
PLAN OF ACTION ON ENTOMOLOGY AND VECTOR CONTROL 2018-2023: FINAL REPORT

Introduction

1. Vector-borne diseases (VBDs) such as dengue, chikungunya, Zika virus disease, yellow fever, malaria, schistosomiasis, leishmaniasis, and Chagas disease, among others, are a major threat to people's health and represent a significant burden of disease and mortality for the Region of the Americas (1). According to World Health Organization (WHO) estimates, VBDs represent about 17% of infectious diseases globally and cause more than 700 000 deaths each year, as well as causing school absenteeism, economic losses, increased poverty, and health costs (2). For this reason, the main objectives of the Plan of Action on Entomology and Vector Control 2018–2023 (Document CD56/11) (3), adopted by the 56th Directing Council of the Pan American Health Organization (PAHO) in September 2018 through Resolution CD56.R2 (4), included strengthening regional and national capacities for the prevention and control of key vectors, reducing the spread of vector-borne diseases, and collaborating for the elimination of diseases identified as priorities by PAHO and WHO. This final report presents the progress made and the challenges encountered in the implementation of the plan of action.

Background

2. The plan of action was aligned with the resolutions, strategies, and plans of action specific to the different VBDs of importance to the Region (5–8), providing the strategic and methodological framework for technical cooperation and actions by Member States, the Pan American Sanitary Bureau (PASB), and other stakeholders contributing to the achievement of regional targets for the control and elimination of these diseases. The plan of action has contributed to impact goals 6 ("Reduce mortality due to communicable diseases") and 8 ("Eliminate priority communicable diseases in the Region") of the PAHO Strategic Plan 2014–2019 (9), in addition to supporting the achievement of results related to the 2020–2025 Strategic Plan (10). The plan has also contributed to target 10.10 ("Control the transmission of dengue, chikungunya, Zika, and yellow fever with an integrated and intersectoral approach") of the Sustainable Health Agenda for the Americas 2018–2030 (11). It has also contributed directly to the goals proposed in the WHO-led *Global vector control response 2017–2030* project (1). It is important to note that this plan includes proven and innovative strategies and promotes training for personnel to improve entomological surveillance and vector control in the Americas.

Analysis of Progress Achieved

3. Among all the world's regions, the Region of the Americas suffered the most from the effects of the COVID-19 pandemic (12). The response to this emergency severely affected the functioning of health systems, with repercussions for national vector prevention and control programs, as well as their priority supply chains. Physical distancing and confinement measures altered or, in some cases, prevented routine entomological surveillance and vector control activities, which are mainly conducted in people's homes. The reallocation of resources to address the COVID-19 emergency affected the regular funding of vector control programs. In addition, in many countries it was necessary to redistribute the activities of vector surveillance and control personnel to support the emergency response. This situation presented an additional challenge to the implementation of the plan of action and impacted its activities, especially those related to the training of personnel and implementation of field activities.

4. Despite these difficulties, progress has been made in the Region. In that regard, the COVID-19 pandemic also catalyzed proactive efforts by countries, PASB, and our strategic partners to explore alternative solutions, overcome obstacles, and regain lost ground. The countries of the Region have made progress in building innovative alternatives and diversifying training programs for entomologists and vector control professionals, incorporating virtual and face-to-face modalities. Similarly, progress has been made in the construction and introduction of innovative operating models for vector control, based on the risk stratification strategy and the integration of epidemiological, entomological, and laboratory surveillance systems. This has improved the detection of viruses in mosquitoes, as well as the monitoring and management of resistance to insecticides used in public health.

5. A review of information on the results obtained showed that, of the 11 indicators in the plan of action, 3 were exceeded, 6 were achieved, 1 was partially achieved, and only one was not achieved (54% achieved). The sources of information for this final report are documents and reports submitted to PAHO and WHO by countries, reports on technical cooperation visits, and summaries of regional and subregional meetings addressing this issue. In addition, a comprehensive consultation was carried out with 16 selected countries, of which 11 responded. A summary of progress on each strategic line of action is presented below, along with the corresponding evaluation of indicators, following the criteria presented in Annex B to the Report of the End-of-biennium Assessment of the PAHO Program and Budget 2018-2019/Final Report on the Implementation of the PAHO Strategic Plan 2014-2019 (Document CD58/5, Add. I) (13).

Strategic Line of Action 1: Multilevel Integration Dimension - Strengthen interprogrammatic, intrasectoral, and intersectoral action and collaboration in vector prevention and control

6. During the period under review, progress has been made in strengthening interprogrammatic, intrasectoral and intersectoral actions. The countries of the Region have an instrument (an operational document and recommendations) that facilitates coordination and whose main focus is the implementation of integrated vector management adapted to the context in the Americas (14). In the countries of the Region, integrated work between vector control programs and stakeholders beyond the health sector has been strengthened, including work with government agencies, non-State actors, and academic institutions. This has helped to leverage the experiences of these actors,

as well as collective resources to advance in the implementation of key vector control actions. Examples of this type of integration include the incorporation of the One Health perspective, which recognizes the relationships between people, animals, and the environment in the prevention and control of tungiasis in Brazil and Colombia (15), and the creation and implementation of intersectoral roundtables for the prevention of arboviruses in the countries of the Region.

Objective 1.1: Inter-ministerial task force for multisectoral engagement in vector control established and functioning	
Indicator, baseline, and target	Status
<p>1.1.1 Number of countries and territories that have established a task force for multisectoral engagement in vector control (including vector control during emergencies/outbreaks) that has convened in the past 12 months and developed a national vector control work plan</p> <p>Baseline (2017): 3 Target (2020): 10 Target (2023): 20</p>	<p>Exceeded. By the end of the period, 23 countries and territories reported that they had a task force for multisectoral engagement in vector control, and 22 had developed a national vector control plan. These groups play a very important role in outbreak control and in VBD elimination processes where feasible.</p>
Objective 1.2: Vector control programs using data and information from multiple sources for integrated decision-making	
Indicator, baseline, and target	Status
<p>1.2.1 Number of countries and territories with vector control programs using data and information (e.g., temperature, rainfall, climate, environment, potable water, sanitation and waste management, infrastructure and housing) from various sources for integrated decision-making within the vector control programs</p> <p>Baseline (2017): 3 Target (2020): 10 Target (2023): 20</p>	<p>Exceeded. A total of 24 countries and territories are using data and information from a variety of sources, at different levels of analytical complexity, for decision-making in their vector control programs. During this period, an important achievement has been the integration of epidemiological information into entomology data in order to design vector prevention and control strategies and prioritize areas of intervention. At present, the Region has methodological instruments that encourage and facilitate this practice (16).</p>

Strategic line of action 2: Government and Community - Engage and mobilize regional and local governments and communities, including local health services, for sustainable commitments to entomology and vector prevention and control

7. By the end of the implementation period of the plan of action, Member States had made progress in developing and implementing working models with communities and local actors, both public and private, to strengthen vector surveillance and control. Examples include: a) Mosquito Action Week, created during the period of the plan of action as a community, family, and intersectoral action and mobilization initiative, with the participation of countries and other partners;¹ b) transfer of

¹ For more information, see: <https://www.paho.org/en/mosquito-awareness-week>.

communication and social mobilization capacities to vector control program managers in 24 countries; c) development and updating of communication materials for vector surveillance and control, which countries have adopted as a reference for producing local materials adapted to their realities; and d) investment in the construction of new channels on social networks to disseminate public messages on VBD prevention.² This strategic line of action has helped to redesign and enrich general strategies for the prevention and control of VBDs and adapt them to local contexts.

Objective 2.1: Engage and mobilize regional and local government and communities, including local health services, to increase sustainable commitments to and action in vector control	
Indicator, baseline, and target	Status
<p>2.1.1 Number of countries and territories in which national or territorial health authorities have developed plans or agreements for effective community participation, engagement, and mobilization at the national, regional, and local level (including local health services) with sustainable commitments in vector control</p> <p>Baseline (2017): 3 Target (2020): 10 Target (2023): 15</p>	<p>Achieved. A total of 15 countries and territories have developed or updated their plans or agreements for community participation, collaboration, and mobilization in vector surveillance and control.</p>

Strategic line of action 3: Vector Control Programs and Systems - Enhance entomological surveillance and vector control monitoring and evaluation, including insecticide resistance monitoring and management

8. During the period of implementation of the plan of action, entomological surveillance systems and vector control strategies in the Region have been improved. Cooperation mechanisms have been created between countries and strategic partners such as the Centers for Disease Control and Prevention (CDC) in the United States of America, the Oswaldo Cruz Foundation (Fiocruz) in Brazil, the Center for Research on Pests and Insecticides (CIPEIN) in Argentina, and the Autonomous University of Yucatán (UADY) in Mexico. These mechanisms have facilitated the identification of vector populations with altered patterns of susceptibility to the insecticides used in public health and enabled timely adjustments in their selection and use and in the adaptation and improvement of control strategies. As a result of this effort, 2 regional networks have been created for entomological surveillance (surveillance of resistance to insecticides used in public health, and surveillance of mosquito viruses), as well as a subregional network (the Caribbean Vector-borne Diseases Network—CariVecNet³). These networks facilitate and standardize vector control actions in accordance with the guidelines and instruments recommended by PAHO and WHO. In addition, analytic capacity and access to new products and technologies (insecticides, repellents, impregnated mosquito nets, traps, etc.) was improved with the certification of 3 regional laboratories (CIPEIN, Fiocruz, and UADY) as references for good laboratory practices.

² Examples can be found at:

<https://www.paho.org/en/communication-materials-dengue-chikungunya-and-zika-prevention>.

³ For more information, see: <https://carivecnet.carpha.org/>.

Objective 3.1: Entomological surveillance systems established or strengthened and integrated with health information to guide vector control programs and activities	
Indicator, baseline, and target	Status
<p>3.1.1 Number of countries and territories that have established or strengthened their entomological surveillance system and database in accordance with PAHO/WHO guidelines and/or recommendations</p> <p>Baseline (2017): 2 Target (2020) 15 Target (2023): 22</p>	<p>Exceeded. A total of 28 countries and territories have reported the creation or improvement of their entomological surveillance systems, including optimization of their mechanisms for collecting, processing, and analyzing information. In addition, the following regional actions were carried out to support countries: <i>a)</i> incorporation of entomology modules into the Health Information Platform for the Americas (PLISA) to facilitate comprehensive analysis of entomological information (currently, 5 countries have analytic dashboards); <i>b)</i> publication of 2 technical reference documents, on entomological surveillance and on how to structure entomology laboratories (16, 17).</p>
<p>3.1.2 Number of countries and territories that have established or strengthened a system for the monitoring and management of vector resistance to insecticides used in public health, in accordance with PAHO/WHO guidelines and/or recommendations</p> <p>Baseline (2017): 3 Target (2020): 10 Target (2023): 22</p>	<p>Achieved. A total of 22 countries and territories established or optimized their systems for surveillance of resistance to insecticides used in public health, following the PAHO and WHO recommendations. It should be noted that the Region has up-to-date technical documents on resistance assessment testing (18), and that a systematic review has been published on <i>Aedes aegypti</i> resistance to insecticides used in the Region (19).</p>
Objective 3.2: Vector control needs assessment conducted and/or updated	
Indicator, baseline, and target	Status
<p>3.2.1 Number of countries and territories that have completed or updated their existing vector control needs assessment (workforce, entomology, and vector control capacity and structure) through a consultative process within the past 24 months, in accordance with PAHO/WHO guidelines and/or recommendations</p> <p>Baseline (2017): 5 Target (2020) 15 Target (2023): 35</p>	<p>Achieved. A total of 35 countries and territories completed or updated their existing vector control needs assessment at least once during the period using a standardized tool developed in accordance with PAHO/WHO recommendations.</p>

Strategic line of action 4: Tools and Interventions - Test, document, and integrate proven and/or novel tools and approaches, and scale them up when possible or needed

9. The Region of the Americas has excelled in evaluating new vector surveillance and control tools and scaling up their use through national programs. PASB has provided tools to make these advances a reality and has provided direct support to countries by evaluating projects for the use of Wolbachia bacteria in *Aedes aegypti* mosquito control, at the request of Brazil (municipality of Niteroi) and Colombia (city of Medellín). In addition, a new model was developed for *Aedes aegypti* control focused on risk stratification; the capacity to implement it was transferred to 21 countries; and progress in its deployment has been documented in municipalities in 5 countries. It is important to emphasize that this new model serves as a platform for the incorporation of new tools and approaches to vector surveillance and control. Additionally, it is important to note the support provided by key partners such as the CDC (United States of America), Fiocruz (Brazil), UADY (Mexico), and the International Atomic Energy Agency for the achievement of the targets on this strategic line.

Objective 4.1: Ministries of health have tested and documented selected novel vector control tools, as recommended by PAHO/WHO, in operations or pilot studies	
Indicator, baseline, and target	Status
<p>4.1.1 Number of ministries of health that have tested and documented vector control tools or measures to improve control of priority VBD</p> <p>Baseline (2017): 1 Target (2020): 10 Target (2023): 15</p>	<p>Exceeded. A total of 18 ministries of health report that they have evaluated and documented vector control tools or measures to improve the control of priority VBDs, such as the use of insecticide spreaders (2 countries), indoor residual spraying for <i>Aedes aegypti</i> (1 country), and the sterile mosquito technique (18 countries).</p>
<p>4.1.2 Number of novel tools for vector control scaled up using standard methodologies, and independent evaluation initiated in selected countries and territories</p> <p>Baseline (2017): 3 Target (2020): 5 Target (2023): 8</p>	<p>Achieved. A total of 8 tools were evaluated following the protocols established by the countries (Wolbachia-infected mosquitoes, insecticide spreaders, indoor residual spraying for <i>Aedes aegypti</i>, sterile mosquito technique, genetically modified mosquitoes, nets impregnated with second-generation long-lasting insecticides, lethal traps, and novel insecticide molecules).</p> <p>The following regional activities facilitated the achievement of this target: <i>a)</i> publication of a document to support the evaluation and incorporation of new technologies for <i>Aedes aegypti</i> control (20); <i>b)</i> creation of an independent external group to support countries in the evaluation of new technologies for the control of <i>Aedes spp</i>; <i>c)</i> publication of a PAHO position paper with analysis of the use of Wolbachia (21).</p>

Objective 4.2: Countries and territories have scaled up and/or integrated water and sanitation improvements, housing improvements, and/or urban planning in vector control operations	
Indicator, baseline, and target	Status
<p>4.2.1 Number of countries and territories that have national or territorial plans or programs for water and sanitation improvement, housing improvement, and/or urban planning that include entomological risk as a factor for prioritizing actions and conducting assessments and studies</p> <p>Baseline (2017): 1 Target (2020): 4 Target (2023): 8</p>	<p>Achieved. A total of 8 countries report having national or territorial plans or programs for housing improvement or urban planning that consider entomological risks as a priority factor. An example of this are the plans to improve housing in areas with endemic Chagas disease, and to improve water and sanitation in relation to arboviruses and other VBDs.</p>

Strategic line of action 5: Workforce and Training - Create and expand opportunities for entomologists, entomology technicians, and public health workers to receive regular training, continuing education, and career development

10. In the Region, progress was being made in the creation of spaces to expand opportunities to develop and update the capacities and competencies of health personnel involved in vector surveillance and control; however, the COVID-19 pandemic altered the course of these efforts and hindered the use of traditional training models. In response, investment was made in online platforms, and the use of these tools was accelerated to maintain continuity of training. In 2021, for example, an online course on "Prevention and comprehensive control of dengue in the context of the circulation of other arboviruses" was developed, endorsed by the National Institute of Public Health of Mexico. Also, in collaboration with the Open University of the Unified Health System of Brazil, an online course on "Surveillance and control of vectors of public health importance" was designed and published.⁴ In collaboration with the Pedro Kourí Institute of Tropical Medicine in Cuba, a "Regional course on integrated vector management" was developed. After pandemic-related restrictions ended, face-to-face activities gradually resumed and, with the support of strategic partners (Fiocruz and the Evandro Chagas Institute in Brazil; and the National Institute of Tropical Medicine in Argentina), hybrid training processes were organized for the monitoring of insecticide resistance, sandfly surveillance, and virus surveillance in mosquitoes. Despite the achievements made, there is still a need to strengthen the Region's workforce in order to tackle the complex demands of vector control and the fight against VBDs. In addition, it is difficult to ensure the permanence and retention of personnel specialized in entomology. Frequent turnover of workers and the loss of entomology positions in the health systems have had an impact on the comprehensive achievement of the targets of this strategic line.

⁴ Available at: <https://www.unasus.gov.br/cursos/curso/46674>.

Objective 5.1: National public health entomology workforce strengthened and maintained to meet identified needs; and national and/or regional institutions or networks to support training and education in entomology and vector control established and functioning	
Indicator, baseline, and target	Status
<p>5.1.1 Number of countries and territories with staff from national health authorities and/or their supporting institutions trained in entomology, vector control, and IVM, in alignment with the national vector control needs assessment</p> <p>Baseline (2017): 9 Target (2020): 20 Target (2023): 35</p>	<p>Not achieved. A total of 19 countries and territories reported having staff from the national health system and/or their supporting institutions trained in entomology, vector control, and IVM, in alignment with the national vector control needs assessment conducted during the period of the plan.</p>
<p>5.1.2 Number of countries and territories that have used a national or regional institution or network to conduct a training or education program (degree/diploma/certificate) that included entomology, vector control, and IVM in the past 24 months</p> <p>Baseline (2017): 3 Target (2020): 12 Target (2023): 35</p>	<p>Partially achieved. A total of 27 countries and territories report having used a national or regional institution or network to conduct a training or education program (degree/diploma/certificate) that included entomology, vector control, and IVM.</p>

Lessons Learned

11. Implementation of the plan of action has provided Member States with conceptual and methodological models that have allowed them to make progress in key areas for the improvement of vector control, based on the best available technical evidence. It was also noted that information sharing, training of human talent, and support for decision-makers were facilitated by the strengthening of networks (for mosquito virus surveillance and for monitoring resistance to insecticides used in public health), by the Region's capacity to assess the quality of vector control products (resulting from the accreditation of 2 laboratories in relation to good laboratory practices) and by the updating of technical guidelines, all of which has been driven by the plan of action. In addition, the COVID-19 pandemic showed that, in addition to the rapid adaptation and development of computer tools and other technologies that provide Member States with quality, safe, and timely technical cooperation, it is essential that vector control programs give priority to updating and adapting their current protocols for routine entomological surveillance, periodic vector control, and timely response to future emergencies. Finally, it is important to highlight the importance and need to continue integrated joint work with different actors both within and beyond the health sector (governments, academia, private sector, communities, and donors), in order to safeguard countries' achievements and fully restore the technical and operational capacity of vector control programs.

Action Needed to Improve the Situation

12. In light of the progress and challenges described in this report, the following actions are presented for consideration by the Member States:
- a) Consolidate collaboration strategies between the health sector and other key sectors (environment, water, sanitation, urban infrastructure, housing) in order to obtain results in the modification of the social and environmental determinants associated with the development and spread of VBDs.
 - b) Continue efforts to ensure the mobilization and allocation of resources at the regional and national levels to guarantee the availability of the equipment, supplies, and personnel needed to implement entomological surveillance and vector control actions.
 - c) Promote the development of operational and logistic strategies to enable vector control programs to adapt and maintain essential operations during emergencies.
 - d) Build and encourage the adoption of new evidence-based theoretical and operational models to help countries restructure or rebuild their vector surveillance and control programs, and to guide them in the rational adoption and incorporation of new technologies and approaches.
 - e) Promote capacity development in routine integrated analyses using data from various sources (epidemiology, entomology, climate, public services, demography) to improve and focus interventions and to optimize the use of resources.
 - f) Improve and promote the implementation of social communication and community participation strategies that give the population a better understanding of the vector control actions undertaken by health ministries and that help people adopt individual and collective prevention measures and incorporate them into their daily lives.
 - g) Strengthen partnerships between governments and academic institutions to expand the supply of continuous training for vector surveillance and control personnel through the design of multiple training strategies (face-to-face and remote learning) based on available evidence and focused on meeting local needs.
 - h) Strengthen and expand technical cooperation networks between countries, such as the mosquito virus surveillance network and the insecticide resistance monitoring network, to create synergies in regional capacities and leverage collective human talent and resources.

Action by the Executive Committee

13. The Executive Committee is invited to take note of this report and make any comments it deems pertinent.

References

1. World Health Organization. Global vector control response 2017–2030. Geneva: WHO; 2017 [cited 30 January 2024]. Available from: <https://www.who.int/publications/i/item/9789241512978>.
2. World Health Organization. Vector-borne diseases. Geneva: WHO; 2 March 2020 [cited 30 January 2024]. Available from: <https://www.who.int/news-room/fact-sheets/detail/vector-borne-diseases>.

3. Pan American Health Organization. Plan of Action on Entomology and Vector Control 2018-2023 [Document CD56/11] 56th Directing Council of PAHO, 70th Session of the Regional Committee of WHO for the Americas; 23–27 September 2018. Washington, D.C.: PAHO; 2018. Available from: <http://iris.paho.org/xmlui/bitstream/handle/123456789/49612/CD56-11-e.pdf>.
4. Pan American Health Organization. Plan of Action on Entomology and Vector Control 2018-2023 [Resolution CD56.R2] 56th Directing Council of PAHO, 70th Session of the Regional Committee of WHO for the Americas; 23–27 September 2018. Washington, D.C.: PAHO; 2018. Available from: <https://iris.paho.org/bitstream/handle/10665.2/49712/CD56-R2-e.pdf>.
5. Pan American Health Organization. Integrated Vector Management: A Comprehensive Response to Vector-borne Diseases [Resolution CD48.R8] 48th Directing Council of PAHO, 60th Session of the Regional Committee of WHO for the Americas; 29 September–3 October 2008. Washington, D.C.: PAHO; 2008. Available from: <http://www3.paho.org/english/gov/cd/cd48.r8-e.pdf>.
6. Pan American Health Organization. Plan of Action for the Elimination of Neglected Infectious Diseases and Post-elimination Actions 2016-2022 [Document CD55/15] 55th Directing Council of PAHO, 68th Session of the Regional Committee of WHO for the Americas; 26-30 September 2016. Washington, D.C.: PAHO; 2016. Available from: <https://www3.paho.org/hq/dmdocuments/2016/CD55-15-e.pdf>.
7. Pan American Health Organization. Plan of Action for Malaria Elimination 2016-2020 [Document CD55/13]. 55th Directing Council of PAHO, 68th Session of the Regional Committee of WHO for the Americas; 26–30 September 2016. Washington, D.C.: PAHO; 2016. Available from: <https://www3.paho.org/hq/dmdocuments/2016/CD55-13-e.pdf>.
8. Pan American Health Organization. Strategy for Arboviral Disease Prevention and Control [Document CD55/16]. 55th Directing Council of PAHO, 68th Session of the Regional Committee of WHO for the Americas; 26–30 September 2016. Washington, D.C.: PAHO; 2016. Available from: <https://www3.paho.org/hq/dmdocuments/2016/CD55-16-e.pdf>.
9. Pan American Health Organization. Strategic Plan of the Pan American Health Organization 2014–2019 [Official Document 345]. Washington, D.C.: PAHO; 2014. Available from: <https://iris.paho.org/handle/10665.2/7654>.
10. Pan American Health Organization. Strategic Plan of the Pan American Health Organization 2020–2025 [Official Document 359]. Washington, D.C.: PAHO; 2019. Available from: <https://www.paho.org/en/documents/paho-strategic-plan-2020-2025>.
11. Pan American Health Organization. Sustainable Health Agenda for the Americas 2018–2030: A Call to Action for Health and Well-being in the Region. Washington, D.C.: PAHO; 2017. Available from: <https://iris.paho.org/handle/10665.2/49170>.
12. Pan American Health Organization. Annual Report of the Director of the Pan American Sanitary Bureau [Official Document 368] 60th Directing Council of PAHO, 75th Session of the Regional Committee of WHO for the Americas; 25-29 September 2023. Washington, D.C.: PAHO; 2023. Available from: <https://www.paho.org/en/documents/od368-annual-report-director-pan-american-sanitary-bureau>.

13. Pan American Health Organization. Report of the End-of-biennium Assessment of the PAHO Program and Budget 2018–2019/Final Report on the Implementation of the PAHO Strategic Plan 2014–2019 [Document CD58/5, Add. I]. 58th Directing Council of PAHO, 72nd Session of the Regional Committee of WHO for the Americas; 28-29 September 2020. Washington, D.C.: PAHO; 2020. Available from: <https://www.paho.org/en/documents/cd585-add-i-report-end-biennium-assessment-paho-program-and-budget-2018-2019final-report>.
 14. Pan American Health Organization. Handbook for Integrated Vector Management in the Americas. Washington, D.C.: PAHO; 2019. Available from: <https://iris.paho.org/handle/10665.2/51759>.
 15. Pan American Health Organization. Experiencias en la vigilancia, la prevención, la atención y el control de la tungiasis en Brasil y Colombia. Washington, D.C.: PAHO; 2023. Available from: <https://iris.paho.org/handle/10665.2/58686>.
 16. Pan American Health Organization. Métodos de vigilancia entomológica y control de los principales vectores en las Américas. Washington, D.C.: PAHO; 2021. Available from: <https://doi.org/10.37774/9789275323953>.
 17. Pan American Health Organization. Orientaciones para la estructuración de laboratorios de entomología en salud pública. Washington, D.C.: PAHO; 2019. Available from: <https://iris.paho.org/handle/10665.2/51690>.
 18. Pan American Health Organization. Procedimientos para evaluar la susceptibilidad a los insecticidas de los principales mosquitos vectores de las Américas. Washington, D.C.: PAHO; 2023. Available from: <https://iris.paho.org/handle/10665.2/57424>. T
 19. Guedes RNC, Beins K, Navarro Costa D, Coelho GE, Bezerra HSDS. Patterns of insecticide resistance in *Aedes aegypti*: meta-analyses of surveys in Latin America and the Caribbean. *Pest Manag Sci*. 2020 Jun; 76(6):2144–2157. Available from: <https://doi.org/10.1002/ps.5752>.
 20. Pan American Health Organization. Evaluation of Innovative Strategies for *Aedes aegypti* Control: Challenges for their Introduction and Impact Assessment. Washington, D.C.: PAHO; 2019. Available from: <https://iris.paho.org/handle/10665.2/51375>.
 21. Pan American Health Organization. Use of Wolbachia in the Americas to Control Vectors Responsible for Diseases of Public Health Interest. PAHO position and data analysis. Washington, D.C.: PAHO; 2019. Available from: <https://www.paho.org/en/documents/use-wolbachia-americas-control-vectors-responsible-diseases-public-health-interest-paho>.
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