoring and Evaluation indicator 1.1.8, which captures ITNs that VectorLink delivers to a distribution point.

1.6.1 PROGRAM HIGHLIGHTS

- Provided oversight to key activities during the mass ITN campaign in the Far North, facilitating daily communication of activity-level data (including logistics) among key partners and supporting ongoing coordination meetings. VectorLink Cameroon helped create a document outlining which campaign activities would be supported by the USAID Global Health Supply Chain -Procurement and Supply Management (GHSC-PSM) Project and VectorLink in collaboration with the NMCP and PMI. Though GHSC-PSM was originally planned to support logistician trainings, VectorLink was requested to take on this support during distribution. VectorLink also hired canoes to transport ITNs and supervision teams in some health areas due to poor road conditions and flooding along the Lagone River.
- Facilitated daily and final supervision meetings during each major campaign milestone, which allowed VectorLink Cameroon to evaluate the level to which the objectives were met and correct course if necessary. For example, daily meetings held with partners to monitor household registration led to an increase in the percentage of households that received accurate ITN logistics information, from 49% on the first day of registration to 85% on the last day.
- Collaborated with the NMCP and GHSC-PSM on continuous distribution of ITNs at health facilities, resulting in 143,746 ITNs being issued to pregnant women during antenatal care (ANC) visits in the North and Far North regions from October 2019 to September 2020.
- Conducted facility-level data audits and worked with health facility staff and other stakeholders to develop key recommendations to strengthen inventory, stock management, and accountability systems for continuous ITN distribution at the district and health facility levels.
- Monitored continuous distribution of ITNs on a quarterly basis through a joint survey with the Regional Technical Group in the Far North and the health districts, and shared feedback with partners, resulting in the adjustment of health facility ITN stocks and improved quality of ITN stock data. In addition, VectorLink Cameroon trained 90 trainers of stock managers and 477 stock managers on stock management best practices. The project plans to support two monthly data validation meetings, which include health facility officials from 45 health districts in the North and Far North regions.
- Conducted longitudinal entomological vector surveillance in five sentinel sites: Gounougou and Simatou in the North and Bonabéri, Mangoum, and Nyabessang in the South. Collections occurred every other month from October 2019 to April 2020 in the southern sites and monthly in the northern

sites. From June to September 2020, the project conducted collections monthly across all sites. Activities were suspended in April and May 2020 due to COVID-19.

- Evaluated susceptibility of *An. gambiae* s.l. to pyrethroids, carbamate, organophosphates, neonicotinoids, and pyrrole insecticides using CDC bottle assay and WHO susceptibility test kits in all five sites, and resistance intensity and synergist assays of *An. gambiae* s.l. when pyrethroid resistance was observed.

1.7 CÔTE D'IVOIRE

TABLE 4: CÔTE D'IVOIRE VECTOR CONTROL AT A GLANCE

IRS	**Dates and length of PMI-supported IRS campaign**	August 10, 2020 to September 12, 2020 19 operational days		
	Number of districts covered by PMI-supported IRS	2 (Sakassou and Nassian)		
	Insecticide(s)	Fludora Fusion WP-SB and SumiShield 50 WG		
	IRS results*	Structures Sprayed: 53,962	Structures Found: 58,695	Spray Coverage: 91.9%
	Population protected by PMI-supported IRS	Total 193,935	Pregnant Women 4,349	Children < 5 30,053
	Number of people trained with U.S. govt funds to deliver IRS	353 (308 male, 45 female)		

* The results for the Côte d'Ivoire 2020 campaign are pending final End of Spray Report submission and approval.

1.7.1 PROGRAM HIGHLIGHTS

- Organized a Boot Camp/Master Training in November 2019 to develop national-level capacity to plan and implement IRS. The project then facilitated an IRS national planning workshop with all national and district stakeholders to share the IRS implementation plans for each IRS district.
- Engaged the NMCP, PMI, the Vector Control Steering Committee, and other stakeholders in planning and implementing IRS campaign activities: quantification of insecticides and equipment (based on results of the enumeration conducted in September 2019), developing the information, education, and communication (IEC) plan and tools, conducting advocacy visits to IRS districts, facilitating trainings, and conducting supervision.
- Prepared and received USAID approval for the 2020-2024 SEA for IRS in Côte d'Ivoire, identified 19 operational sites for IRS, and completed all site refurbishments and soak pit construction in compliance with the PMI Best Management Practices Manual.
- Adapted all field activities to ensure the safest possible conditions for personnel, partners, and beneficiaries in spite of a significant delay to the start of the IRS campaign (four months in Sakassou and two months in Nassian at the request of the NMCP) due to the COVID-19 pandemic.
- Conducted door-to-door mobilization in the target communities starting two weeks before the IRS campaign, since it was the first year of IRS in Côte d'Ivoire. Radio programs were also broadcast in both districts to disseminate information about malaria and IRS and prepare communities to welcome spray teams. The Ministry of Health (MOH) hosted an official IRS launch ceremony in Sakassou as well as a televised press conference with participation from the U.S. Ambassador to Côte d'Ivoire and USAID Mission Director.
- Implemented mobile data collection with smartphones by all SOPs at the household level to facilitate near real-time reporting and operational decision making during the 2020 spray campaign.
- Supported monthly vector bionomics studies in four sites (two IRS, Sakassou and Nassian, and two control, Beoumi and Dabakala), preceded by a refresher training on entomological collection methods, and completed insecticide resistance monitoring in 17 of 18 sites by September 2020.
- Hired the second NMCP Vector Control Specialist in October 2019 and arranged for two NMCP staff to receive six months of medical entomology training at Burkina Faso's IRSS to support data analysis

and interpretation for appropriate vector control decision making. The project also provided technical assistance to the NMCP to develop the 2021-2025 National Malaria Strategic Plan.

- Conducted monthly longitudinal entomological vector surveillance in four sites (IRS sites Nassian and Sakassou and control sites Beoumi and Dabakala) from April 2019 to September 2020. Activities were suspended in April and May 2020 due to COVID-19, but were resumed by June, 2020.
- Evaluated susceptibility of *An. gambiae* s.l. to pyrethroids, carbamate, organophosphates, neonicotinoids, and pyrrole insecticides using CDC bottle assay and WHO susceptibility test kits in 17 sites, and conducted resistance intensity tests to pyrethroids, carbamates, and organophosphates, and synergist assays for pyrethroids when resistance was observed.
- Conducted the 2020 IRS spray quality and the insecticide decay rate assessments in August and September 2020; 100% mortality was recorded on all wall types (mud and cement) in both districts at both time points (tests ongoing).
- Supporting an evaluation of IRS in Côte d'Ivoire; PATH completed an assessment of HMIS data quality in July 2020 to determine the suitability of the data for the evaluation.

1.8 Democratic Republic of the Congo

1.8.1 Program Highlights

- Conducted entomological activities through the National Institute of Biomedical Research (INRB) in 14 provinces (Kongo Central, Sankuru, Mai-Ndombe, Tshopo, Tanganyika, Haut Katanga, Kasai Central, Sud Kivu, Kinshasa, Equateur, Lomami, Mongala, Kasai Oriental, and Sud Ubangi).
- Conducted longitudinal entomological activities monthly in three sites: Kimpese (Kongo Central), Sankuru (Lodja), and Inongo (Mai-Ndombe).
- Conducted insecticide susceptibility testing with permethrin, deltamethrin, and alpha-cypermethrin in 13 provinces at one sentinel site per province. Pyrethroid resistance intensity, PBO synergist assays and susceptibility tests with chlorfenapyr were conducted in seven sites to aid decision making regarding the type of nets to purchase for future ITN campaigns.
- Conducted the baseline survey for the comparative evaluation of standard (PermaNet 2.0) and dual-treated (PermaNet 3.0) ITN efficacy in Sud Ubangi, which included entomological and ITN bio-efficacy monitoring.
- Supported the NMCP's bi-annual Vector Control Working Group workshop, to facilitate review of country data and inform vector control decision making.
- Established and equipped a new molecular laboratory dedicated for entomology at the INRB as part of the project's response to improve timeliness of laboratory reporting.
- Entering all entomological data collected from sentinel sites in 2020 into the VectorLink Collect database in transition from a local database for entomological data management to the VectorLink Collect system.

1.9 ETHIOPIA

TABLE 5: VECTORLINK ETHIOPIA VECTOR CONTROL AT A GLANCE

IRS	**Dates and length of PMI-supported IRS campaign**	**Benishangul-Gumuz Region**: June 23 to July 27, 2020 (30 operational days) **Gambela Region:** June 2 to 19, 2020 (16 operational days) **Oromia Region:** June 2 to August 3, 2020 (up to 30 operational days per district, with staggered start dates and interruptions due to nationwide unrest)		
	Number of districts covered by PMI-supported IRS	44: Benishangul-Gumuz (20), Gambela (14), and Oromia (10)		
	Insecticide(s)	Actellic 300CS (132,194 units); piloted SumiShield 50 WG (480 units) and Fludora Fusion WP-SB (260 units) in 2 kebele in Benishangul-Gumuz		
	IRS results	Structures Sprayed: 527,375	Structures Found: 551,504	Spray Coverage: 95.6%
	Population protected by PMI-supported IRS	Total 1,511,728	Pregnant Women 43,747	Children < 5 226,996
	Number of people trained with U.S. govt funds to deliver IRS	2,350		

1.9.1 PROGRAM HIGHLIGHTS

- Developed a nationwide SEA authorizing the use of four WHO-Pre-Qualified classes of insecticides (pyrethroids, carbamates, organophosphates, and neonicotinoids, as well as a clothianidin/deltamethrin combination) for IRS in Ethiopia.
- Implemented all precautionary measures recommended by PMI and WHO related to COVID-19. All target districts completed spraying within 30 operational days despite the postponement of the campaign start date from May 12 to June 2 due to COVID-19; resulting in difficulties associated with spraying in the rainy season. Nationwide unrest forced the project to suspend the campaign for seven days in seven districts in Oromia. This phase of the campaign extended beyond the original end date, further exacerbating the challenge of operating in heavy rains. A nationwide three-week shutdown posed challenges for project leaders monitoring progress to take corrective actions in real time.
- Piloted two insecticides (SumiShield 50WG and Fludora Fusion WP-SB) in one kebele each in Menge District of Benishangul-Gumuz Region. SumiShield 50 WG sprayed houses caused 100% mortality of *Anopheles arabiensis* (insectary colony, susceptible to insecticides) within 72-120 hours of cone bioassay tests conducted from the first week to the third month after spraying. On the other hand, Fludora Fusion killed 94-100% of *An. arabiensis* within 72 hours in the same period. At the end of the reporting period, the study was still ongoing.
- Collaborated with the three regional health bureaus to implement policies and interventions to promote hiring female personnel and, as a result, women's participation increased from 27.9% in 2019 to 34.6% in 2020.
- Evaluated the quality and decay rate of Actellic 300CS in Lare, Godare, Abaya, and Bambasi districts. In cone bioassays at an insectary in the first week after spraying, Actellic 300CS killed 100% of *An. arabiensis*. Mortality of *An. arabiensis* was above 80% in tests conducted after one to three months after spraying in Lare, Godare, and Bambasi, while it declined to below 80% in Abaya in the second month.
- Conducted longitudinal vector surveillance in seven sites. *An. arabiensis* was the dominant vector in all the sentinel sites. Indoor resting density was very low in all sites except Benatsemay.
- Conducted insecticide resistance tests for *An. arabiensis* in nine sites. The major malaria vector, *An. arabiensis,* was susceptible (100% mortality) to bendiocarb, propoxur, and pirimiphos-methyl and resistant to all pyrethroids in all nine sites. Populations of *An. arabiensis* demonstrated moderate resistance intensity to alpha-cypermethrin, deltamethrin and permethrin in four sentinel sites. Pre-exposure PBO tests of alpha-cypermethrin restored full and partial susceptibility to four and three sentinel sites, respectively. Full susceptibility was attained to deltamethrin and permethrin in each of

five sites and partial susceptibility in three and two sites, respectively. In addition, populations of *An. arabiensis* were susceptible to clothianidin in five of five sites where it was tested.

- Conducted insecticide resistance tests for *An. stephensi* in four sites. *An. stephensi* exhibited resistance (less than 90% mortality) to bendiocarb, propoxur, pirimiphos-methyl, alpha-cypermethrin, deltamethrin, and permethrin in all four sites. *Anopheles stephensi* exhibited high resistance intensity to alpha-cypermethrin (66-83% mortality at 10X concentration) in three sites, moderate resistance intensity to deltamethrin in one site (99% mortality at 10X) and high resistance intensity in another two sites (83-95% mortality at 10 X). *Anopheles stephensi* showed low resistance intensity to permethrin in two sites (98-99% mortality at 5X concentration) and moderate resistance in one site (100% mortality at 10X). Pre-exposure to PBO tests on *An. stephensi* restored full susceptibility to alpha-cypermethrin in one site (100% mortality) and partial susceptibility in two sites (93.3% mortality), showing the presence of additional resistance mechanisms to mixed function oxidases in the two sites. Pre- exposure to PBO restored susceptibility to deltamethrin and permethrin (98.7%-100% mortality) in three sites showing mixed function oxidases playing a primary role as resistance mechanism for the survival of *An. stephensi* against the two insecticides.
- Investigated the presence of *An. stephensi* in 23 rural areas in eastern Ethiopia to map rural distribution; all 23 sites were positive. A virtual meeting of stakeholders on the control of *An. stephensi* took place in May 2020. Following the recommendations forwarded, the project prepared a policy document and a manuscript for publication.
- Provided technical and material support to nine universities (Addis Ababa, Jimma, Mekelle, Jigjiga, Arba Minch, Dire Dawa, Assosa, Debre Markos, and Gondar) to build their institutional capacity to conduct entomological monitoring and insecticide resistance monitoring so they can serve as training and resource centers in the future.
- Subcontracted the Malaria Consortium to review the IRM plan and management strategic document for the National Malaria Elimination Program (NMEP), which is expiring in 2020.
- Continued to build the IRS capacity of key governmental staff at the central, regional, zonal, and district levels. In 2020, 140 government staff from different levels attended IRS training and supervision programs. The project also provided technical and limited material support to 60 graduated districts in Oromia Region, and renovated 15 soak pits in three additional non-PMI regions (Amhara, Tigray, and Southern Nations, Nationalities, and People's regions).
- Completed an initial data assessment in February 2020 to determine the suitability of using existing data sources for an evaluation of the 2017-2019 IRS campaigns in the Benishangul-Gumuz and Gambela regions. The data sources evaluated included malaria case data, population estimates, administrative borders, entomology data, and IRS implementation data from VectorLink and Ethiopia Federal Ministry of Health campaigns. Through a data review workshop held in February 2020, PATH shared these results with stakeholders and outlined key next steps to move ahead with the evaluation.

1.10 GHANA

TABLE 6: VECTORLINK GHANA VECTOR CONTROL AT A GLANCE

IRS	**Dates and length of PMI-supported IRS campaign**	March 24, 2020 to April 28, 2020 30 operational days		
	Number of districts covered by PMI-supported IRS	9 (Bunkpurugu-Nakpanduri, East Mamprusi, Gushegu, Karaga, Kumbungu, Mamprugu Moaduri, West Mamprusi, Tatale-Sanguli, and Yunyoo-Nasuan)		
	Insecticide(s)	Actellic 300CS, Fludora Fusion WP-SB, and SumiShield 50 WG		
	IRS results	Structures Sprayed: 339,139	Structures Found: 366,283	Spray Coverage: 92.6%
	Population protected by PMI-supported IRS	Total 965,467	Pregnant Women 21,295	Children < 5 161,750
	Number of people trained with U.S. govt funds to deliver IRS	843 (603 men, 240 women)		

ITN	**VectorLink technical assistance to ITN distribution channel(s) and dates of distribution**	VectorLink technical support to: Health facility and schools October 2019 to September 2020 (health facility), March 2020 (schools)
	Number of districts included in distribution	N/A
	Number of ITNs distributed	Distributed by partners with VectorLink support*: Health facility: 1,592,616 Schools: 13,479 (for a mobile tracking application trial)
	Type and brand of ITNs distributed	PBO: PermaNet 3.0 for schools Standard pyrethroid-only: MAGNet for health facilities

* VectorLink Ghana provided technical support to the NMCP for ITN distribution to health facilities and to District Education Departments for piloting ITN distribution to schools in two districts to test distribution tracking mobile application, but it did not manage direct distribution of these ITNs. This figure does not count toward VectorLink Monitoring and Evaluation indicator 1.1.8, which captures ITNs that VectorLink delivers to a distribution point.

- Expanded IRS to a new district, Tatale-Sanguli, thus providing malaria protection to an additional 67,000 people and introduced mobile spray data collection in an operations site in Gushegu district and in all sites in Tatale-Sanguli district.
- Increased the number of community health nurses to integrate IRS messaging in daily routine work and enhance campaign mobilization from 46 in 2019 to 154 in 2020. After the campaign, the nurses continued including IRS messages in their routine health promotion activities at the community and facility levels.
- Conducted spraying in animal shelters in five IRS districts and continued observations of vector resting behavior in living and non-living structures.
- Conducted spray quality tests with results demonstrating 100% mosquito mortality at 1-3 days after spraying across all districts for all three insecticides used during the 2020 IRS campaign.
- Established four additional entomological surveillance sites outside of the project-supported IRS districts as part of the national entomological monitoring led by the NMCP.
- Installed an additional container insectary on the project office premises and established a pyrethroid-resistant *An. gambiae* (Tiassalé strain) colony for assessing the bio-efficacy of new IRS and ITN products developed for controlling insecticide-resistant mosquitoes.
- Established a laboratory to carry out ELISA tests on the project office premises to ensure timely processing of specimens and reporting of data.
- Trained district health department teams on the use of ITN checklists for the implementation of integrated supportive supervision (ISS) in 16 regions and malaria-specific outreach training and supportive supervision (OTSS) in five regions. The district teams then visited 1,560 ANC clinics, 1,661 child welfare clinics (CWCs) and 379 health facilities as part of the ISS. In addition, VectorLink Ghana participated in post-OTSS review meetings and carried out routine data analysis and monitoring of ITN distribution in health facilities. ITN issuance rate for the period of October 2019-September 2020 was 87.87% and 91.02% for CWCs and ANC clinics, respectively (DHIS2 data accessed 10/07/2020).
- Rescheduled school-based distribution of 1,237,196 ITNs due to COVID-19. The distribution, originally planned for May 2020 to reach pupils in 26,981 schools, was postponed to November 2020.
- Developed and refined prototypes for a school-based campaign to enhance ITN use and care in five districts in the Central Region. The campaign is targeting health workers as ITN champions and pregnant women for promotion of ITN at the community level.
- Began 24-month ITN durability monitoring. In August, the project trained field data collectors and supervisors. Data collection in Nanumba South and Zabzugu districts was completed in September.

1.11 KENYA

TABLE 7: VECTORLINK KENYA VECTOR CONTROL AT A GLANCE

IRS	**Dates and length of PMI-supported IRS campaign**	February 10, 2020 to March 21, 2020 24 operational days		
	Number of districts covered by PMI-supported IRS	2 counties (Migori and Homa Bay)		
	Insecticide(s)	Actellic 300CS		
	IRS results	Structures Sprayed: 436,472	Structures Found: 482,831	Spray Coverage: 90.4%
	Population protected by PMI-supported IRS	Total 1,792,495	Pregnant Women 40,727	Children < 5 211,868
	Number of people trained with U.S. govt funds to deliver IRS	2,309		

1.11.1 PROGRAM HIGHLIGHTS

- Supported the development of key national IRS documents: IRS Implementation Strategy, Malaria Vector Surveillance Operational Guidelines, Integrated Vector Control Strategy, and IRM Plan.
- Implemented measures to curb data falsification: (a) revised the spray data form to document when a new bottle of insecticide was opened; (b) tracked IRS sticker usage among SOPs; (c) had a village elder authenticate the accuracy of the data collected (e.g., household owner name, number of households recorded) before the SOP left a village; (d) required every seasonal worker to sign an ethics addendum to their contracts; (e) managed and adjusted SOP targets as needed; (f) adopted a pull system for insecticide distribution; the system required demand for insecticide to be driven by the number of structures being sprayed at the time; and (g) allocated specific villages to spray teams to increase accountability for actual spraying and data reporting for those villages.
- Conducted more data collection verifications to identify data quality issues faster in the field by all levels of supervisors including MOH supervisors in 2020, a 65.1% increase from 2019.
- Scaled up the use of smartphones for data collection among SOPs from one operations site with 30 SOPs in 2019 to five operations sites in 2020 covering a total of 143 SOPs, 23 team leaders, and their five spray team supervisors.
- Replaced door-to-door mobilization with mass mobilization. VectorLink Kenya created a new cadre of mobilizers who were embedded with the spray team and worked hand in hand with the teams in the community. Their job description was revised to include house preparation.
- Found that Actellic 300CS provided mean mortality of >80% for five months through monthly cone bioassays conducted from February 2020 on sprayed walls with the susceptible *An. gambia*e Kisumu strain.
- Conducted insecticide resistance monitoring in eight malaria endemic counties, evaluating permethrin, deltamethrin, chlorfenapyr, pirimiphos-methyl, alpha-cypermethrin and clothianidin. PBO synergist tests were conducted with permethrin and deltamethrin. The evaluation found that pre-exposure to PBO synergist resulted in substantial increases in mortality for permethrin and deltamethrin in all eight counties. Based on this finding, PBO nets should be considered for future ITN distribution campaigns across western Kenya.
- Found that malaria vectors continue to be susceptible to pirimiphos-methyl and clothianidin in counties with IRS; therefore, both insecticides can be used in future as part of a rotation strategy.
- Piloted community-based entomological monitoring in four sites, involving community health volunteers and county entomologists in supervision following capacity-building training held in August 2020.
- Conducted 24-month durability monitoring to monitor DawaPlus 2.0 ITNs in Busia sub-county and DuraNet ITNs in Kwale sub-county.
- Developed a concept note for implementation of continuous community ITN distribution in Homa Bay and Migori counties starting in July 2020; the activity did not move forward due delays in ITN distribution due to COVID 19 and on-going discussion of where to spray in 2021 at the time.

1.12 LATIN AMERICA

- Developed a study protocol for the evaluation of the efficacy of IRS and ITN distribution using and strengthening the entomological monitoring systems already in place in Colombia. This research study will support the development and application of evidence-based approaches on how and where to best apply the vector control tools.
- Held meetings to move forward the planning of the efficacy study. The VectorLink Entomologist met in person with Colombia MOH and National Institute of Health counterparts to identify the region for the study and scope, based on already planned government activities. Final negotiations with the MOH are ongoing, but a work plan and budget are being drafted along with a Memorandum of Understanding in order to coordinate agreed-upon work with the MOH.

1.13 LIBERIA

1.13.1 PROGRAM HIGHLIGHTS

- Conducted vector surveillance activities in eight sentinel sites: Madina (Grand Cape Mount County), Fissebu (Lofa County), Koryah (Bong County), Saint John (Grand Bassa County), Suehn Town (Bomi County), Jackson Farm (Margibi County), Zeanzue (Bong County), and Gbedin (Nimba County). Vector composition, behavior, and density were assessed at each site. Due to the COVID-19 pandemic, collections were suspended in April 2020 and resumed in August 2020.
- Conducted insecticide resistance tests on the *An. gambiae* s.l. population collected in Jackson Farm, Careysburg (Monteserrado County), Liberian Agricultural Company plantation (Grand Bassa County), Cestos City (River Cess County), Gbedin Camp3 (Nimba County), Zeanzue (Bong County), and Suehn Town (Bomi County). The project used CDC bottle assays to assess vector resistance to deltamethrin and permethrin and the effect of a PBO synergist on pyrethroid-resistant *An. gambiae* s.l. The vector was resistant to deltamethrin and permethrin; susceptibility increased after pre-exposure to PBO, but full susceptibility was not restored, indicating that other mechanisms of resistance could also be involved.
- Conducted susceptibility tests using chlorfenapyr in one site in each of the seven counties listed in the first bullet. *An. gambiae* s.l. was fully susceptible to chlorfenapyr in all sites three days post-exposure.
- A team from the Liberia Institute of Biomedical Research (LIBR) research branch of the National Public Health Institute of Liberia resumed processing mosquito samples using ELISA method to assess the sporozoite rate.
- Supported an evaluation of the 2020 Interceptor G2 ITN mass campaign in Liberia. In support of this activity, PATH completed an assessment of HMIS data quality in July 2020 to determine the suitability of the data for the evaluation and subsequently developed a detailed plan for the ITN evaluation in September 2020.
- Completed training and data collection for the 24-month round of durability monitoring of DuraNet ITNs in Lofa and Grand Gedeh counties. Remote training of trainers was conducted on July 21-23, followed by in-person fieldworker training on July 28-31 and data collection on August 8-26. Household survey analysis is completed, and laboratory analysis and reporting are in progress.
- Participated in and supported events organized by the NMCP, including strategical plan development, annual review, proposal writing for the Global Fund grant, and planning for the coming mass campaign net distribution. VectorLink is also providing periodical technical support to LIBR to start their own research activities including entomological work.

1.14 MADAGASCAR

TABLE 8: VECTORLINK MADAGASCAR VECTOR CONTROL AT A GLANCE

IRS	**Dates and length of PMI-supported IRS campaign**	November 04, 2019 to November 30, 2019 24 operational days		
	Number of districts covered by PMI-supported IRS	5 (Tuléar II, Sakaraha, Betioky, Ihosy, and Iakora)		
	Insecticide(s)	Actellic 300CS (30,667 units), SumiShield 50 WG (13,430 units), and Fludora Fusion WP-SB (3,566 units)		
	IRS results	Structures Sprayed: 267,874	Structures Found: 279,746	Spray Coverage: 95.8%
	Population protected by PMI-supported IRS	Total 1,150,922	Pregnant Women 53,287	Children < 5 204,833
	Number of people trained with U.S. govt funds to deliver IRS	1,063		

1.14.1 PROGRAM HIGHLIGHTS

- Updated the Madagascar SEA, which will be valid through 2023.
- Implemented the "Exit Plan" developed by the VectorLink Madagascar team in close coordination with the NMCP and PMI in Ampanihy District following its removal from the IRS target districts list for the 2020 spray campaign due to the lower incidence rate of malaria. The plan's objective was to monitor malaria incidence to ensure that other vector control strategies were in place after the withdrawal of IRS.
- Conducted entomological data collection, recording *An. gambiae* s.l., *An. funestus* s.l., and *An. mascarensis* as malaria vectors, and *An. coustani*, a potential vector in various sentinel sites. *An. gambiae* s.l. was the main vector in the East Coast (Analanjirofo), Vatovavy Fitovinany, Ihorombe, and South West regions.
- Conducted insecticide resistance monitoring across the country; results indicated susceptibility of *An. gambiae* s.l. to pirimiphos-methyl, clothianidin, bendiocarb, and chlorfenapyr in all sprayed and non-sprayed areas. Resistance to pyrethroids was observed in four (two East and two South West) out of 10 sites tested.
- Conducted monthly WHO wall cone bioassays to test the residual efficacy of sprayed insecticides. The recorded residual efficacy of Actellic 300CS was six months post-spray, six to seven months with SumiShield 50WG, and seven months with Fludora Fusion WP-SB.
- Conducted analysis and reporting for the 12-month round of durability monitoring and completed training for the 24-month round. The activity monitored Dawa Plus ITNs in Farafangana, Bekily, and Maintirano districts and PermaNet 2.0 ITNs in Fort Dauphin District. The approved 12-month durability monitoring report was translated into French and shared with in-country malaria partners.
- Completed an initial HMIS data assessment to determine the suitability of using existing data sources in evaluation of 2018 and 2019 IRS campaigns in Madagascar. The report outlined a series of recommendations for using the HMIS data in the evaluation, which will be completed in Year 4.

1.15 MALAWI

TABLE 9: VECTORLINK MALAWI VECTOR CONTROL AT A GLANCE

IRS	**Dates and length of PMI-supported IRS campaign**	October 17, 2019 to November 22, 2019 32 operational days
	Number of districts covered by PMI-supported IRS	1 (Nkhotakota)
	Insecticide(s)	Actellic 300CS (42,767 units) in seven operations sites and SumiShield 50WG (9,782 units) in two operations sites.

	IRS results	Structures Sprayed: 107,565	Structures Found: 121,167	Spray Coverage: 88.8%
	Population protected by PMI-supported IRS	Total 441,375	Pregnant Women 11,182	Children < 5 74,173
	Number of people trained with U.S. govt funds to deliver IRS	565 (310 men, 255 women)		
ITN	**ITN distribution channel(s) and dates of distribution**	Campaign net distribution Chauma: began on September 30, 2019 Lupachi: began on October 8, 2019		
	Number of districts included in distribution	1 (Nkhotakota, Chauma Island, and Lupachi)		
	Number of ITNs distributed	Distributed by VectorLink: 4,808		
	Population protected by ITNs distributed by VectorLink	Estimated Total: 8,654		
	Type and brand of ITNs distributed	PBO: Olyset Plus		

1.15.1 Program Highlights

- Built capacity at national and district levels through trainings, skills development, and advocacy to ensure high quality spray. The NMCP and district health teams were trained in coordination, implementation, and supervision of IRS activities.
- 46.7% of seasonal staff hired during the 2019 campaign in Nkhotakota District were women, exceeding the project's target percentage of women hired by 4.7%.
- Worked closely with the NMCP, District Health Office (DHO), and Environmental Affairs Department to ensure environmental compliance through inspections before, during, and after spraying.
- Provided technical assistance during planning and implementation of the Global Fund-supported spray conducted by World Vision International (WVI) and the NMCP in Mangochi District, which ran from November 6 through December 19, 2019.
- Conducted capacity-building workshops in environmental compliance in collaboration with the NMCP and WVI; IRS leadership and operations; and VectorLink Collect DHIS2 for the national and district IRS task force members of the Global Fund-supported IRS districts (Mangochi, Balaka, and Nkhata Bay).
- Provided two full-time technical advisors to support the NMCP, WVI, and the Mangochi DHO with the planning, training, supervision, and close-out of IRS operations in Mangochi.
- Continued to conduct comprehensive longitudinal entomological monitoring activities through local partner Malaria Alert Centre (MAC) in 15 sentinel sites in seven districts, and performed molecular lab analysis for species identification and detection of malaria parasite infection in vector mosquitoes. *Anopheles gambiae* s.l. (62.8%) and *An. funestus* (34.0%) were the dominant species identified from the mosquitoes collected. The overall *Plasmodium falciparum* infection rate of *An. funestus* s.l. was 1.8% and of *An. gambiae* s.l. was 1.2%.
- Conducted insecticide resistance monitoring, spray quality, and residual efficacy tests in selected sites. *An. funestus* s.l. and *An. gambiae* s.l. are fully susceptible to pirimiphos-methyl, chlorfenapyr and clothianidin while they are highly susceptible to deltamethrin, permethrin and alpha-cypermethrin. Monthly cone assay tests confirmed Actellic 300CS had a 2-4 month residual life; the residual life of SumiShield 50WG was 12 months. The project is investigating reasons for the short residual life of Actellic 300CS.
- Strengthened the national Vector Control Technical Working Group (VCTWG). With support from Malaria Consortium, VectorLink Malawi supported the development of the Integrated Vector Control

Strategy for Malaria Control in Malawi 2020-2025. The strategy was developed with assistance from MAC with inputs from the stakeholders through VCTWG meetings.

- Distributed 547 PBO ITNs to 196 households on Chauma Island, and 4,261 ITNs to 1,623 households in Lupachi, protecting an estimated 9,914 people in September and October 2019. The rest of Nkhotakota District received IRS; PMI, VectorLink, and the NMCP agreed that it was not cost-efficient nor environmentally safe to undertake IRS in these two hard-to-reach, sparsely populated areas.

1.16 MALI

TABLE 10: VECTORLINK MALI VECTOR CONTROL AT A GLANCE

IRS	**Dates and length of PMI-supported IRS campaign**	June 15, 2020 to August 12, 2020 28 operational days (Bandiagara and Djenné) 30 operational days (Mopti)		
	Number of districts covered by PMI-supported IRS	3 (Bandiagara, Djenné, and Mopti)		
	Insecticide(s)	SumiShield 50 WG (12,965 units) in Bandiagara, Actellic 300CS (9,646 units) in Djenné and Fludora Fusion WP-SB (22,310 units) in Mopti.		
	IRS results	Structures Sprayed: 129,302	Structures Found: 133,426	Spray Coverage: 96.9%
	Population protected by PMI-supported IRS	Total 503,043	Pregnant Women 34,462	Children < 5 87,606
	Number of people trained with U.S. govt funds to deliver IRS	441 (366 men, 75 women)		

1.16.1 PROGRAM HIGHLIGHTS

- Started the 2020 IRS campaign as scheduled on June 15 in two of the three districts, Djenné and Bandiagara. International supply chain disruptions related to the COVID-19 pandemic delayed the delivery of Fludora Fusion WP-SB, and so the spray campaign in Mopti District started on June 29.
- Introduced mobile data collection in Mali. Every SOP was trained on how to collect data via the smartphone. Compound-level data collection and quality significantly improved, resulting in greater transparency about campaign performance for PMI and government partners.
- Conducted IRS quality assurance and monthly insecticide decay rate monitoring in 10 houses in each of the three IRS districts. Quality assurance cone bioassays performed within a week after spraying showed 100% mortality regardless of the type of wall or the insecticide. Good residual efficacy was observed three months after IRS in all sites on all wall types (88% to 100%).
- Conducted monthly entomological monitoring from July through September 2020 in the three IRS districts, one control district (Tominian), and two sites in Sikasso Region (Selingue and Bougouni). Community-based surveillance was introduced in August 2020 in two sites: one village sprayed with Fludora Fusion WP-SB (Sarema), and a non-sprayed village (Toguel) in Mopti District. *An. gambiae* s.l. accounted for 99% of *Anopheles* collected. Molecular results are in progress.
- Tested eight of 10 scheduled sites for insecticide resistance using WHO susceptibility tube tests. Resistance to pyrethroids was observed in most sites. Implication of mixed function oxidases in resistance to deltamethrin, permethrin, and alpha-cypermethrin was also observed. Susceptibility to clothianidin and chlorfenapyr was recorded in all eight sites.
- Conducted the final round of durability monitoring through subcontractor Laboratoire de Biologie Moléculaire Appliquée (36 months survey) in two districts in the Kayes region, Kenieba District with Yorkool nets and Kita District with PermaNet 2.0 nets.
- Developed dashboards summarizing case incidence, vector control coverage, and descriptive analyses of the impact of IRS for the 2017 to 2019 campaigns. The dashboards were presented to the NMCP during a data review workshop in December 2019. Based on feedback from this workshop, early in 2020 VectorLink developed dashboards for the prioritization of locations for the Interceptor G2 ITNs

and for the stratification of districts based on 2019 case incidence. In May 2020, VectorLink completed the evaluation of the 2017 to 2019 IRS campaigns, then discussed the results with NMCP in September 2020.

1.17 MOZAMBIQUE

TABLE 11: VECTORLINK MOZAMBIQUE VECTOR CONTROL AT A GLANCE

IRS	**Dates and length of PMI-supported IRS campaign**	October 28, 2019 to December 14, 2019 35 operational days		
	Number of districts covered by PMI-supported IRS	5 (Maganja da Costa, Milange, Molumbo, Mopeia, and Morrumbala)		
	Insecticide(s)	SumiShield 50WG and Fludora Fusion WP-SB		
	IRS results	Structures Sprayed: 338,330	Structures Found: 350,172	Spray Coverage: 96.6%
	Population protected by PMI-supported IRS	Total 1,484,191	Pregnant Women 77,084	Children < 5 209,747
	Number of people trained with U.S. govt funds to deliver IRS	1,446		

1.17.1 PROGRAM HIGHLIGHTS

- Postponed and staggered the start dates of the 2019 spray campaign due to delays in the arrival and clearance of insecticides. The original start date on October 22, following the October 21 launch, was postponed to October 28 in two districts (Mopeia and Morrumbala) and to November 4 in the remaining three districts (Maganja da Costa, Milange, and Molumbo).
- Supported preparations for the NMCP IRS campaign in Nampula Province as follows: worked alongside Nampula environmental teams to conduct Pre-spray Environmental Compliance Assessments (PSECAs) in the eight operation sites for the IRS districts; provided financial support to Nampula staff to attend the NMCP-led national boot camp held in Maputo; and provided district staff per diems, venue selection, and meals for the provincial training of trainers.
- Participated in entomology and IRS Technical Working Group meetings; in 2019, a key objective of working groups was to harmonize the IRS implementation amongst three implementers, NMCP, Tchau Tchau Malaria and VectorLink, in areas such as training, IRS supplies and materials, spray data collection, etc. Began partial phase-in of agreed-upon recommendations on neck covers, SOP bags, and additional day for SOP and team leader training as permitted by the approved budget.
- Performed monthly entomological monitoring in three intervention districts in Zambezia Province (Maganja da Costa, Milange, and Mopeia) and one unsprayed control district (Lugela). In Nampula Province, VectorLink Mozambique also performed monthly entomological monitoring in two intervention districts, Nampula City and Monapo, and in Erati, the control district. *An. funestus* s.l. is the dominant malaria vector in Zambezia, whereas *An. gambiae* s.l. is the dominant in Nampula.
- Assessed IRS quality by cone wall bioassays, which showed that spray teams were able to achieve optimal insecticide application in all districts. The insecticide decay rate assessment showed that SumiShield 50WG and Fludora Fusion WP-SB lasted at least 9-10 months.
- Found that local vectors are fully susceptible to pirimiphos-methyl, chlorfenapyr, clothianidin, and bendiocarb though results of insecticide susceptibility tests. Assays for pyrethroids revealed widespread vector resistance to pyrethroids. Further assays to assess the strength of resistance in *An. gambiae* s.l. showed the presence of moderate to high intensity of resistance to pyrethroid insecticides. This finding demonstrates the importance of continued use of IRS with next generation insecticides. Synergist assays with PBO demonstrated restoration of the vector's susceptibility to pyrethroids (deltamethrin and permethrin) at most of the sites in Zambezia, indicating that PBO nets may also be an additional option to overcome the observed pyrethroid resistance for vector control in Zambezia. However, PBO did not restore the vector's susceptibility to pyrethroid insecticides in Nampula Province and the continued use of IRS with next generation insecticides is recommended for malaria vector control in the area.

1.18 NIGER

TABLE 12: VECTORLINK NIGER VECTOR CONTROL AT A GLANCE

ITN	**VectorLink technical assistance to ITN distribution channel(s) and dates of distribution**	Distribution channel: Continuous distribution, ANC and EPI
	Number of districts included in distribution	21: 8 in Dosso Region (Birni N'Gaouré, Logo, Dosso, Tibiri, Doutchi, Gaya, Falmèye, Dioundiou) and 13 in Tahoua Region (Bagaroua, Bouza, Madaoua, Konni, Illéla, Tahoua départ, Keita, Tahoua Commune, Malbaza, Abalak, Tilia, Tassara, Tchinta)
	Number of ITNs distributed	Distributed by partners with VectorLink support: No distributions during reporting period
	Type and brand of ITNs distributed	N/A

1.18.1 PROGRAM HIGHLIGHTS

- Completed entomological monitoring including vector surveillance in ten sentinel sites selected by the NMCP between October 2019 and March 2020. The NMCP used the entomological data to revise epidemiological strata and update vector control tools with the possible introduction of IG2 and PBO nets in 2022.
- Conducted longitudinal vector surveillance in six sites (Agadez, Keita, Balleyara, Guidimouni, Gaya, and Niamey V) and insecticide resistance monitoring in four out of 15 sites (Agadez, Tchintabaraden, Keita, Tessaoua, Guidimouni, Gaya, Boboye, Say, Balleyara, Niamey 5, Diffa, Goudoumaria, Tillaberi, Madarounfa, and Madaoua) since June 2020.
- Conducted an entomological methods training for field technicians involved in the VectorLink-supported entomological data collection from the *Centre de Recherche Médical et Sanitaire* (CERMES) and NMCP.
- Conducted a laboratory training with assistance from the University of Notre Dame, to ensure the national entomological monitoring capacity is consistent with international standards.
- Rehabilitated the CERMES insectary into a functional space, provided equipment for it, and imported susceptible mosquitoes to rear and maintain an *An. gambiae* Kisumu colony in Niger. As the only research institution within Niger's Ministry of Public Health, CERMES will now be able to support the NMCP in vector control decision making.
- Provided technical assistance to the NMCP for the development and finalization of the guidelines and the Operational Guide for Routine Distribution of ITNs. VectorLink supported the organization of an official ceremony where the guidelines and Operational Guide were distributed to the eight heads of the health regions. The NMCP successfully used the updated policy guidelines to ensure health facilities in the other six regions were sufficiently stocked for continuous distribution and 100% of health districts reported having ITNs available in their warehouse.
- Organized a technical assistance mission to revise the data collection tools (Mother-Child cards and vaccination registers) for continuous ITN distribution in Niger. Via the PMI Impact Malaria team, VectorLink briefed health workers from 17 health districts of Tahoua and Dosso on the guidelines for continuous ITN distribution.
- Completed training and data collection for the 24-month follow-up round for durability monitoring (Olyset ITNs in Gazaoua and Madaoua districts). Remote training of trainers was conducted on August 4-6, in-person fieldworker training on August 11-14, and fieldwork between August 17 and September 2. Household survey analysis, and laboratory analysis and reporting for the 24-month round were all in process at the end of the reporting period.

- Provided technical assistance to the NMCP and CERMES entomological technicians for the review and interpretation of entomological data, which can be used to inform strategic and cost-efficient deployments of vector control interventions and to improve integrated vector control decision making. The project introduced the NMCP to VectorLink Collect in September 2020.

1.19 NIGERIA

1.19.1 PROGRAM HIGHLIGHTS

- Conducted monthly vector surveillance and longitudinal monitoring across five sites (Akwa Ibom, Ebonyi, Oyo, Plateau, and Sokoto) and insecticide resistance management (IRM) in six sites (Bauchi, Benue, Cross River, Kebbi, Nasarawa, and Zamfara) with routine supervision from VectorLink technical staff. VectorLink also assisted Global Fund-supported sentinel sites in the procurement and distribution of entomology materials for surveillance and insecticide resistance activities.
- Found permethrin resistance was predominant in *An. gambiae* s.l. mosquitoes across all sentinel sites. *Anopheles gambiae* s.l. mosquitoes were resistant to deltamethrin in all selected Local Government Areas (LGAs) in Akwa Ibom, Bauchi, Ebonyi, Nasarawa, Plateau, and Sokoto. Susceptibility to deltamethrin was observed at all sampling sites in Cross River, Benue, and Kebbi. Pre-exposure of resistant mosquitoes to PBO restored deltamethrin susceptibility in *An. gambiae* s.l. from Akwa Ibom, Nasarawa, Oyo, Sokoto, and Zamfara. Alpha-cypermethrin resistance was observed in *An. gambiae* s.l. in Akwa Ibom, Bauchi, Ebonyi, Nasarawa, and Plateau. Susceptibility was restored when pre-exposed to PBO in Ebonyi, Nasarawa, and Zamfara.
- Conducted capacity-strengthening training on basic entomological methods and mosquito taxonomy for 11 Principal Investigators and 38 Entomology Technicians representing all vector surveillance and insecticide resistance monitoring sites. VectorLink Nigeria also provided a refresher training for 23 ITN data collectors in the ongoing assessment of PBO ITN ownership and use among households in five LGAs in Ebonyi. Data collected will feed into the program monitoring dashboard.
- Supported the roll-out of PBO ITNs in Ebonyi State (which occurred in November 2019) with an ITN program monitoring activity. Based on the results of the data assessment, VectorLink developed a PBO ITN monitoring plan and then developed a monitoring dashboard and populated it with baseline data including malaria case incidence, key entomological indicators, ITN coverage, and climate data. This dashboard will be updated in 2021 to monitor the impact of PBO ITNs on malaria case incidence.
- Began working with PMI to define the scope of the durability monitoring activity to follow the 2021 ITN mass distribution campaign in Oyo and Nasarawa states.

1.20 RWANDA

TABLE 13: VECTORLINK RWANDA VECTOR CONTROL AT A GLANCE

IRS	**Dates and length of PMI-supported IRS campaign**	Campaign Round 1: January 20, 2020 to February 11, 2020 (20 operational days) Campaign Round 2: August 24, 2020 to September 18, 2020 (20 operational days)		
	Number of districts covered by PMI-supported IRS	Campaign Round 1: 1 (Ngoma) Campaign Round 2: 3 (Nyagatare, Ngoma, and Kirehe including Mahama refugee Camp)		
	Insecticide(s)	Fludora Fusion WP-SB		
	IRS results*	Structures Sprayed: 334,802	Structures Found: 335,774	Spray Coverage: 99.7%
	Population protected by PMI-supported IRS	Total 1,355,656	Pregnant Women 19,468	Children < 5 187,811
	Number of people trained with U.S. govt funds to deliver IRS	2,882 (1,440 male, 1,442 female)		
ITN	**ITN technical assistance to distribution channel(s) and dates of distribution**	Distribution channel: Mass Campaign, EPI, and ANC Mass Campaign: February 17-21, 2020, March 2-6, 2020 in some districts, June 8-14, 2020 in others		
	Number of districts included in distribution	Total: 10 PermaNet 3.0 Nets (5): Kicukiro, Gasabo, Nyarugenge, Rulindo, and Gicumbi Olyset Nets (5): Burera, Nyagatare, Kirehe, Ngoma, and Gakenke		
	Number of ITNs distributed	Distributed by partners with VectorLink support**: Total: 2,526,206 (PermaNet 3.0: 1,399,528; Olyset: 1,126,678)		
	Type and brand of ITNs distributed	PBO: PermaNet 3.0 Nets Standard pyrethroid-only: Olyset Nets (Permethrin)		

*Rwanda conducted two campaigns during this reporting period. Ngoma District was sprayed during both campaigns/rounds. To avoid double counting of structures and population protected in these consolidated Year 3 results, we have followed PMI annual reporting guidance as follows. "In countries where two spray rounds are implemented within a given fiscal year, indicators should only be counted ONCE. For those countries, the following process should be used to calculate totals: If the two rounds covered the same districts, count only the round with the highest number of people protected." We have applied this approach to Ngoma District results only, and following this guidance the results for Campaign Round 2 for this district are included in the above results. Full details of each campaign are provided in separate End of Spray Reports.

.**VectorLink Rwanda supported the MOPDD in their ITN distribution efforts. Technical support included training, transport, and other support; VectorLink did not manage ITN distribution directly. This does not count toward VectorLink Monitoring and Evaluation indicator 1.1.8, which captures ITNs that VectorLink delivers to a distribution point.

1.20.1 PROGRAM HIGHLIGHTS

- Conducted comprehensive entomological monitoring in three IRS districts (Nyagatare, Kirehe, and Ngoma) in collaboration with the Malaria and Other Parasitic Diseases Division (MOPDD). VectorLink Rwanda also performed ELISA tests to assess parasite infection rate and blood meal source in a sample of mosquitoes and PCR for identification of vectors to the species level.
- Conducted bioassays in collaboration with the MOPDD to monitor the residual efficacy of Fludora Fusion WP-SB in three IRS districts (Nyagatare, Kirehe, and Ngoma). Tests confirmed the residual efficacy of Fludora Fusion WP-SB was more than 11 months.
- Supported the MOPDD collecting baseline data for the ITN durability monitoring of net brands: PermaNet 3.0 (Kicukiro District), Olyset (Burera District), Yahe LN (Ruhango District) and Interceptor G2 (Karongi District). The study will continue in Year 4.
- Conducted IRS in three districts and one refugee camp, protecting 1,355,656 people from malaria. The campaign exceeded its targeted number of structures. The campaign included new COVID-19 mitigation measures.
- Following reports of underreporting of non-sprayed structures, the campaign redoubled messaging and enhanced supervision on this important issue.

1.21 SENEGAL

TABLE 14: VECTORLINK SENEGAL VECTOR CONTROL AT A GLANCE

IRS	**Dates and length of PMI-supported IRS campaign**	Phase 1: May 28, 2020 to July 2, 2020 (25 operational days) Phase 2: July 13, 2020 to August 16, 2020 (21 operational days)		
	Number of districts covered by PMI-supported IRS	4 (Kedougou, Makacolibatang, Koumpentoum, and Koungheul)		
	Insecticide(s)	SumiShield 50 WG in Kedougou Fludora Fusion WP-SB in Kakacolibantang, Koumpentoum and Koungheul		
	IRS results*	Structures Sprayed: 136,417	Structures Found: 137,932	Spray Coverage: 98.9%
	Population protected by PMI-supported IRS	Total 571,649	Pregnant Women 13,575	Children < 5 95,249
	Number of people trained with U.S. govt funds to deliver IRS	828 (630 men, 198 women)		
ITN	**ITN technical assistance to distribution channel(s) and dates of distribution**	Public sector through health facilities and community through community-based organizations		
	Number of districts included in distribution	8 (Dakar, Kaffrine, Kaolack, Fatick, Ziguinchor, Sedhiou, Diourbel, and Thies)		
	Number of ITNs distributed	Distributed by partners with VectorLink support**: 373,900		
	Type and brand of ITNs distributed	Standard pyrethroid-only: Olyset Net		

* The results for the Senegal 2020 campaign are pending final End of Spray Report approval.

.**VectorLink Senegal provided support to the NMCP on their ITN distribution efforts, though VectorLink did not manage ITN distribution directly. This does not count towards VectorLink Monitoring and Evaluation indicator 1.1.8, which captures ITNs that VectorLink delivers to a distribution point.

1.21.1 PROGRAM HIGHLIGHTS

- Conducted IRS in four districts – the first completed since 2017, when PMI first sprayed there.
- Conducted geographical reconnaissance in October and November 2019, held a National IRS Planning Workshop on February 4-6 2020, and completed advocacy visits to the four IRS targeted districts on February 24-27, 2020.
- Completed the procurement of IRS commodities, training of actors, and hiring of seasonal workers in preparation for the campaign. Communication activities were primarily carried out by the NMCP.
- Established a M&E system based on two mobile phone applications, one for spray performance data and another one for supervision related data which allowed for real-time data review and increased data quality as compared to paper-based systems.
- Completed renovations and refurbished the SLAP (*Service de Lutte Antiparasitaire*) and UCAD (University of Cheikh Anta Diop) laboratories including procuring two containers to build an insectary space and additional laboratory space at UCAD. VectorLink is also procuring equipment for the UCAD lab.
- Conducted cone bioassays in two sprayed villages in each IRS district within a week of receiving IRS. The results of wall bioassays indicated that the structures were adequately sprayed in both districts, with 100% mortality recorded between one and four days on both wall types.
- Conducted entomological monitoring in 30 sites across 17 districts of the country through pyrethroid spray catches, human landing catches, and insecticide susceptibility testing. Six *Anopheles* species were collected during the monitoring; *An. gambiae* s.l. was the predominant vector collected in all sites except

in Ndoffane, where the prevalent species was *An. funestus* s.l. Both *An. gambiae* s.l. and *An. funestus* s.l. bite more outdoors than indoors.

- Submitted and received approval for technical report on the ITN continuous distribution assessment conducted in 2019.
- Supported the NMCP's nationwide continuous distribution of ITNs through public sector health facilities and community-based channels. VectorLink received 1,725,000 ITNs in 2020, worked collaboratively with the NMCP to quantify the supply of ITNs, and distributed 373,900 ITNs to eight regions from January to September 2020.

1.22 SIERRA LEONE

1.22.1 PROGRAM HIGHLIGHTS

- Conducted monthly entomological monitoring in eight sentinel sites in four districts representing the regions in Sierra Leone: Lagon and Gerihoun in Bo (Southern Region), Kamaranka and Masongbo in Bombali (Northern Region), Teikor and Sori Town in Kono (Eastern Region), and Sand Sand Water and Tombo in Western Rural (Western Region) from October 2019 to February 2020. The monitoring was extended to Port Loko District in the Northern Province in March 2020. Monitoring was suspended from April through May due to COVID-19. Mosquito collections were extended to one additional chiefdom in Bo, Bombali, and Port Loko and to Karene and Moyamba districts for the evaluation of the impact of the co-deployment of IRS and PBO nets.
- Conducted resistance tests and synergist assays with PBO for permethrin, deltamethrin, and alpha-cypermethrin in Gbanti Kamaranka in Bombali, Jaima Bongor in Bo, and in Koya in Western Rural Area. Results show *An. gambiae* s.l. is resistant to pyrethroids and pre-exposure to PBO did not fully restore susceptibility.
- Supported the NMCP to organize the Integrated Vector Management Technical Working Group (IVMTWG) and the National Steering Committee meetings. Through the meetings, VectorLink supported the insecticide selection for the 2021 IRS campaign in Bo and Bombali districts.
- Trained 22 environmental health officers from the sentinel districts (Bo, Bombali, Port Loko, Karene, and Moyamba) and four seasonal technicians on entomological monitoring, including morphological identification of *Anopheles*, susceptibility tests, and cone bioassays in Freetown.
- Conducted eligible structures enumeration in Bo and Bombali districts.
- Completed preparations for the 2020 ITN durability monitoring activity, including finalizing the protocol and questionnaires, and competitive selection of a local data collection agency. The activity will monitor PermaNet 3.0 in Bo District and OlysetPlus ITNs in Moyamba District.
- Supported an evaluation of the co-deployment of IRS and PBO ITNs in Sierra Leone. VectorLink core partner PATH completed an assessment of HMIS data quality in August 2020 to determine the suitability of the data for the evaluation. Based on these findings, VectorLink has developed a detailed protocol for the evaluation with a timeline from 2020 to 2022.

1.23 TANZANIA

TABLE 15: VECTORLINK TANZANIA VECTOR CONTROL AT A GLANCE

IRS	**Dates and length of PMI-supported IRS campaign**	October 15, –November 25, 2019, February 15-27, 2020 and March 3-19, 2020 63 operational days in total across all phases		
	Number of districts covered by PMI-supported IRS	15: 6 in Mainland Tanzania (Kakonko, Kasulu, Kibondo, Biharamulo, Bukombe, and Ukerewe); 9 in Zanzibar (Central, Micheweni, Mkoani, North A, North B, South, West A, West B, and Wete)		
	Insecticide(s)	Actellic 300 CS (66,362 units) and SumiShield 50WG (68,097 units)		
	IRS results	Structures Sprayed: 471,622	Structures Found: 503,567	Spray Coverage: 93.7%
	Population protected by PMI-supported IRS	Total 1,915,151	Pregnant Women 56,964	Children < 5 373,976
	Number of people trained with U.S. govt funds to deliver IRS	3,182		
ITN	**ITN distribution channel(s) and dates of distribution**	School Net Program and health facilities October 1, 2019 to September 30, 2020 (ongoing)		
	Number of districts included in distribution	19 (Geita, Mara, Kagera, Kigoma, Mwanza, Simiyu, Shinyanga, Katavi, Tabora, Lindi, Mtwara, Ruvuma, Morogoro, Pwani, North Pemba, South Pemba, Unguja South, Unguja North, Unguja Urban West)		
	Number of ITNs distributed	Distributed by VectorLink: Total: 5,683,551 Community: 148,550 Facility: 2,427,330 School: 3,107,671		
	Population protected by ITNs distributed by VectorLink	Estimated Total: 10,230,392		
	Type and brand of ITNs distributed	Standard pyrethroid-only: PermaNet 2.0 (1,849,686) PBO: OlysetPlus (1,646,345) and PermaNet 3.0 (2,187,520)		

1.23.1 PROGRAM HIGHLIGHTS

- Introduced IRS in the three refugee camps of Mtendeli, Nduta, and Nyarugusu in Kigoma region in collaboration with the United Nations High Commissioner for Refugees (UNHCR) and the Tanzania Ministry of Home Affairs.
- Piloted the use of mobile soak pits in three sites in Ukerewe to ensure all accessible locations and islands were reached with IRS services.
- Piloted mobile data collection by SOPs in five hard-to-reach community IRS sites, two in Zanzibar and three in Ukerewe district, to ensure timely data collection, reporting, and data accuracy. With the success of the pilot, the project will scale-up its implementation from 20 to 500 additional smartphones for SOP data collection in 2020/2021.
- Introduced SOP forms with unique IRS numbers during the first phase of the campaign. The pilot aimed to reduce duplicate IRS numbers, making the data-cleaning process more efficient.
- Implemented a mobile-based mobilizer form across all sites where site mobilizers uploaded the number of estimated structures at hamlets and shehias, and identified unsprayed households for planning during mop-up. The successful roll-out will be scaled up by linking mobilization data with the VectorLink Collect database for side-by-side analysis of spray progress and coverage data.
- Introduced a mobile-based incident reporting form for all IRS supervisors. The mobile form guaranteed timely flagging of incidents from the field for timely reporting of incidents to PMI and implementation of corrective actions, where needed.

- Introduced continuous supervision books to track supervisory feedback to sites and data centers for future follow-ups. This enabled subsequent supportive supervision visit at sites and data centers to not only document their observations, but follow up on agreed action plans from previous supervisory visits.
- Piloted the 1:2 male-to-female ratio of applicants during SOP recruitment. Due to a below-40% participation of women in IRS in prior years, the project encouraged the selection of more qualified women applicants at villages, resulting in an increased ratio of female seasonal workers from 36.3% to 45.1%. The project will continue this successful approach in future campaigns.
- Expanded the addition of skirts to the personal protective equipment (PPE) for female SOPs in Zanzibar. Due to Zanzibar's conservative culture, the project introduced the PPE skirts last year in Pemba. The skirts, worn on top of coveralls, are available to women who are not comfortable wearing coveralls only.
- Visited 60 of the 179 health facilities of Unguja and Pemba in collaboration with the Zanzibar Malaria Elimination Program (ZAMEP) and district authorities, which is a 33.5% reach. PMI VectorLink's target was to conduct supportive supervision in at least 25% of health facilities in Zanzibar. The target was exceeded because of great support from ZAMEP in terms of transport and personnel.
- Visited 1,495 of 3,158 schools (through national, regional, and council teams) that are participating in the first phase of Schools National Program Year 7 (SNP7) ITN distribution, a 47% reach. PMI VectorLink's target was to conduct supportive supervision in at least 25% of schools across all councils. Some councils visited more schools than targeted during the four-day supervision period due to favorable geographical terrain and conditions.
- Distributed ITNs in health facilities and schools in three phases: July-December 2019, January-April 2020, and May-December 2020. Phase 3 distribution is still ongoing.

1.24 UGANDA

TABLE 16: VECTORLINK UGANDA VECTOR CONTROL AT A GLANCE

IRS	**Dates and length of PMI-supported IRS campaign**	Phase 1: March 2, 2020 to March 28, 2020 (24 operational days) Phase 2: May 25, 2020 to June 20, 2020 (24 operational days)		
	Number of districts covered by PMI-supported IRS and the UK Department for International Development (DFID)-supported districts	16: 10 by PMI (Budaka, Bugiri, Butaleja, Butebo, Kibuku, Lira, Namutumba, Pallisa, Serere, Tororo) 6 by DFID (Alebtong, Amolatar, Dokolo, Kaberamaido, Kalaki, Otuke)		
	Insecticide(s)	Fludora Fusion WP-SB, Actellic 300CS, SumiShield 50WG		
	IRS results	Structures Sprayed: 1,395,569	Structures Found: 1,475,422	Spray Coverage: 94.6%
	Population protected by PMI-supported IRS	Total 4,938,643	Pregnant Women 132,089	Children < 5 950,163
	Number of people trained with U.S. govt funds to deliver IRS	7,805		

1.24.1 PROGRAM HIGHLIGHTS

- Worked closely with the MOH, National Malaria Control Division, district government, sub-county leaders, and other stakeholders to ensure successful implementation of IRS with strict adherence to COVID-19 prevention measures in two phases. Phase I was conducted in eight districts in eastern Uganda (Bugiri, Budaka, Butaleja, Butebo, Kibuhu, Namutumba, Pallisa, Tororo), and phase II in eight districts in northern Uganda (Alebtong, Amolatar, Dokolo, Kaberamaido, Kalaki, Lira, Serere, Otuke).
- Used Fludora Fusion WP-SB in all 16 districts, and the balance of Actellic 300CS (eight phase I districts) and SumiShield 50WG (eight phase II districts) within the first week of those campaigns.
- Enhanced the use of mass media including radio talk shows, radio announcements, and radio spots in consultation with the District Health Management Teams to sensitize communities on IRS key actions

to promote participation during the COVID-19 pandemic. Conducted wall bioassays within two weeks of spraying to assess the quality of spray in the target districts. The project recorded 100% mortality for susceptible *An. gambiae* s.l. This implies that the quality of spraying was satisfactory with no under-dosing of the spray surfaces. Wall bioassays to assess insecticide residual efficacy is continuing. As of October 2020 (7 months post IRS), mortality recorded on plastered painted wall surfaces was above 80% while it was below 80% for mud and plain brick surfaces for both Actellic 300CS and Fludora Fusion (tests ongoing).

- The project is also conducting vector bionomic studies in six sentinel sites and insecticide susceptibility studies in 11 districts in the country.
- The project held meetings with district and sub-county leaders and other stakeholders review the implementation of malaria gains sustainability activities and develop action plans for strengthening ongoing malaria prevention and control interventions in the districts.
- The project worked in close collaboration with the NMCD to explore alignment between PMI-supported databases and Uganda's HMIS DHIS2 system. This included expanded access to VectorLink Collect for government stakeholders, providing support to the MOH to develop an IRS module within their national DHIS2 system to receive VectorLink IRS data, and establishing a working group to continue data related collaborations. IRS and entomology data captured in DHIS2 is currently accessible to NMCD.

1.25 ZAMBIA

TABLE 17: VECTORLINK ZAMBIA VECTOR CONTROL AT A GLANCE

IRS	**Dates and length of PMI-supported IRS campaign**	October 2, 2019 to November 30, 2019 42 operational days		
	Number of districts covered by PMI-supported IRS	20: Eastern Province (9), Copperbelt Province (10) rural and peri-urban areas, and Luapula Province (1)		
	Insecticide(s)	SumiShield 50WG and Fludora Fusion WP-SB		
	IRS results	Structures Sprayed: 536,983	Structures Found: 598,732	Spray Coverage: 90%
	Population protected by PMI-supported IRS	Total 2,273,188	Pregnant Women 50,100	Children < 5 318,396
	Number of people trained with U.S. govt funds to deliver IRS	2,120		

1.25.1 PROGRAM HIGHLIGHTS

- Targeted 617,000 structures across 20 districts for IRS, including 500,000 structures in Eastern, Copperbelt, and Luapula provinces (later adjusted to 480,625 structures) and 117,000 structures in the three pre-elimination districts of Eastern Province (Katete, Sinda, and Chadiza).
- Conducted entomological surveillance following the 2019 IRS campaign that showed the residual efficacy of SumiShield 50WG and Fludora Fusion WP-SB is 11 months. *An. funestus* s.l. is the predominant malaria vector at most of the sentinel sites. Both *An. funestus* s.l. and *An. gambiae* s.l. were susceptible to clothianidin, chlorfenapyr, and pirimiphos-methyl.
- Supported IRS in 15 districts at the request of the NMEP (three districts in Copperbelt Province, all nine districts in Eastern Province, and three districts in Luapula Province). In four districts (the three pre-elimination districts in Eastern Province and Nchelenge District in Luapula Province), the campaign was supported by the Reveal tool, which was implemented for the first time and supports planning, targeting, and recording delivery of IRS activities. In Ndola, Kitwe, Chipata, and Petauke districts, Reveal was used to conduct satellite-based enumeration and mapping.
- Worked closely with the NMEP and other provincial and district stakeholders prior to the IRS campaign in planning activities. VectorLink facilitated the use of maps developed by Geo-Referenced Infrastructure and Demographic Data for Development (GRID3) for microplanning, which enabled districts to delineate areas for IRS and ITNs using structure and population counts.

- Conducted PSECAs in all 15 PMI-supported IRS districts, and supported the necessary repairs and rehabilitations based on the deficiencies found. A total of 17 new operation sites were established across the three provinces.
- Partnered with Mopani and Konkola Copper Mines on IRS planning and insecticide security. VectorLink staff inspected the mines' insecticide stores and trained their storekeepers on inventory management best practices.
- Conducted a capacity-building workshop on IRS operations in Copperbelt Province for select IRS Master Trainers from across the country, including from the two Copperbelt mines. Furthermore, VectorLink facilitated trainings of seasonal workers in readiness for the 2020 spray campaign.
- Received approval of the 2020-2025 SEA, which allows for the continued provision of technical assistance to NMEP on the use of DDT for IRS. It also authorizes the continued use of all WHO-recommended pesticides in the pyrethroid, carbamate, organophosphate, and neonicotinoid classes, and approves the use of chlorfenapyr when recommended by WHO pre-qualification.
- Developed interactive dashboards to inform vector control product choice in Zambia. Through core partner PATH, VectorLink Zambia then facilitated the use of these dashboards during the Insecticide Resistance Monitoring and Management Plan (IRMMP) Technical Advisory Committee (TAC) meeting in January 2020. These dashboards integrated entomologic data across partners for the first time and were used to inform the IRMMP TAC's recommendation for IRS product choice for each district. VectorLink also supported the development of DHIS2 data collection forms to support the NMEP in implementation of IRS and ITN campaigns and facilitated data collection trainings.
- Provided ongoing technical assistance to the Zambia NMEP to plan the 2020-2021 ITN mass distribution campaign. VectorLink Zambia supported the establishment of national planning structures and production of a comprehensive ITN work plan, and facilitated training of trainers at the central, province, and district levels. VectorLink actively participates in campaign subcommittee meetings, chaired the district microplanning and budget consolidation meetings, and supported the integration of campaign data collection into DHIS2. The project also helped the NMEP to mainstream COVID-19 guidance in mass campaign activities and procured PPE for 20,000 community-based volunteers involved in household registration and distribution, which is expected to begin in late 2020.
- Finalized the protocol and study tools for the ITN Misuse Assessment in Zambia and received approval from ERES Converge, the PSI Research Ethics Board, and Zambian National Health Research Authority. A local research agency was selected to support the activity. VectorLink Zambia and PMI agreed to postpone training and fieldwork until the next work plan year due to COVID-19 related risks.

1.26 ZIMBABWE

TABLE 18: VECTORLINK ZIMBABWE VECTOR CONTROL AT A GLANCE

IRS	**Dates and length of PMI-supported IRS campaign**	November 4, 2019 to December 16, 2019 36 operational days		
	Number of districts covered by PMIsupported IRS	2 (Mashonaland East Province: Mudzi and Mutoko)		
	Insecticide(s)	Actellic 300CS and Fludora Fusion WP-SB		
	IRS results	Structures Sprayed: 131,191	Structures Found: 139,736	Spray Coverage: 93.9%
	Population protected by PMI-supported IRS	Total 307,209	Pregnant Women 5,010	Children < 5 48,047
	Number of people trained with U.S. govt funds to deliver IRS	430 (309 men, 121 women)		

1.26.1 .PROGRAM HIGHLIGHTS

- Implemented a full package of IRS support in two districts in Mashonaland East Province, prioritizing the spray campaign in 18 wards in Mudzi and 28 wards in Mutoko.

- Provided technical and limited material support in four districts in Manicaland Province (Nyanga, Mutasa, Mutare, and Chimanimani) as part of transition from PMI to Government of Zimbabwe support.
- Worked with national, provincial, and district government stakeholders to conduct microplanning and post-IRS conference meetings to most effectively review and plan for spray operations.
- Piloted the use of 273 (92 females and 181 males) local community guides successfully to help beneficiaries to remove household goods to facilitate smooth spray operations. VectorLink used the community guides to address gaps in coverage reported in 2018. In coordination with provincial and district officials, VectorLink selected five wards from Mutoko District (Hoyuyu Luckydip, Nyamuganhu, Hoyuyu Clearwing, Nyamukapa, and Hoyuyu Mangondo) that did not meet 2018 coverage targets, to participate in the pilot. The percentage increase in structures sprayed from 2018 to 2019 varied from 15.5% in Hoyuyu Mangondo to 31.2% in Nyamuganhu, with all five wards meeting the 85% coverage target in 2019. These increases can be attributed to the community guide efforts.
- Followed the standard WHO cone bioassay method to measure the quality of spraying and insecticide decay rate of Fludora Fusion WP-SB and Actellic 300CS following the routine spraying of walls at Kawere in Mutoko District and Dendera in Mudzi District, respectively. Mosquito mortality was still >80% on all four surface types four months after spraying both Fludora Fusion WP-SB and Actellic 300CS prior to pausing activities due to COVID-19. Bioassays resumed in August in Dendera, but not in Kaware as the province re-sprayed the area in response to a malaria outbreak.
- Began preparations for the 2020 spray campaign including support of microplanning meetings and mobilization efforts at the district and community level including COVID-19 mitigation measures. The 2020 IRS campaign started the refurbishment of nine campsites (soak pits, wash areas, water supply, and storerooms) in Mudzi and Mutoko districts of Mashonaland East Province.
- Discontinued routine vector surveillance for four months due to COVID-19 restrictions but resumed with mitigation measures in August 2020 at three sites in Mashonaland East Province (Dendera, Kawere, and Makarara) and one site in Manicaland Province (Bruma). Insecticide resistance monitoring continued at all six sites with precautions throughout the reporting period.
- Continued support to Africa University with international procurement of materials including reagents. The project also strengthened capacity building in stock management/inventory, M&E, mosquito morphological identification, insecticide resistance testing, and raising new *An. funestus* colonies.
- Established coordination meetings during the second half of 2020 with Africa University to complete the construction of the insectary, which started in May 2017 with the procurement of the containers. VectorLink contracted Concrete Masters to complete the construction and a Project Manager to supervise. The final construction phase started July 1, 2020 and was completed on October 29, 2020.
- Conducted data collection in three provinces in September 2020 in Mashonaland Central, Masvingo, and Matabeleland North in support of the NMCP rebranding both technically and financially. Re-branding efforts collected information from the community and other stakeholders on i) awareness and perceptions of the NMCP, on how they think the NMCP can improve their mandate and improve their brand, ii) how stakeholders can help the NMCP improve, iii) the overall image of the NMCP stakeholders would like to see in future, and iv) how NMCP can project itself in the community and which other community sectors need to be covered, including types of malaria communications.

2. CORE

2.1 COVID-19 ADAPTATIONS

PMI VectorLink adapted operations to continue life-saving vector control activities during the COVID-19 global pandemic. The most immediate shifts were the closure of project offices worldwide, drafting and disseminating telecommuting policies, and suspending all international travel. The project then developed and trained staff on several new strategies to allow vector control operations to continue uninterrupted while minimizing relative risk increases of COVID-19 transmission. To develop these new strategies, the project relied heavily on CDC and global guidance for COVID-19 prevention, primarily ensuring at least 6ft (2m) physical distancing, frequent handwashing, and mandatory face coverings for anyone participating in project activities. Furthermore, the project adapted spray calendars and daily routines to reduce common areas of overcrowding such as the wash areas during end-of-day clean-up.

During IRS, ITN, and other vector control activities, the project reduced the numbers of people who could ride together in the same vehicle to promote physical distancing while also mandating PPE use during transport. The project also adapted all in-person training events, microplanning meetings, and data-entry activities to take place outdoors or in well-ventilated spaces, and whenever possible shifted its standardized training curriculum to be delivered virtually. VectorLink developed strict protocols for contact tracing, testing requirements, and quarantine and isolation mandates within the project's sphere of influence. All of PMI VectorLink's COVID-19 adaptations were included in the project's *Operating Standards to Reduce the Risk of Transmission of COVID-19*.

2.2 OPERATIONS RESEARCH

Experimental Hut Trial on Partial Spraying of New Generation IRS Insecticides in Côte d'Ivoire

PMI VectorLink is conducting an experimental hut trial in Côte d'Ivoire. The main objective of this study is to determine whether partial spraying with clothianidin-based insecticides (SumiShield 50WG and Fludora Fusion WP-SB) will have the same effect as the partial spraying with Actellic 300CS, and to determine if partial spraying with these new insecticides is a viable option to reduce the cost of IRS without compromising efficacy. The study is evaluating different scenarios by spraying the top or bottom half of the walls along with the ceilings, and this will be compared with full spraying (positive control) and the unsprayed huts (negative controls). Data collection started in August 2020 following approvals of the protocol by the Operations Research committee and Institutional Review Boards. Baseline data collection was completed in September 2020 followed by spraying of the huts and post intervention data collection. The study is expected to be completed in March 2021.

2.3 VECTORLINK CORE ITN ACTIVITIES

Laboratory Capacity to undertake Durability Monitoring in Sub-Saharan Africa

In Year 3, PMI VectorLink began supporting durability monitoring of ITNs with new active ingredients, including pyrethroid + PBO-synergist nets and pyrethroid + chlorfenapyr nets. Bioassay standard operating procedures for these ITN products are more complex than for pyrethroid-only ITNs, and include the use of tunnel tests and laboratory-raised or wild pyrethroid-resistant mosquito strains. In March 2020, VectorLink designed a short questionnaire to capture information on laboratory capacity to undertake durability monitoring of new types of nets in sub-Saharan Africa. A seven-item questionnaire was created in SurveyMonkey and promoted through the RBM Vector Control Working Group mailing list. Input was also sought directly from VectorLink entomology staff and from PMI. The first iteration of the ITN Bioassay Laboratory Register is an Excel spreadsheet documenting the lab capacity for tunnel tests and the use of pyrethroid-resistant mosquito strains for 43 laboratories in 21 countries. Subject to delays due to the pandemic, it is expected that approximately 12 out of these countries will have distributed in 2020 or will be distributing in 2021, dual a.i. or PBO nets. The registry will be updated on an annual basis, using available contact information for lead scientists, and expanded to capture more information on strain

characteristics, the presence of experimental huts, and Good Laboratory Practice (GLP)-certification, among other attributes.

ITN Continuous Distribution Assessment Toolkit

PMI VectorLink developed an ITN Continuous Distribution Assessment Toolkit to enable continuous distribution stakeholders to assess the existing continuous distribution channels in a country, and to provide recommendations for improving or expanding them. It provides a 10-step guide, which includes three key activity areas (Planning, Implementation, and Reporting), a Terms of Reference, and an indicative budget template. The toolkit is posted on the Alliance for Malaria Prevention's (AMP) website and available on continuousdistribution.org.

Health Facility ITN Supervision Checklist

The project developed a Health Facility ITN Supervision checklist that focuses on assessing various components of continuous distribution of ITNs at health facilities through on-the-job supervision. Intended users of this checklist are any partners conducting supervision of continuous distribution of ITNs at health facilities, including NMCPs. Once finalized and approved, the checklist will be digitalized in 2021 and will be available on continuousdistribution.org.

Survey to understand the Perceptions and Use of the continuousdistribution.org Website

To support the use of continuousdistribution.org resources by key target audiences (e.g., NMCPs, implementing partners, RBM Partnership to End Malaria partners, etc.),

PMI VectorLink developed a light-touch survey tool in English and French that was sent out to approximately 2,000 individuals from various partner organizations – 55 responses were recorded and reported on and recommendations were presented.

2.4 MONITORING AND EVALUATION

VectorLink Collect Implementation and Roll-Out

VectorLink Collect serves as the central, global database for the PMI VectorLink Project. The VectorLink Collect system, built on the DHIS2 platform, continues to be developed and expanded to manage all IRS and entomological data across most VectorLink countries. To date, VectorLink Collect has been rolled out to all 16 VectorLink countries that implement IRS. For entomological data, five VectorLink Collect programs were finalized and rolled out this year to manage data for vector bionomics (longitudinal monitoring), insecticide resistance, and insecticide residual life. Over the course of this reporting period, VectorLink prioritized several activities to ensure the successful roll-out and continued improvement of VectorLink Collect. This included targeted capacity development for VectorLink staff, and selected stakeholders to enable appropriate use of the system, and to enable the use of data for programmatic decision-making.

- *VectorLink Collect IRS Deployment*: VectorLink supported the deployment of VectorLink Collect IRS programs in all remaining spray countries in the first half of Year 3. This included Benin, Ethiopia, and Ghana, as well as new 2020 spray countries Côte d'Ivoire and Senegal, for a total of 16 countries. Country-level M&E staff were trained through a Regional VectorLink Collect for IRS Training held in January 2020 (see below). This completes the deployment of VectorLink Collect for IRS data in all spray countries.
- *VectorLink Collect Entomological Program Finalization and Deployment:* PMI VectorLink planned for a phased roll-out of entomological programs within VectorLink Collect in targeted countries during this reporting period. VectorLink M&E and Entomology teams finalized program development based on final technical dialogue with PMI, and initiated a pilot of the new programs in Zambia beginning in February/March 2020. To support the roll-out of these new VectorLink Collect programs, the VectorLink M&E and Entomology teams developed a comprehensive package of tools to be used by all country teams in preparing to use the system for entomological data management. This package included resources such as: data workflow/data map, data management, and data quality roles and responsibilities matrices, user assignment templates, and geographical mapping tools (to align entomological geographic levels to the organizational hierarchy for IRS). The entomology programs were also translated into French and selected programs were translated into Portuguese; Spanish translations are also in process to support system use for the VectorLink Latin America operational research study.

Due to the COVID-19 pandemic, VectorLink changed trainings to a virtual format, as described below. By September 30, 2020, the project had successfully trained and oriented over 50 VectorLink staff on the new programs (including 43 country-level staff, plus home office technical and M&E staff). Now, 12 countries are using the system for entomological data entry and management (by the end of October 2020, all 17 targeted VectorLink countries will be trained in these new programs). VectorLink also continues to work with a team of PMI beta testers to develop standardized analytics and dashboards for the entomology data. Several iterations of the dashboards have been drafted and reviewed, and the team expects to continue to iterate with analytical advancements into the coming year.

VectorLink continues to work with PMI to determine an appropriate approach for managing entomological laboratory data in VectorLink Collect, given the wide range of operational variances across countries. A critical requirement for this program's success is ensuring the ability to link individual mosquitoes sent for laboratory analyses to the original mosquito collection or insecticide resistance test. VectorLink will enable this linking through careful and intentional coding of the mosquito samples. In discussions with PMI, VectorLink began developing a plan for scannable mosquito labels before proceeding with the roll-out of the laboratory programs. The project aims to launch a pilot for scannable labels before the end of 2020.

- *Legacy IRS Data*: During this reporting period, VectorLink continued to compile, clean, and organize legacy IRS data for sharing with the PMI Data Integration team for PMI's Malaria Data Integration/Visualization for Elimination (MDIVE) platform, and for uploading into VectorLink Collect. All legacy IRS data were compiled and a new summary program was developed within VectorLink Collect. This new "End of Spray Results" program catalogues final IRS campaign results, and has a set of indicators developed to align with those identified by PMI as priority metrics for MDIVE, which will facilitate final results reporting and data exchange. The full IRS legacy data set from 2012-2018 is complete, and final geographical hierarchy cleaning is underway. The project expects to fully launch this program before the end of 2020.
- *Legacy Entomological Data:* VectorLink has continued its efforts to compile and clean legacy entomological data for import into VectorLink Collect with a focus on legacy insecticide resistance data. The consolidated insecticide resistance data set has been cleaned and VectorLink has begun the transformation of the data to align with the approved insecticide resistance data program in VectorLink Collect. The project is on track to have legacy insecticide resistance and residual efficacy data sets prepared by December 2020. Both data sets will include data from 2018 onwards.
- *Sharing Data with PMI's MDIVE Platform:* During this reporting period, VectorLink continued to collaborate with PMI to determine the appropriate approaches for sharing VectorLink data with the PMI MDIVE platform.
- *Collaboration with WHO*: VectorLink also continued to hold periodic discussions with WHO, to ensure alignment between VectorLink data and WHO DHIS2-based entomological modules.

Expanded Use of Digital Tools and Mobile Data Collection

During this reporting period, PMI VectorLink continued to build on the important opportunities the VectorLink Collect system offers for expanding the use of mobile data collection for IRS campaigns. VectorLink successfully implemented mobile data collection in several countries during this reporting period. This year, five countries successfully implemented full mobile data collection for IRS campaigns, including Benin, Burkina Faso, Côte d'Ivoire, Mali, and Senegal. Two of these, Côte d'Ivoire and Senegal, were new IRS countries this year, which was a remarkable achievement to be able to support a campaign and complex digital deployment with only remote technical support given COVID-19 limitations. Several countries have taken a hybrid data collection approach, using a blend of paper-based and mobile solutions: Ghana, Kenya, Tanzania, and Zambia. The VectorLink M&E team continues to consolidate lessons learned and best practices, including documentation for tool design, device specification decisions, and general planning requirements for mobile data collection for IRS campaigns.

Capacity Building/Training

Regional VectorLink Collect Trainings: Three regional M&E trainings were originally planned to support the continued deployment of the VectorLink Collect system in all remaining IRS countries, and to support deployment of the entomological programs in all PMI VectorLink countries during this reporting period. Due to the COVID-19 pandemic, only one of these regional trainings (for IRS) was conducted in person as planned. The two planned regional trainings for entomology, intended to include participants from 12 countries, were adapted to a fully virtual approach. Given the importance of trainee participation in these trainings, VectorLink split the entomology trainings into phases to allow for full participant engagement and practical exercises. These regional trainings are summarized below:

Training Focus	Regional VectorLink Collect IRS Training
Timing and location	January 27-30, 2020 in Accra, Ghana [in-person training workshop]
Participants	Country level: M&E managers and database managers (14) Home office: select home office M&E and system specialists (5)
Participating countries	Benin, Côte d'Ivoire, Ethiopia, Ghana, Senegal, Uganda

Training Focus	Regional VectorLink Collect Entomology Training*			
	Pilot	Phase 1	Phase 2	Phase 3
Timing and location	March 2020 [Virtual]	May 2020 [Virtual]	July 2020 [Virtual]	August 2020 [Virtual]
Countries	Zambia	Angola, Zimbabwe	Ethiopia, Ghana, Rwanda, Sierra Leone	Burkina Faso, Cameroon, Côte d'Ivoire, Democratic Republic of the Congo, Mali
Participants	Trained 43 entomologists, M&E managers, and entomology database managers Average of 3-4 participants per country			

*Phase 4 is planned for October 2020 for: Liberia, Madagascar, Niger, Senegal, and Uganda.

Complementary M&E Training Resources: With 20 VectorLink countries now using VectorLink Collect for IRS and/or entomology data management, the project continues to streamline and improve efforts for data generation and use across the project, including overall system troubleshooting and support approaches. During this reporting period, the M&E team developed several internal tools to support country teams in the use of VectorLink Collect, including new VectorLink Collect Quick Start Guides and VectorLink Collect Troubleshooting Guides for IRS and entomology programs. In addition, the team developed and systematized a new helpdesk ticketing system to support country-level staff using VectorLink Collect more efficiently.

Finally, given the need to pivot most of the project's work to virtual support starting in March 2020 due to COVID-19, the M&E team created a comprehensive set of recommendations for conducting M&E in the COVID-19 context and developed several new innovative training materials, including "how to" videos that were successfully included in virtual trainings. The team developed videos on varied topics to meet country needs, including comprehensive data collection at the structure level, navigating data entry on mobile phone applications, syncing data from mobile phones, troubleshooting mobile devices, and others.

Data Analytics and Visualization: With efforts coordinated by PATH, PMI VectorLink developed a first draft of the Vector Control Integrated Data Analytics and Visualization Best Practices Guide. The guide, designed to support national decision-makers and partners, was developed based on VectorLink's experiences in using existing data sources for the planning, implementation, and evaluation of malaria vector control interventions. It provides indicator definitions, along with how to use and interpret the indicators, data sources, and examples of visualizations created under the project.

2.5 GENDER

Across PMI VectorLink, innovative approaches led by field-based staff advanced the project's gender mainstreaming and female empowerment goals, and the project continues to disseminate results to inform the global dialogue. Despite the added challenges of the COVID 19 pandemic, the project continues to prioritize women's equal participation in vector control activities. The network of field-based gender focal points stay in touch via WhatsApp to share ideas and discuss challenges. Many teams marked International Women's Day and International Day of the Girl with posts on social media. A few other achievements in Year 3 included:

- Participation of two gender focal points from Kenya and Ghana in a virtual symposium "Accelerate to Equal: Engaging Women in Vector Control" in October 2019.
- Expansion of successful pilot of adapted PPE for women from Pemba, Zanzibar to Unguja, Zanzibar. The new PPE include a long skirt, which aligns with typical dress for women in Zanzibar. The skirts are an optional addition to the project's standard PPE.
- Participation of the project's gender advisor and the gender focal points from Kenya and Ghana in a project podcast discussing women in vector control, released in spring 2020.
- Welcoming and orientation of new gender focal points in Côte d'Ivoire.

2.6 ENVIRONMENTAL COMPLIANCE AND SAFETY

In Year 3, VectorLink's Environmental Compliance and Safety team submitted SEAs for, Côte d'Ivoire, Ethiopia, Ghana, Mozambique, Senegal Tanzania, Uganda, and Zambia. Pre-Spray Letter Reports were prepared for Burkina Faso, Kenya, Madagascar, Malawi, Mali, and Zimbabwe.

In February 2020, the Environmental Compliance team updated the PMI Best Management Practices Manual for IRS in Vector Control Interventions to reflect new requirements for serialization of insecticides, triple-rinsing of sprayers, and the formatting of SEAs, among other updates. Along with other members of the VectorLink Team, the Environmental Compliance team developed and disseminated standards to mitigate COVID-19 transmission during all phases of IRS implementation. The team led the design and delivery of two virtual regional environmental compliance workshop series: the first series was with VectorLink Environmental Compliance Officers only, and the second series was with government representatives from the English-speaking countries. In the two workshops together, VectorLink trained 69 people including 51 government staff. The training was highly rated by participants both in terms of content and level of interaction despite the virtual platform. A third workshop was scheduled took place in October 2020, outside of this reporting period.

Other accomplishments from this reporting period include:

- Coordination with Vector Control Operations to standardize serialization of insecticide sachets and bottles across all VectorLink countries;
- Implementation of bar code scanning for insecticide tracking pilots in Ghana, Malawi, and Rwanda;
- Provision of short-term technical assistance in Benin, Côte d'Ivoire, Ghana, Ethiopia, Mozambique, Tanzania and Zimbabwe;
- Provision of coaching and materials for VectorLink Malawi to provide an environmental compliance boot camp for the Malawi NMCP's IRS campaign;
- Implementation of methods for reducing congestion in end-of-day wash areas as a COVID-19 mitigation measure, including staggered spray team arrivals, twinning of wash areas, and use of auxiliary wash areas using mobile soak pits;
- Hiring and training of new Environmental Compliance Officers in Côte d'Ivoire, Malawi, Mozambique, Senegal and Uganda; and
- Provision of online training for Burundi's NMCP Master Trainers and other IRS actors on environmental and operations aspects of IRS.

2.7 CONFERENCES

Twelve of VectorLink's submissions were accepted at the **American Society of Tropical Medicine and Hygiene 2019 Conference**, which took place in National Harbor, Maryland. Two of them were accepted as oral presentations and 10 were accepted as poster presentations.

Several members of the VectorLink team participated in the **Global Digital Health Forum** in early December 2019, including one VectorLink presentation on Validating Use of Satellite Data for Household Enumeration in Rural Ethiopia.

In late January and early February 2020, VectorLink participated in the **Alliance for Malaria Prevention and Roll Back Malaria Annual Vector Control Working Group (VCWG)** meetings. VectorLink hosted two symposia as part of one of the VCWG's plenary sessions: 1) Insecticide resistance management (IRM) and practical implementation of resistance management, and 2) Innovative approach to optimize planning, implementation, and practical implementation of resistance management. Through core partner PATH, VectorLink also presented "Leveraging routine data for vector control decision-making: country-specific examples" at the VCWG, demonstrating how integrated data sources were used to guide decisions in Mali and Zambia. VectorLink's Technical Director served as co-chair and facilitator of the IRS/IRM workstream for this meeting.

VectorLink attended the **DHIS2 Symposium**, which was held virtually on September 1–17, 2020. Two M&E team members gave a presentation on "Large Scale, Quick Turnaround: Verifying and Using Data in DHIS 2-based VectorLink Collect with an Emphasis on Timeliness". PMI VectorLink also participated in the **DHIS2 Annual Conference** which was held virtually, on September 21-25, 2020, and was offered free of charge. This annual conference, formerly known as the DHIS2 Experts Academy, is an important opportunity to learn from the broader community of DHIS2 implementers and technical experts.

2.8 COMMUNICATIONS

During this reporting period, the PMI VectorLink Project produced 11 success stories and two photo stories, and profiled four malaria fighters. The project also repurposed two videos, produced one animation video on VectorLink's implementation of mobile data collection, and published 47 internal Fist Bump Friday posts, which give recognition to a person or team for a job well-done. The project also successfully submitted five peer-reviewed journal articles[2] that were published during the reporting period.

At the beginning of this implementation year, the project introduced a new video-podcast series, called the PMI VectorLink Podcast, to engage relevant experts in conversation on important vector control topics and promote the technical expertise of project staff. The project produced three episodes, which can be found on SoundCloud here: https://soundcloud.com/pmi-vectorlink.

The Vector LearningXchange hosted three webinars: Mapping 101 with Maxar: How Geospatial Data Improves Planning and Implementation in IRS, Exploring the Contribution of 3rd Generation IRS Products with NGenIRS, and Advancing Progress in Malaria Control: Optimizing the collection, analysis, and use of entomological data for vector control decision-making. The site was also updated with new resources, including tool kits, training guides, and best practices.

The aforementioned communications were posted on the project and PMI websites, promoted through the project Twitter account, and distributed via the PMI VectorLink quarterly e-letter.

The project distributed one e-letter this reporting period in June 2020 and five e-alerts (December 2019 for the WHO World Malaria Report, January 2020 for a NGenIRS webinar, April 2020 for World Malaria Day, May 2020 for the Maxar webinar, and August 2020 for World Mosquito Day) to reach nearly 4,000 global health professionals.

The project's website was updated to reflect the project's integrated vector approach, including our work in data analytics and ITNs. Seven technical briefs and three infographics were updated and two COVID-

[2] https://pmivectorlink.org/resources/reports-and-publications/

19 mitigation standards documents were produced and posted. Links to the aforementioned communications can be found in Annex B.

2.9 CLOSE-OUT OF NGENIRS

The Innovative Vector Control Consortium (IVCC)-implemented and Unitaid-funded NGenIRS Project ended in December 2019. Before completion, NGenIRS negotiated two-year price-cap agreements with the three main insecticide manufacturers (Bayer, Sumitomo, and Syngenta) with the overall objective of maintaining competitive pricing. As part of these agreements, PMI and Global Fund committed to submitting consolidated insecticide forecasts by the end of October in both 2020 and 2021. Rather than conducting regional forecasting workshops, in the summer and early fall of 2020, PMI VectorLink country teams organized country-specific meetings with their respective vector control steering committees dedicated specifically to forecasting insecticide needs for 2021.

2.10 TRAINING CURRICULUM FOR COMMUNITY-BASED ENTOMOLOGICAL SURVEILLANCE

The current approach of mobilizing a handful of trained entomologists centrally to collect entomological data from limited sites does not provide the high-resolution entomological data needed to inform tailored sub-national deployment of vector control interventions. When properly implemented, community-based entomological surveillance enables parallel collection of longitudinal entomological data from multiple sites in a cost-effective manner and contributes to capacity building. In Year 3, PMI VectorLink worked with EnCompass to develop a training curriculum that will be used to train the district malaria focal points and community mosquito collectors. The curriculum kit includes detailed manuals for the trainers, workbooks for district malaria focal points and community-based collectors, PowerPoint presentations, and pre- and post-training assessments. The documents are currently under PMI review and after finalization will be used as a standard tool for training purposes in 2021.

ANNEX A:
M&E RESULTS SUMMARY

TABLE A.1: VECTORLINK SUMMARY VECTOR CONTROL RESULTS AND POPULATION PROTECTED

Country	IRS Structures Sprayed	IRS Structures Found	IRS Spray Coverage	Population Protected by IRS	Population Protected by IRS: Pregnant women	Population Protected by IRS: Children <5	ITNs Distributed by VectorLink	Population Protected by ITNs (estimate**)
Angola	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benin	350,349	375,131	93.4%	1,104,928	44,046	199,200	N/A	N/A
Burkina Faso	162,037	171,276	94.6%	508,107	21,103	95,445	N/A	N/A
Cameroon	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cote d'Ivoire*	53,962	58,695	91.9%	193,935	4,349	30,053	N/A	N/A
Ethiopia	527,375	551,504	95.6%	1,511,728	43,747	226,996	N/A	N/A
Ghana	339,139	366,283	92.6%	965,467	21,295	161,750	N/A	N/A
Kenya	436,472	482,831	90.4%	1,792,495	40,727	211,868	N/A	N/A
Liberia	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Madagascar	267,874	279,746	95.8%	1,150,922	53,287	204,833	N/A	N/A
Malawi	107,565	121,167	88.8%	441,375	11,182	74,173	4,808	8,654
Mali	129,302	133,426	96.9%	503,043	34,462	87,606	N/A	N/A
Mozambique	338,330	350,172	96.6%	1,484,191	77,084	209,747	N/A	N/A
Niger	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nigeria	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Rwanda*	334,802	335,774	99.7%	1,355,656	19,468	187,811	N/A	N/A
Senegal*	136,417	137,932	98.9%	571,649	13,575	95,249	N/A	N/A
Sierra Leone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Tanzania	471,622	503,567	93.7%	1,915,151	56,964	373,976	5,683,551	10,230,392
Uganda	1,395,569	1,475,422	94.6%	4,938,643	110,170	756,617	N/A	N/A
Zambia	536,983	598,732	90.0%	2,273,188	50,100	318,396	N/A	N/A
Zimbabwe	131,191	139,736	93.9%	307,209	5,010	48,047	N/A	N/A
Total	5,718,989	6,081,394	94.2%	21,017,687	606,569	3,281,767	5,688,359	10,239,046

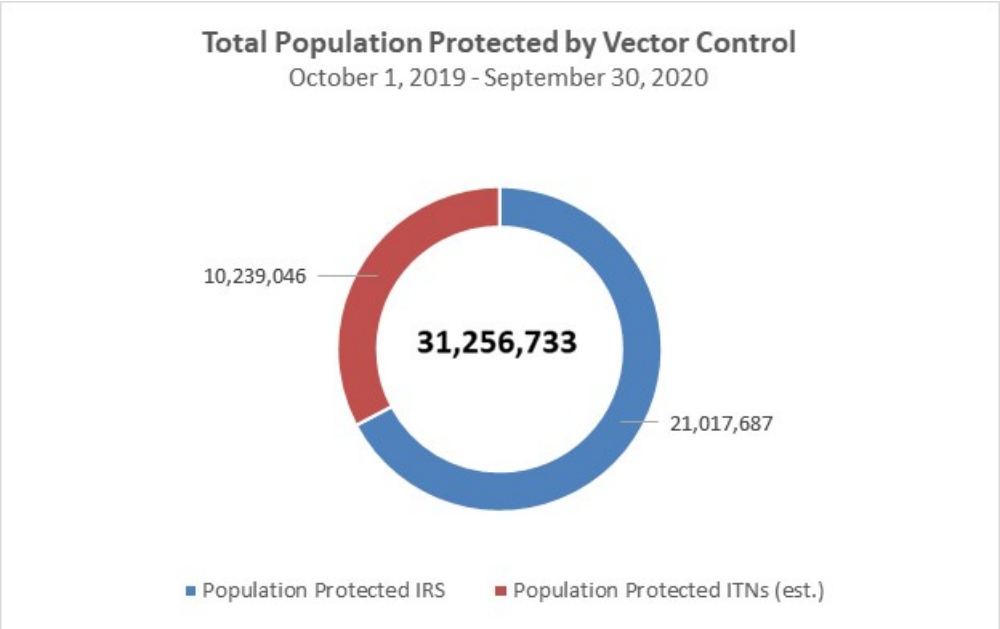
*In this table and figures below, an asterisk indicates that final IRS results are still under review by PMI and the End of Spray Report is not yet final.

** Note: This table only estimates population protected by ITNs for ITNs distributed by VectorLink (in Malawi and Tanzania), using a factor of 1.8 per ITN distributed. A summary of ITNs distributed by partners with PMI VectorLink support is provided in Table A.2 below.

TABLE A.2: PMI VECTORLINK VECTOR CONTROL DETAILS

VectorLink Country	Indoor Residual Spraying			Insecticide Treated Nets		
	IRS Structures Sprayed	IRS Personnel Trained with PMI Funds	IRS Insecticide Used	ITNs Distributed by VectorLink	ITNs Distributed by Partners with VectorLink Support	ITNs Distributed
Benin	350,349	2,128	Actellic 300CS, Fludora Fusion WP-SB	N/A	N/A	N/A
Burkina Faso	162,037	1,493	SumiShield 50WG, Fludora Fusion WP-SB	N/A	N/A	N/A
Cameroon	N/A	N/A	N/A	N/A	1,329,189	Standard pyrethroid-only: TanaNet, Olyset
Cote d'Ivoire*	53,962	353	SumiShield 50WG, Fludora Fusion WP-SB	N/A	N/A	N/A
Ethiopia	527,375	2,350	Actellic 300CS, SumiShield 50WG, Fludora Fusion WP-SB	N/A	N/A	N/A
Ghana	339,139	843	Actellic 300CS, SumiShield 50WG, Fludora Fusion WP-SB	N/A	1,606,095	PBO (schools): PermaNet 3.0; Standard pyrethroid only (HF): MAGNet
Kenya	436,472	2,309	Actellic 300CS	N/A	N/A	N/A
Madagascar	267,874	1,063	Actellic 300CS, SumiShield 50WG, Fludora Fusion WP-SB	N/A	N/A	N/A
Malawi	107,565	565	Actellic 300CS, SumiShield 50WG	4,808	N/A	PBO: Olyset Plus
Mali	129,302	441	Actellic 300CS, SumiShield 50WG, Fludora Fusion WP-SB	N/A	N/A	N/A
Mozambique	338,330	1,446	SumiShield 50WG, Fludora Fusion WP-SB	N/A	N/A	N/A
Niger	N/A	N/A	N/A	N/A	N/A	N/A
Rwanda*	334,802	2,882	Fludora Fusion WP-SB	N/A	2,529,206	PBO: PermaNet 3.0; Standard pyrethroid-only: Olyset
Senegal*	136,417	828	SumiShield 50WG, Fludora Fusion WP-SB	N/A	373,900	Standard pyrethroid-only: Olyset
Tanzania	471,622	3,182	Actellic 300CS, SumiShield 50WG	5,683,551	N/A	PBO: Olyset Plus, PermaNet 3.0; Standard pyrethroid-only: PermaNet 2.0
Uganda	1,395,569	7,805	Actellic 300CS, SumiShield 50WG, Fludora Fusion WP-SB	N/A	N/A	N/A
Zambia	536,983	2,120	SumiShield 50WG, Fludora Fusion WP-SB	N/A	N/A	N/A
Zimbabwe	131,191	430	Actellic 300CS, Fludora Fusion WP-SB	N/A	N/A	N/A
Total	5,718,989	30,238		5,688,359	5,838,390	

FIGURE A.1.



Note: This figure only estimates population protected by ITNs for ITNs distributed by VectorLink (in Malawi and Tanzania), using a factor of 1.8 per ITN distributed

FIGURE A.2.

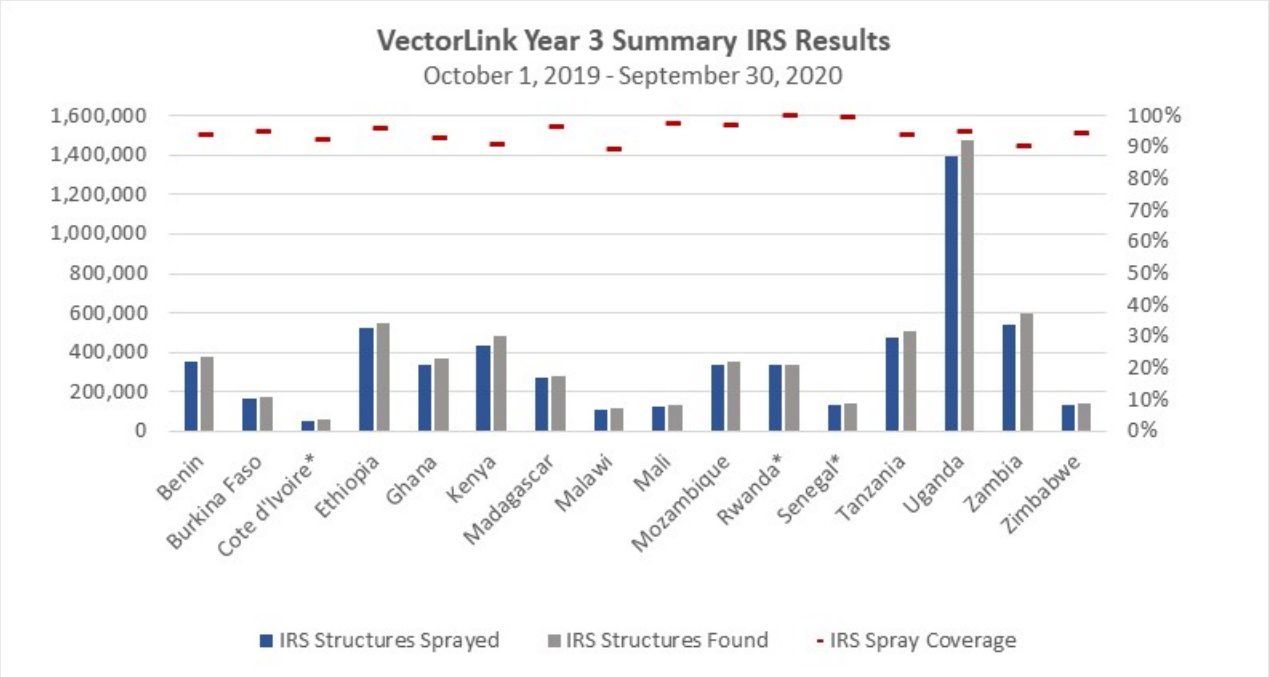
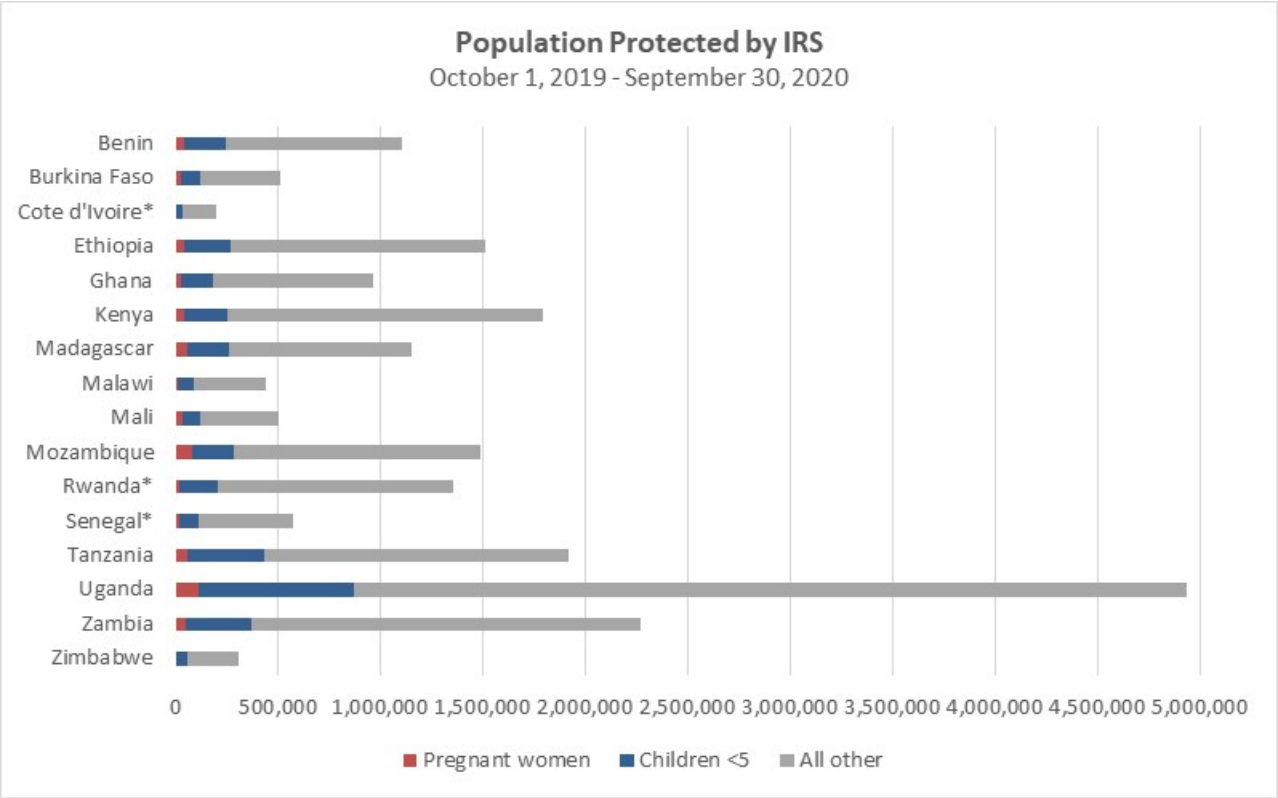


FIGURE A.3.


Population Protected by IRS
October 1, 2019 - September 30, 2020
Benin
Burkina Faso
Cote d'Ivoire*
Ethiopia
Ghana
Kenya
Madagascar
Malawi
Mali
Mozambique
Rwanda*
Senegal*
Tanzania
Uganda
Zambia
Zimbabwe
0
500,000
1,000,000
1,500,000
2,000,000
2,500,000
3,000,000
3,500,000
4,000,000
4,500,000
5,000,000
Pregnant women
Children <5
All other

ANNEX B: COMMUNICATIONS

SUCCESS STORIES

Niger Puts Mosquitoes to the Test
Faith Leaders Promote Uptake of IRS amidst COVID-19
Entomologists Take Testing Matters into Their Own Hands
Moving Forward with IRS during Uganda COVID-19 Lockdown
PMI Enhances Evidence-based Decision Making to Prevent Malaria
Harnessing Technology in South to South Collaboration to Fight Malaria
A New Generation of Nets
Commemorating World Malaria Day in Ghana
PMI Assists Ethiopia along the Journey to Self-Reliance in IRS
Better Data, Better Results
Building Capacity One Insectary at a Time

PHOTO STORIES

Maintaining Malaria Prevention in the Face of COVID-19
PMI VectorLink Photos Place in Abt 2020 Photo Contest

MALARIA FIGHTERS

PMI Malaria Fighter Ojok John
PMI Malaria Fighter Dr. Oliver Lulembo
PMI Malaria Fighter Josephine Tossa
PMI Malaria Fighter Jean-Pierre Rucakibungo

PODCASTS

Gender Equity in Vector Control: A PMI VectorLink Podcast
Managing Malaria in the Midst of COVID-19

VIDEOS

Reducing the Burden of Malaria: How IRS Works
Armed in Malaria Prevention
The U.S. Ambassador to Kenya Spends a Day with PMI VectorLink

WEBINARS

Mapping 101 with Maxar: How Geospatial Data Improves Planning and Implementation in IRS
Exploring the Contribution of 3rd Generation IRS Products with NgenIRS

INFOGRAPHICS

Integrated Vector Control Map

ITN Distribution + TA Coverage Map

Results and Project Outcomes

TECHNICAL BRIEFS

PMI VectorLink Climate Risk Management Plan

PMI VectorLink Guidance on Entomological Monitoring Activities in the Context of COVID-19

PMI VectorLink Project Technical Brief

PMI VectorLink Vector Control Operations Technical Brief

PMI VectorLink ITN Technical Brief

PMI VectorLink Integrated Analytics Technical Brief

PMI VectorLink Entomology Technical Brief

PMI VectorLink Environmental Compliance Technical Brief

PMI VectorLink Gender Technical Brief

PEER REVIEWED JOURNAL ARTICLES

- *Anopheles gambiae* (*s.l.*) exhibit high intensity pyrethroid resistance throughout Southern and Central Mali (2016–2018): PBO or next generation LLINs may provide greater control, *Parasites & Vectors*, May 2020
- Intensity of pyrethroid resistance in *Anopheles gambiae* before and after a mass distribution of insecticide-treated nets in Kinshasa and in 11 provinces of the Democratic Republic of Congo, *Malaria Journal*, April 2020
- Indoor residual spraying for malaria control in sub-Saharan Africa 1997 to 2017: an adjusted retrospective analysis, *Malaria Journal*, April 2020
- Impact of indoor residual spraying with pirimiphos-methyl (Actellic 300CS) on entomological indicators of transmission and malaria case burden in Migori County, western Kenya, *Scientific Reports*, March 2020
- Geographical distribution of *Anopheles stephensi* in eastern Ethiopia, *Parasites & Vectors*, Jan 2020