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TOOL TO ASSESS ENTOMOLOGICAL MONITORING, ENVIRONMENTAL COMPLIANCE, AND VECTOR CONTROL CAPACITY

FOR THE PREVENTION AND CONTROL OF ZIKA AND OTHER ARBOVIRUSES

The Health Finance and Governance Project
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Prepared by: Dereje Dengela

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Abt Associates Inc. | 4550 Montgomery Avenue, Suite 800 North | Bethesda, Maryland 20814
T: 301.347.5000 | F: 301.652.3916 | www.abtassociates.com

Avenir Health | Broad Branch Associates | Development Alternatives Inc. (DAI) |
| Johns Hopkins Bloomberg School of Public Health (JHSPH) | Results for Development Institute (R4D)
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TOOL TO ASSESS ENTOMOLOGICAL MONITORING, ENVIRONMENTAL COMPLIANCE, AND VECTOR CONTROL CAPACITY

FOR THE PREVENTION AND CONTROL OF ZIKA AND OTHER ARBOVIRUSES

1. INTRODUCTION

This assessment tool was designed to assess country capacity to conduct *Aedes* vector control and entomological monitoring activities in five countries in Latin America and the Caribbean – the Dominican Republic, El Salvador, Guatemala, Haiti, and Honduras. The purpose of the tool is to review capacity strengths and gaps within each of these countries, and to propose recommendations that improve country readiness to prevent and control Zika and other arboviruses. The tool will assess capacity in line with nine thematic areas:

1. Place, Structure, and Financial Resources of Entomological Surveillance and Vector Control at Various Administrative Levels
2. Stakeholders' Coordination and Community Mobilization /Engagement for Control of *Aedes* Mosquitoes
3. Human Resources
    - 3.1. National Level
    - 3.2. Province/District Level
4. Infrastructure
    - 4.1. Presence of Reference Laboratory at the National Level
    - 4.2. Functional Insectary
5. Capacity to Design and Prepare Entomological Monitoring, Vector Control, and Environmental Control Plan
6. Implementation Capacity
7. Data Collection, Analysis, and Reporting
    - 7.1. Capacity to Capture Comprehensive Entomological, Environmental Compliance and Vector Control Data in One Central Database
    - 7.2. Capacity to Analyze and Interpret Data
    - 7.3. Capacity to Produce High Quality Reports
8. Stakeholders' Engagement and Use of Entomological Data to Inform Vector Control
9. Insecticide Registration Status and Environmental Compliance

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2. ASSESSMENT CHECKLIST

Thematic Area	Current Status As applicable: Specify administrative level (e.g. National, Provincial, District, etc.)	Recommendations As applicable: Specify audience (e.g. Government, Donors, etc.)
1. Place, Structure, and Financial Resources of Entomological Surveillance and Vector Control at Various Administrative Levels		
• How are entomological monitoring and *Aedes* mosquitoes of arboviral vector control programs organized structurally? Is it a vertical program or is it integrated into the health offices at various administrative levels? Is entomological surveillance part of vector control? Please attach the copy of the current organogram, if available, to indicate how it relates to other health programs.		
• Are the entomological monitoring and vector control unit/s responsible for all vector-borne diseases? Do these units structurally exist at different levels of administration? If there is no separate unit at a lower administrative level, are there at least focal persons at each administrative level, particularly for the control of *Aedes* mosquitoes that are vectors of arboviral diseases? Describe how the different levels undertake planning, implementation and monitoring and evaluation. Describe the information (report) and feedback flow between the centers and peripheral		

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administrative levels.		
• How are entomological surveillance and vector control for different vector- borne diseases organized? Are they organized under one unit or in different departments? Describe how the entomological surveillance and vector control efforts for different vector-borne diseases undertake joint planning for budgeting, implementation, and monitoring and evaluation, with emphasis on the control of *Aedes* mosquitoes that are vectors of arboviral diseases.		
• Do entomological surveillance and vector control efforts for different vector–borne diseases share a common budget at different levels? Which levels are these?		
• Is a there strategic plan for entomological surveillance and vector control for all vector-borne diseases? If yes, provide the copy and briefly describe the different elements of the plan.		
• What is the main vector control methods used to reduce diseases transmitted by *Aedes* mosquitoes? Briefly describe how each of the vector control methods is planned, implemented, monitored and evaluated, and who is responsible at each administrative level for these activities?		

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Thematic Area	Current Status As applicable: Specify administrative level (e.g. National, Provincial, District, etc.)	Recommendations As applicable: Specify audience (e.g. Government, Donors, etc.)
What indicators are used for monitoring and evaluation? Is the country vector control program open to evaluate and deploy new novel *Aedes* mosquitoes control techniques, if found effective, such as male SIT, Pyriproxyfen, Bti, infection refractory mosquitoes (Wolbahcia), and lethal ovitraps, etc.?		
• How frequently is entomological surveillance monitoring data collected? Is it adequate to inform vector control program? Which entomological indicators are regularly monitored? What sampling methods are used?		
• Is there an annual government allocation of funds for entomological surveillance and vector control planning, implementation, and monitoring and evaluation, for the different vector-borne diseases? Please provide a detailed cost breakdown by administrative level and vector–borne disease, if possible. Indicate other sources of funding if any, and short falls in funding level.		
• What is the status and trend of vector resistance to different insecticides and larvicides?		
• Is there a central database for entomological surveillance and vector		

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control to which all in country stakeholders have access? Is the country using mHealth for rapid transmission of data from the peripheral to the central database? Is there capacity at the national level to perform appropriate statistical analysis using rigorous statistical methods to inform the vector control program?		
• Does the program have nationwide data on VC coverage in terms number households/people and/ or administrative units like number of municipalities? If yes, please provide the copy of the report. Please disaggregate the data by vector control type if possible.		
• Is there coordination among health care providers (Zika should be the immediately notifiable disease), public health offices, environmental compliance officers, and vector control officers, in terms of sharing of epidemiological, entomological and vector control data? If yes, please describe the information sharing mechanism in place and frequency.		
2. Stakeholders' Coordination and Community Mobilization/ Engagement for Control of *Aedes* Mosquitoes		
• Is there a vector control technical working group or steering committee at the national level? If yes, describe the terms of reference of this committee, the		

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composition of the members and the roles and responsibilities of each member. Please also describe the role and achievement of the steering committee in terms of advancing entomological surveillance and vector control.		
• Are there strategies for social mobilization and advocacy? If yes, please describe how the overall goal of such strategic effort is being achieved.		
• Are there IEC/ BCC materials available that could help to advance community awareness and knowledge about vector-borne diseases transmitted by *Aedes* mosquitoes? What is best approach to reach out to the community to create awareness?		
• Is there community wide/level surveillance and control of *Aedes* mosquitoes lead by the communities or peripheral health workers? What are the best methods/ approaches to strengthen these activities?		
• Are there systems in place for planning, implementation, and monitoring and evaluation, of IEC/BCC campaigns and community engagement? Is there coordination among the vector–borne diseases control stakeholders in the		

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planning and implementation of IEC/BCC?		
3. Human Resources		
3.1 National Level - Presence of well trained and experienced entomologists, vector control officers, and environmental health officers at the national level that have the capacity to:		
• Develop Zika and other arboviral vector control strategy and guidelines		
• Develop national level entomological surveillance, Zika and other arboviral vector control, and human and environmental safety plans		
• Lead and oversee implementation of entomological surveillance, vector control, and environmental compliance activities		
• Conduct (annual) susceptibility tests on both larvae and adult *Aedes* mosquitoes		
• Determine the competence of suspected *Aedes* mosquitoes in transmission of Zika		
• Morphologically identify primary and secondary vectors of Zika		
• Conduct (annual) molecular analysis		
• Conduct biochemical tests if vector		

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resistance to insecticides is detected		
• Manage insectary and sustain susceptible colony of mosquitoes		
• Provide continuous training to sustain pool of trained technicians/ vector control and environmental health officers for entomological surveillance, vector control, and environmental compliance at provincial and district levels.		
• Ensure that high quality entomological data are collected from representative Zika risk areas		
• Map out high transmission risk geographical areas from moderate to low risk (stratification based on the level of risk)		
• Establish one central database that captures entomological surveillance and vector control data at the national level to which all in country stakeholders have access to. Ability to use rigorous statistical methods to analyze data.		
• Immediately share data on insecticide and larvicide resistance, when it becomes available, with in country vector control		

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stakeholders		
• If change in vector density or behavior is observed, share data immediately with in country Zika and Arboviruses vector control stakeholders for decision making		
• Analyze and interpret comprehensive entomological data and share the report with in country Zika and other Arbovirus vector control stakeholders (twice per year)		
• Establish entomological thresholds at which humans get infected with Zika		
• Triangulate entomological, vector control and epidemiological data to inform control of Zika and other arboviruses and share this report with in country stake holders (annually)		
• Establish strong intersectoral collaboration among public sectors such as ministry of health, ministry of education, ministry of finance, municipalities, ministry of water resources, etc., private sectors and civil society		
• Develop standard IEC/BCC materials for community mobilization and education		

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Thematic Area	Current Status As applicable: Specify administrative level (e.g. National, Provincial, District, etc.)	Recommendations As applicable: Specify audience (e.g. Government, Donors, etc.)
campaigns		
• Ensure constant coordination among health care providers (Zika should be an immediately notifiable disease), public health offices, and environmental compliance and vector control officers.		
• Monitor the effectiveness of vector control methods deployed and compliance to human and environmental safety		
3.2 Province/District Level - Presence of trained entomologists, vector control and environmental health officers / technicians working for Ministry of Health or other health institutions that have the capacity to:		
• Establish community- wide survey of aquatic stages (larvae and pupae) of known or suspected vectors of Zika		
• Identify *Aedes* larvae from others (*Culex*, *Anopheles*, etc.)		
• Identify types of breeding containers and geographical areas that are most productive for targeting vector control		
• Develop detailed maps to help track larval sites of Zika vectors		
• Collect *Aedes* mosquito larvae and pupae,		

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and transport and rear them to adults in the insectary for correct identification of species, density monitoring by species, and perform susceptibility tests		
• Identify and use proper adult *Aedes* mosquito sampling methods		
• Morphologically identify adult *Aedes* mosquitoes from others (*Culex, Anopheles*, etc.)		
• Morphologically identify male from female *Aedes* mosquitoes		
• Morphologically identify species of *Aedes* mosquitoes		
• Determine vector resting		
• Monitor vector density by species		
• Monitor changes in seasonality and vector composition		
• Monitor changes in vector behaviors		
• Dissection of ovaries and determination of parity rates		

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• Properly preserve mosquitoes and send them to the central level for further molecular analysis that includes proper labelling of samples (unique codes corresponding to the sample record, etc.)		
• Assess changes in vector abundance before and after deployment of an intervention (impact of vector control intervention on vector density and behavior)		
• Perform descriptive analysis of entomological data and assess the impact of vector control on entomological indicators		
• Perform resistance testing		
• Perform quality check on vector control products/tools		
• Ensure constant coordination among health care providers (Zika should be immediately notifiable disease), public health offices, environmental compliance officers and vector control officers		
• Conduct community mobilization focusing on reducing or eliminating vector larval habitats		

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Thematic Area	Current Status As applicable: Specify administrative level (e.g. National, Provincial, District, etc.)	Recommendations As applicable: Specify audience (e.g. Government, Donors, etc.)
• Lead community wide source reduction (remove and dispose of water holding containers)		
• Make sure that large water holding containers are covered, dumped, modified so that they would not serve as breeding site for the vector or treat the breeding sites with long-lasting larvicide		
• Deploy larvicides (chemical and biological larvicides) where needed		
• Assess the possibility of using biological control (copepods and larvivorious fish, etc.)		
• Deploy adulticides (space spray, residual spray, barrier spray) where necessary		
• Deploy physical control (e.g., non-insecticidal mosquito traps) where feasible		
• Is there funding to support entomological surveillance and control of *Aedes* mosquitoes that transmit arboviruses? If yes, please describe the amount by the source of funding if possible (government, bilateral donors, WHO, etc.).		

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4. Infrastructure		
4.1 Presence of Reference Laboratory at the National Level that has the capacity to:		
• Accurately identify *Aedes* mosquitoes by species using morphological identification key (serve as quality control of field identification work)		
• Accurately label, preserve, and store mosquito samples		
• Labels have unique codes and correspond to some record		
• Do PCR to determine arbovirus infection rates		
• Do molecular analysis to determine mechanism of resistance (KDR and ACE-1R)		
• Conduct biochemical analysis (to identify the presence of detoxifying enzymes) or have connection with other laboratories that have the capacity to perform this activity		
• Procure all the equipment, materials, regents and other supplies needed to perform their duties		

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• Provide feedback to the field entomologists on the quality of preserved samples received and guidance on how to improve the quality further if needed.		
4.2 Functional Insectary – Presence of one or more functional insectary that has:		
• Separate well-screened adult and larval room with optimal temperature and humidity		
• Consistent water supply		
• Consistent power supply to keep the micro-climate at optimum for rearing mosquitoes		
• Insectary has:		
○ Thermometer		
○ Hygrometer		
○ Heater		
○ Humidifier		
• Regular supply of larval food and sugar/blood source for adults		
• Susceptible mosquito colony for vector control and susceptibility test quality control		
• Trained technicians to perform routine		

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activities to sustain mosquito colony		
• Space and capacity to rear field collected larvae and pupae to adult when needed		
• Ability to increase vector population when large numbers of mosquitoes are needed for different activities		
5. Capacity to Design and Prepare Entomological Monitoring , Vector Control, and Environmental Plan – Ability to perform:		
• Desk review and compilation of comprehensive entomological and vector control data available including information from neighboring countries		
• Stratification of country using combination of factors that include but not limited to:		
○ Distribution of Zika vectors		
○ Intensity of Zika transmission		
○ Level of community awareness about Zika, its mode of transmission, vector breeding habitat and level of health education needed		
○ Distribution and type of breeding sites		
○ Type of vector control method used		

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Thematic Area	Current Status As applicable: Specify administrative level (e.g. National, Provincial, District, etc.)	Recommendations As applicable: Specify audience (e.g. Government, Donors, etc.)
○ Quantity of insecticides used for agriculture and other vector control purposes		
○ History, status and trends of vector resistance to different insecticides and larvicides		
○ Uses of insecticides at the house-hold level		
• Based on the assessment results, prepare a comprehensive health education campaign, community mobilization, entomological monitoring, and a vector control and environmental compliance plan		
6. Implementation Capacity - Assess capacity to:		
• Procure equipment, materials, and reagents needed for entomological monitoring activities, vector control, and environmental compliance		
• Entomological monitoring, vector control, and environmental teams have:		
○ Transportation services needed for the field work		
○ Fuel for vehicles		

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○ Adequate field staff		
○ Maintain and calibrate equipment		
• Establish adequate number of sentinel sites in each geographical areas with different levels of disease (Zika) risk and regularly collect data on:		
o Proportion of breeding sites that are positive for aquatic stages of target mosquitoes (eggs, larvae, and pupae)		
o Species composition of the vectors		
o Vector distribution and seasonality		
o Vector resting behavior		
o Vector infectivity		
o Parity rates		
• Collect data on insecticide and larvicide susceptibility and mechanism of resistance from Zika infested areas annually		
• Conduct community education and mobilization campaign at the community level to promote source reduction		

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(environmental management), weekly		
• Monitor environmental management (source reduction) activities by the community and coverage, weekly		
• Perform IRS, mosquito traps where effective, and assess the feasibility of biological control		
• Apply larvicides on breeding sites that can't be removed by source reduction or covered to prevent mosquito breeding on a weekly interval?		
7. Data Collection, Analysis, and Reporting		
7.1 Capacity to Capture Comprehensive Entomological, Environmental Compliance and Vector Control Data in One Central Database		
• Have standard data collection tools /worksheets for entomological monitoring, IEC/BCC, vector control, and environmental compliance across the country		
• Presence of central entomological, vector control, and environmental compliance databases		
• Ability to link molecular/lab data back to		

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field specimens		
7.2 Capacity to Analyze and Interpret Data - Capacity to perform some descriptive analysis and interpret and determine entomological indices:		
• Determine larval, pupal, egg, and female adult survey indices		
• Proportion of mosquitoes of a given species infected with arboviruses		
• Resting habit		
• Longevity of the population of vectors		
• Interpret the entomological measurements and their implication on vector control and local epidemiology of Zika.		
• Number and percentage of community educated and mobilized for vector control		
• Vector control coverage		
• Number and percentage of population protected by vector control		
7.3 Capacity to Produce Good Quality Report		
• Produce good quality progress and final		

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report that can be shared with stakeholders		
8. Stakeholders' Engagement and Use of Entomological Data to Inform Vector Control		
• The presence of functional inter-sectoral coordination mechanism established in the country		
• Organizational structure of MOH established to fulfill their vector control, entomological monitoring, and environmental compliance mission		
• Mechanism in place to involve all stakeholders in the early design and planning of entomological monitoring, vector control, and environmental compliance activities		
• Mechanisms in place to educate and mobilize community to help reduce or eliminate vector breeding sites		
• Regular stakeholders meeting platform where entomological surveillance data and vector control coverages are discussed and used for decision-making		
• Linkage with universities and/ or research		

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institutions for operational research and data sharing to inform vector control and policy formulation		
• Availability of financial and technical support for entomological monitoring, community education and mobilization, vector control and environmental compliance by partners		
• Please describe if there any challenges with regards to shareholders coordination and/or opportunities that enhance control of *Aedes* mosquitoes		
9. Insecticide Registration Status and Environmental Compliance		
• What insecticides are registered for public health use in the country?		
• Is there any law/policy that allows pesticides to be registered during a public health emergency situation, such as Zika?		
• What is the waste management capacity in country with respect to insecticide waste - specifically, are there high temperature facilities (including cement kilns) that meet the following specifications: o Commercially licensed facilities that are		

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accredited and licensed by the host governments to dispose toxic waste; o Burn between 1100°C and 1300°C, with a minimum 2 second residence time in the afterburner chamber (hot zone) with excess oxygen (>11%) and with high levels of induced turbulence in the gas stream to promote complete combustion; o Have air scrubbers to ensure minimal impact to air quality.		
• Does the country require its own environmental assessment for use of public health insecticides, or can it use USAID's environmental assessments?		
• Is there a public consultation period for public health insecticides, and if so, does the emergency nature of the situation preclude public consultation?		
• Is there an environmental expert sitting within MOH, or what is the interface between the Ministries of Environment (or equivalent) and Health?		
• When was last time the country conducted		

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an IRS and or larviciding campaign?		