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 from contracting malaria through its PMI VectorLink Project. An integral part of the project is robust entomological monitoring to help enable entomologists to identify which mosquitoes carry malaria, the relative geographical and temporal distribution of the mosquitoes transmitting malaria, and the feeding and resting habits of the vector. PMI VectorLink monitors the quality of spraying as well as the length of time that sprayed insecticides remain effective. Monitoring also helps to determine which insecticides are effective against the target mosquito population and to assess the impact of IRS on mosquito population and behavior. The collected data is made public through the Insecticide Resistance (IR) Mapper, an online data platform, which consolidates reports of insecticide resistance in malaria vectors onto filterable maps to inform vector control strategies.

What Data Is Collected?

Vector Abundance and Behavior

Knowing and understanding vector density, longevity, and resting and feeding behavior of malaria-carrying mosquitos is essential for effective vector control planning. The PMI VectorLink Project uses controlled interrupted time series design in the collection of longitudinal entomological data to inform selection and assess the impact 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 villages. The data is mainly used to assess the impact of vector control interventions (ITNs and IRS) on vector density, behavior, and species composition.

Spray Quality Assurance

Using World Health Organization (WHO) cone bioassay tests, PMI VectorLink conducts efficacy testing of new ITNs and the IRS insecticide in the first week of spraying to assess the quality of those vector control interventions and subsequently monitor their bio-efficacy to inform time for re-application of IRS and replacements of nets.

Monitoring the Residual Life of Insecticides

Each month following the spray, cone bioassay data continues to be collected to determine whether the insecticide has remained effective on sprayed surfaces. The project also monitor the insecticidal activity of nets at six month intervals to determine the durability of bio-efficacy of nets.

Insecticide Resistance Data

Each year after a spray campaign is completed, data on the susceptibility of vectors to potential insecticides is collected, analyzed, and presented to local government and in-country partners to support the selection of the next year's insecticide for IRS and also for subsequent LLIN campaigns. PMI VectorLink also uses WHO tube tests and Centers for Disease Control and Prevention bottle bioassays to determine the intensity of resistance to pyrethroid insecticides, to determine whether resistance is likely to be at a level that may compromise effectiveness of pyrethroid LLINs. Insecticide resistance and residual life 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.

Synergist bioassays are conducted to determine whether next generation LLINs with PBO synergist would provide better levels of control in areas of intense pyrethroid resistance.

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 uniform entomological data across project countries that is complete and pertinent for effective planning of vector control interventions and assessing impact of IRS and LLINs on entomological indicators.

Vector Link Collect, DHIS2 Entomology Instance

PMI and the PMI VectorLink Project have developed DHIS2 based entomological databases for important indicators: insecticide resistance, cone bioassay tests, and vector densities. The entomology database 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 hired trained entomologists to coordinate and lead entomological activities in the project countries. In countries lacking trained entomologists, such as Mozambique, high school graduates interested in entomology are recruited locally. Extensive training is provided on basic entomological monitoring, 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.

Regional molecular entomology training courses were conducted in Tanzania and Benin by the project with assistance from CDC and University of Notre Dame, with participants from 17 countries. This training strengthened data quality for determining the proportion of Anopheles mosquitoes infected with malaria sporozoites and for conducting molecular mosquito species identification.

In Angola, Liberia, Mali, and DRC insectaries (infrastructure for rearing and keeping mosquitoes) were lacking. AIRS took innovative measures to overcome this challenge, converting 40-foot shipping (Insectary-in-a-Box). These insectaries provided an optimal environment for rearing and keeping of mosquitoes; testing; and identification, dissection and preserving mosquitoes for further analysis.

Moving Forward

PMI VectorLink provides the information governments and stakeholders need to ensure IRS and other vector control strategies are effective and efficient. Strong data combined with increased capacity of local governments to implement vector control is helping to reduce the incidence of malaria.

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