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U.S. President's Malaria Initiative

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INTELLIGENT › INNOVATIVE › INTEGRATED

Technical Brief

Data Drives Decisions in Vector Control

Strong Entomological Monitoring
Leads to Evidence-Based Decision Making

The U.S. President's Malaria Initiative (PMI) delivers vector control interventions and protects millions of people against malaria through its PMI VectorLink Project. An integral part of the project is the collection of robust entomological surveillance data to identify which mosquitoes are vectors of malaria, the relative geographical and temporal distribution and abundance of these mosquitoes, and their feeding and resting habits. These data are crucial to the impact assessment of vector control interventions on mosquito population and behavior. When evaluating Indoor Residual Spraying, PMI VectorLink monitors the quality of the spraying as well as the length of time that insecticides sprayed remain effective, and any fumigant effect. The project also performs a series of tests to determine which insecticides are effective against the target mosquito population. These insecticide resistance data are consolidated for the World Malaria Report and the Vector Insecticide Resistance app in the Malaria Threats Map.

What Data Is Collected?

Vector Abundance and Behavior

Knowing and understanding density, seasonality, longevity, infectivity, resting and feeding behavior of *Anopheles* mosquitoes is essential for effective vector control planning. The PMI VectorLink Project collects longitudinal entomological data in a controlled, interrupted time series design to inform selection and assess the impact on the mosquitoes of vector control interventions, particularly the front-line tools: Insecticide Treated Nets (ITNs) and Indoor Residual Spraying (IRS). PMI VectorLink entomologists work with local government entities, research institutes and universities to collect such information from both intervention and control sentinel sites.

IRS Quality Assurance and Residual Efficacy

Using World Health Organization (WHO) cone bioassay tests, PMI VectorLink assesses the quality of the spray operation in the first week of spraying, and in each subsequent month the cone bioassays are used to determine how long the insecticide remains effective on the sprayed surfaces.

ITN Durability Monitoring

The project monitors the attrition (the loss of nets from households), physical durability (the number and size of holes in the net), and insecticidal efficacy of insecticide-treated nets within six months of their distribution (baseline) and at yearly intervals for up to three years post-distribution.

Insecticide Resistance Data

Each year, PMI VectorLink uses WHO tube tests and Centers for Disease Control and Prevention bottle bioassays to determine the

susceptibility of vectors to insecticides used for vector control. Data collected are analyzed and presented to local government and in-country partners to support the selection of insecticide for the next rounds of IRS. The same methods are used to determine the intensity of resistance to pyrethroid insecticides, and to determine whether resistance is likely to be at a level that may compromise effectiveness of pyrethroid LLINs. Synergist bioassays are conducted to determine whether next generation LLINs, incorporating PBO synergist, would provide better levels of control in areas of intense pyrethroid resistance.

Insecticide resistance and IRS residual efficacy data helps PMI and host country governments to properly identify the most effective

insecticide to use and the best time to spray to reduce the burden of malaria.

How Is the Data Collected?

Standardization of Data Collection Tools

PMI VectorLink developed and distributed standard entomological data collection tools to each of the country offices in which it works. The data collection forms cover all mosquito sampling methods used in the project as well as standard mosquito testing methods. The forms help PMI VectorLink to capture entomological data uniformly across all project countries to ensure that datasets are complete and pertinent for effective planning of vector control interventions and assessing impact of IRS and LLINs on entomological indicators.

VectorLink Collect, DHIS2 Entomology Instance

The PMI VectorLink Project has developed DHIS2-based entomological programs for important indicators: vector bionomics,

insecticide resistance and residual efficacy. This robust, dynamic, and interoperable system, called VectorLink Collect, is the standardized project database that houses all project IRS and entomology data. It uses web-based "cloud" storage capacities to allow for easy real-time sharing of information within the country and with the home office, which can be used for further analysis, evaluation, and feedback. The database also allows for pooled, detailed and comparable analysis of the entomology data from multiple countries and enables PMI to contribute to the global and/or regional entomological data pool.

Building Capacity

Trained and well-experienced entomologists in malaria control programs are key to establishing a strong entomological monitoring system. Where possible, VectorLink hires trained entomologists to coordinate and lead entomological monitoring activities in the project countries. In countries lacking trained entomologists, high school graduates

interested in entomology are recruited locally. Extensive training is provided on basic entomological surveillance activities, with a focus on practical demonstrations and field exercises. Recruits are supplied with the necessary equipment and deployed to conduct field work under the direct supervision of experienced entomologists before being allowed to work independently. Continuous assessment, technical support, and on-the-job training are provided.

In Angola, Liberia, Mali, Niger, Senegal, and DRC insectaries (infrastructure for rearing and keeping mosquitoes) were lacking. VectorLink took innovative measures to overcome this challenge, converting 40-foot shipping containers (Insectary-in-a-Box) or rehabilitating existing facilities into insectaries capable of supporting all VectorLink entomological activities. These insectaries provide an optimal environment for rearing mosquitoes for use in cone bioassays and susceptibility tests; and provide facilities for identification, dissection, and preservation of mosquitoes for further analysis.

Moving Forward

PMI VectorLink leverages existing entomological monitoring initiatives with strengthening molecular capacity towards a holistic understanding of local vector species and insecticide resistance. Investing in molecular lab capacity has allowed VectorLink to expand entomological monitoring to utilize advancing PCR and sequencing technologies for detecting genetic markers of insecticide resistance and species identification, as well as ELISA for identifying infectious mosquitoes. Building robust data sets is an essential first step to evidence-based decision making but managing current and legacy data and improving its accessibility is required to maximize its utility. For that, PMI VectorLink is taking steps to standardize digital data collection and to build molecular data into VectorLink Collect—where it can be analyzed in real-time alongside collection and IR data.

PMI VectorLink is also striving to configure VectorLink Collect in alignment with the WHO entomology module and DHIS2-based systems of National Malaria Control Programs. This way, PMI VectorLink provides the information governments and stakeholders need to ensure an appropriate, effective and efficient vector control strategy is selected. Powerful datasets, combined with increased capacity of local governments to implement vector control, are the key to reducing the incidence of malaria.